Attachment I-8:
Public Comments and Responses

Attachment I-8: Public Comments and Responses
Table of Contents

Explanation of Public Comments and Response Organization

This attachment contains public comments that were received on the Lower Susquehanna River Watershed Assessment, October 2014 draft. The public comment period ran from November 13, 2014, to January 9, 2015. Each comment was input into a comment-response matrix. Responses to every comment that was received are provided in the comment-response matrix. Also in this attachment, following the comment-response matrix, are copies of the original comments as submitted by individuals or organizations.

The table below shows the coding system used for the comments. Codes were necessary to identify the commenter without compromising the privacy of individual members of the public, during the compilation of the responses. The text in parentheses in the "commenter code" column shows the location in the October 2014 draft referenced by the comment. Some comments are general comments, while others refer to the main document text or text within the appendices. For example, comment Ex-1 and DR-1 are comments on the main report, whereas comment Ex-A-1 or comment A-1 are comments on Appendix A. If there is any confusion over the location referenced by the comment in the comment response matrix, please see the original copy of the comment at the end of this attachment.

Comment Codes: LSRWA Public Comments

Commenter	Format Received	Commenter Code (comment location in report)
Public Individuals		
Public (from 12/9/14 public meeting)	Comment card at public meeting	P.1-P.38 (general)
Public (from 12/9/14 public meeting	Web question at public meeting	W.1-W.9 (general)
Individual	Email	E.7 (general)
Individual	Email	E.1 (general)
Individual	Email	E.2 (general)
Individual	Email	E.4 (general)
Individual	Email	E.5.# (general)
Organizations		
Chesapeake Bay Foundation	Email	E.6.# (general)
Soil and Water Conservation Society	Email	E.8.# (general)
State Water Quality Advisory Committee	Email	E.10 (general)
Support Conowingo Dam	Hand delivered petition (11,500+ signatures)	E.3 (general)

Commenter	Format Received	Commenter Code (comment location in report)
U.S. Fish and Wildlife Service	Mail	E.11 (general)
Clean Chesapeake Coalition	Email	CCC-L-# (general, from transmittal letter text) CCC-# (general, from enclosure introduction) DR-# (main report) A-# (Appendix A) B-# (Appendix B) C-# (Appendix C) D-# (Appendix D) E-# (Appendix E) F-# (Appendix F) G-# (Appendix G) H-# (Appendix H) I-6-# (Appendix I, Attachment I-6) I-7-# (Appendix I, Attachment I-7) J# (Appendix J and attachments) K# (Appendix K) Mtg-# (Public Meeting 12/9/14)
Exelon Corporation	Email	Ex-# (main report) Ex-A-# (Appendix A) Ex-B-# (Appendix B) Ex-C-# (Appendix C) Ex-D-# (Appendix D) Ex-E-# (Appendix E) Ex-F-# (Appendix F) Ex-I-# (Appendix I) Ex-J-# (Appendix J) Ex-K-# (Appendix K)

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
P.1	The report asserts the nutrients associated with sediments have more of an adverse impact than the sediments themselves and that there may be more cost effective means than restoring the Conowingo storage volume to prevent these nutrients from reaching the Bay. Did the study quantify the nutrient offsets required and identify options and costs for achieving these offsets?	The assessment did not specifically quantify nutrient offsets. The assessment recommends additional modeling, monitoring, and evaluation of management options to determine nutrient offsets. It is recommended that this information be integrated into analyses for the 2017 TMDL midpoint assessment.
P.2	Once the WIPs are in place and fully effective, now many tons per year of nitrogen and phosphorus associated with the sediments are needed to offset the dynamic equilibrium state?	The assessment did not specifically quantify nutrient offsets. The assessment recommends additional modeling, monitoring, and evaluation of management options to determine nutrient offsets. It is recommended that this information be integrated into analyses for the 2017 TMDL midpoint assessment.
P.3	Besides evaluating the impact of sedimentation on the indicators of dissolved oxygen, light attenuation and chlorophyll concentrations, did the study identify the environmental and cost benefits that a reduced sedimentation rate would have on other parameters such as dredging the shipping channels, restoring the oyster population, and sustaining recreational activities?	No. A direct relationship between material that passes the dam versus what ends up in the channels has not been determined. The material that deposits in the channel is mostly from the Bay bottom nearby, but it is obvious that storms generate sediment. It should be noted that maintenance dredging the channels is much more economical than dredging the reservoirs. Impacts of sedimentation on oysters or recreation from chronic or ongoing sedimentation are not specifically accounted for in the models used during this study.
P.4	What are the panel's thoughts that the draft report is already influencing some Maryland politicians and policy makes to make the case of why should their jurisdictions be required to control nonpoint source sediments and nutrients since they won't be controlled beyond the WIPs in place form the very large areas of New York and Pennsylvania?	The panel concurred that the best available science should be used to determine where and how much nutrients and sediments should be addressed by the states/jurisdictions. The assessment produced numerous products that are now available to assist in future watershed planning efforts. Furthermore, the LSRWA identified critical data needs that resulted in additional monitoring efforts to fill data gaps and better inform this decision-making. The report recommends that U.S. EPA and their seven Chesapeake Bay watershed jurisdictional partners integrate these into their ongoing analyses and development of their Phase 3 watershed implementation plans as part of the Chesapeake Bay TMDL 2017 midpoint assessment.
P.5	The Susquehanna River Basin Commission has studied the sediments from the floor of the Conowingo Pond and reported to MDE (the Maryland Department of the Environment) that such sediments contain PCBs (polychlorinated biphenlys), pesticides and herbicides, phosphorus and nitrogen, and acid mine drainage (AMD) that contained sulfides. Does the Draft LSRWA take into account the impact of such components of scored sediments on the aquatic life in the Bay? If so, how does the report account for the impact of such components on the aquatic life in the Bay? If not, why were such impacts not considered? Does the Draft LKSRWA take into account the impact of such components of scored sediments on the SAV (submerged aquatic vegetation) in the Bay? If so, how does the report account for the impact of such components on the SAV in the Bay? If not, why were such impacts not considered?	Studies do indicate that contaminants other than nutrients may be attached to sediments behind the dams. However, the assessment focused on the nutrients associated with sediments and did not evaluate other potential contaminants. Chapter 5.4.3 briefly discusses heavy metals found in sediment cores with regards to the beneficial reuse of dredged sediments. Additional study is needed on other potential contaminants and on the biologic availability of these contaminants, including nutrients, as they are released from sediments.

Comment Code	Comment	Comment Response
P.6	USGS reports that a flow event greater than or equal to 800 cfs (cubic feet per second) will occur once every 25 years and the last time such a flow event occurred was in 2011 (Tropical Storm Lee). Appendix A at page 41; Draft LSRWA Report page 71. USGS estimates that the scour from the floor of the Conowingo Pond during such a flow event is between 4 and 20 million tons of sediment. Exelon has requested a 46 year permit from FERC (the Federal Energy Regulatory Commission), so such a storm event is predicted to occur twice during the life of the renewal period. Why does the Draft LSRWA not take into account the scour that will occur during such a storm event? What accounts for the large range or predicted scour? What impact will such a scour event have on fisheries habitat and which fisheries would be impacted? What impact will such a scour event have on SAV habitat and how was such impact determined?	The models did evaluate scour from high flow events, including modeling scenarios for Tropical Storm Lee and the January 1996 high flow event. Appendix C discusses these model simulations in detail, including the impacts of scour events on water quality (light attenuation, chlorophyll and dissolved oxygen) and aquatic life. Impacts to aquatic life, including SAV, are also discussed in Chapter 4. Chapters 4.2.1, 4.2.2, and Table 4-7 discuss the range of scour for different flow events. Appendices A-1 and B detail the computations for predicted scour and sediment load. The ranges in scour and estimates of total loads transported out the reservoir system allow for differences in season, total volume of potential scour flow, and errors in the estimates.
P.7	USGS reports that a flow event greater than or equal to 1 million cfs (cubic feet per second) will occur once every 60 years and the last time such a flow event occurred was in 1972 (Hurricane Agnes). Appendix A at page 41. USGS estimates that the scour from the floor of the Conowingo Pond during such a flow event is between 10 and 31 million tons of sediment. Exelon has requested a 46 year permit from FERC (the Federal Energy Regulatory Commission), so such a storm event is predicted to occur during the life of the renewal period. Why does the Draft LSRWA not take into account the scour that will occur during such a storm event? What accounts for the large range or predicted scour? What impact will such a scour event have on fisheries habitat and which fisheries would be impacted? What impact will such a scour event have on SAV habitat and how was such impact determined?	See response to comments W.1 and P.6. See response to comment CCC-L-7 for a description of the effects of Tropical Storm Lee on SAV in the upper Bay.
P.8	Does the Draft LSRWA account for sediments that are scoured from the floor of Lake Aldred and Lake Clark during storm events and already are in suspension in the river when it flows into the Conowingo Pond? If so, how does the Draft LSRWA account for such scoured sediments and what appendix references the data used to determine the quantity of such scour and how such scour varies with the rate of flow across those lakes during storm events?	Yes, the assessment does account for sediment scoured from the floors of Lake Aldred and Lake Clarke which are in suspension when the flow reaches Conowingo Pond. Appendix A discusses the 1-D USGS model used to simulate transport through these three reservoirs. Streamflow and sediment boundary-condition data were developed using this model. This information was used to develop a 2-D model (described in Appendix B) to predict scour and deposition zones, sediment transport, and scenario development for the Conowingo Reservoir and upper Chesapeake Bay.
P.9	How if at all do the models used in the Draft LSRWA predict scour from the floors of the Conowingo Pond, Lake Aldred, and Lake Clark and account for scour that occurs from the circular flow and agitation that occurs when storm surges hit the Conowingo, Holtwood and Safe Harbor Dams and are turned back. How many cfs (cubic feet per second) can flow through the sluiceway at each dam? How many cfs can flow through each gate at each dam? How many gates are at each dam? During what storm events has water flowed over each dam?	See response to comment P.8. The 2D models account for motion in the vertical and horizontal direction and for the physics of the reservoir bed; therefore, circular flow and agitation are considered. Erosion rates of bottom sediments from Conowingo Reservoir were also evaluated using sediment cores eroded in a flume (Appendix B-2). Some information on Conowingo Dam is provided in Table 1-1. Specific information on the dam can be found on Exelon's website: http://www.exeloncorp.com/PowerPlants/conowingo/relicensing/background.aspx

Comment Code	Comment	Comment Response
P.10	EPA studies show that phosphorus that is bound to sediments in a fresh water river estuary and is therefore not available to spawn algae blooms is released into the water and is available to spawn algae blooms when such sediments are transported into a slightly saline, warmer and more acidic bay or delta estuary. Does the LSRWA account for the impact of the release of phosphorus bound to sediments that are scoured from the floor of the Conowingo Pond and if so what percentage or quantity of phosphorus is attributed to phosphorus bound to sediments prior to passing through or over the Conowingo Dam and being release in the Bay estuary.	The assessment did not specifically evaluate the release of phosphorus from sediments scoured from Conowingo Pond. It is estimated that the Susquehanna River contributes about 40 percent of the total phosphorus inputs to the Bay; however, the percentage attributed to scoured sediments is not known. The enhanced monitoring and modeling will better evaluate the impacts of nutrients on water-quality and habitat in the Bay.
P.11	Is a Hurricane Agnes (with excessive delivery of sediment that buries subaquatic vegetation) now more likely to occur or not? And if so what are we going to do about it, if anything?	Following the occurrence of Agnes, the storm was calculated to be a 500-year event, but each time the hydrologic record is updated, that number declines. Climate change simulations for the Chesapeake Bay watershed out to the year 2100 predict increased precipitation amounts in the winter and spring, as well as increased intensities of precipitation, tropical storms, and northeasters (although their frequency may decrease). The impacts of these events will need to be considered when planning for climate changes.
P.12	A lifetime ago, when the dam was built, what historically, if indeed anything, was said about sediment or other environmental impacts, their costs, how they would be dealt with or the like? Is this the missing discussion we now need to have?	The build-up of sediment behind the dam does not impact the generation of electricity; therefore, there was no past motivation to address the impacts. Furthermore, the dam was built before the federal Clean Water Act and other environmental laws curbing sediment impacts. The report makes recommendations (Chapter 8.1) for a commitment to enhanced long-term monitoring and analyses of sediment and nutrient processes in the lower Susquehanna River and upper Chesapeake Bay. For the relicensing process, Exelon has agreed to fund studies to address the Maryland Department of the Environment's questions/concerns regarding water quality impacts from the Conowingo Hydroelectric Project. Other environmental impacts to fisheries and recreation must also be addressed during relicensing.
P.13	If one percent of the value of the electricity produced by the dam since it was built was spent on preventing sediment scouring or fish kills, what would that number of dollars be? How much to date for that sort of thing has been spent?	The assessment did not evaluate these costs. The build-up of sediment behind the dams does not impact the generation of electricity; therefore there was no past motivation to address this. To date, substantial investment has been made to address concerns for sediment storage in the lower Susquehanna River reservoirs (see Chapter 2.2, Sediment Management Investigations). The report makes recommendations (Chapter 8.1) for a commitment to enhanced long-term monitoring and analyses of sediment and nutrient processes in the lower Susquehanna River and upper Chesapeake Bay to promote adaptive management into the future.
P.14	If Conowingo Dam was not there would it make a difference in the amount of sediment in the Bay? Has an extensive study been done assessing the storms that pass down from NY and PA? How much sediment?	The assessment shows that between 2008 and 2011, about 13 percent of the Susquehanna River's sediment load came from the reservoir behind the Conowingo Dam. The remaining 87 percent originated from the 27,510-square mile Susquehanna River watershed. During lower flow periods, the three reservoirs act as sediment traps and aid in the health of the Bay until the next high-flow event or storm occurs. Without the dam, the river would carry all the sediment to the Bay from throughout the watershed. Subsequently, the dam is affecting the timing and delivery of sediments to Chesapeake Bay as well as holding back some of the coarser sediments (i.e., sand, gravel) from reaching the bay since they are more resistant to scouring.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
P.15	All of the discussion has focused on Conowingo Dam. What about Holtwood Dam and Safe Harbor Dam? It seems that the study recommendations are equally applicable to those dams as well.	The focus of the assessment was on the Conowingo Dam and mathematically defining the quantity of sediment coming from behind the Conowingo Dam. However, the other two dams were considered in the analyses (see response to comment P.8). The models show that all three reservoirs are active with respect to scour and deposition even at the dynamic equilibrium storage capacity, as is the case in the upper two reservoirs. The findings of the study are applicable to the upper two reservoirs, but not to same degree.
P.16	What are the costs for achieving/implementing enough BMPs in the watershed to make a difference? Is this even feasible?	Discussion of concept-level BMP costs is included in Section 5.2 and Appendix J-1. Note that Appendix J-1 describes costs associated with the "E3" scenario, which involves the theoretical maximum implementation of BMPs throughout the watershed (E3 = Everything, Everywhere, by Everyone). It would not be feasible to implement the E3 scenario (it was a "what-if" modeling exercise) and the relatively small reduction in sediment over the WIPs would not justify the cost.
P.17	How does this report impact the dam relicensing?	In addition to the Federal Energy Regulatory Commission requirements, a license for continued operation of Conowingo Dam cannot be granted to Exelon without a Section 401 water quality certification from the Maryland Department of the Environment (MDE). Issuance of a certification is contingent upon the applicant demonstrating to MDE that the proposed project will comply with state water quality standards. The current findings of the assessment were considered MDE's decision-making process for the water quality certification. In December 2014, Exelon withdrew its application for Section 401 water quality certification and agreed to fund studies to address MDE's questions/concerns regarding water quality impacts.
P.18	Is non-renewal of operating license being considered as a possible measure to be taken?	The Federal Energy Regulatory Commission has jurisdiction over hydroelectric licensing; therefore, the team cannot comment on their considerations with regards to relicensing the Conowingo Hydroelectric Project. Also see responses to comments W.7 and P.17.
P.19	I am an avid fisherman, boater and wildlife photographer. I fully support relicensing the Conowingo Dam and its form of renewable green energy. (The dam is not a source.) What can I do as a Maryland resident to support the restriction on sources of nutrient and sediment into the Chesapeake Bay watershed?	Attending and providing comment at the public meeting for this assessment is a good step toward voicing your support for sediment and nutrient restrictions. Continue to provide input to organizations and governments in your watershed and do your part to implement best management practices at home.
P.20	Do we know what sources of nutrients are largest contributors?	The main sources of nutrients in the Susquehanna River watershed include agricultural runoff, wastewater treatment plants, septic systems, stormwater runoff, and atmospheric deposition.
P.21	We seem to have a handle on the nutrient load that is impacting the Chesapeake. Given the reforestation recommendation in particular as it contributes to best practices, do we have an estimate for the approximate acreage that would need to be reforested? How achievable would that be?	The assessment did not quantify acreage needed to support achievement of TMDLs.
P.22	Recommendation: In the Executive summary (page ES-4) sediment is quantified as cubic yards. Elsewhere in the report, those sections describing TMDL, sediment is quantified as tons. Recommend that any cubic yard figures be also shown as tons.	**Editorial Comment** In the executive summary, cubic yards will also be identified as tons (final report pages ES-5 and ES-6).
P.23	Has there been any analysis or data collection into the impact of the Vulcan Materials Quarry in Harve de Grace on upper Bay water quality?	The report did not look specifically at impacts from the Vulcan Materials Quarry.

Comment Code	Comment	Comment Response
P.24	All dams have a lifespan, what happens to the sediment behind the dam when the dam reaches the end of its useful life? Who pays for it?	This question was not part of the assessment since the Conowingo Dam is expected to operate into the foreseeable future.
P.25	The assessment concludes that it is not cost effective to dredge the sediment. It shifts the solution and the costs upstream. In doing so, it shifts the burden from a few big players, Feds, States, etc. to small jurisdictions. Will sufficient funding be made available to the townships in PA and similar jurisdictions in NY to get the job done?	Comment noted. The team cannot speak to the funding that will be provided to support achievement of water quality milestones.
P.26	How are TMDLs enforced? What will it take to strengthen them - i.e. what is the approval process?	The Chesapeake Bay TMDL is discussed Chapter 2, Management Activities in the Watershed. Under Section 303(d) of the Clean Water Act, states and authorized tribes are required to list and develop TMDLs for impaired surface waters not meeting water quality standards. Federal actions to enforce TMDLs are described in Section 2.1.2 of the assessment. Further details about the TMDL approval process can be found on the EPA website: http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/dec4.cfm
P.27	There's a great deal of talk about sediment with Conowingo Dam. Are there other ecological impacts associated with the dam that we should be concerned about? If so, what can be done to reduce those impacts?	The dams do trap course-grained sediments, which provide downstream aquatic habitat and help SAV and wetlands proliferate. The enhanced monitoring recommended by the assessment will evaluate the biologic availability of nutrients and other ecological impacts. The dam also impacts the movement of migratory fishes, impeding access to spawning grounds. The dam relicensing process will help ensure this impacts are addressed. Chapters 5.4.3 and 5.4.5 discuss the beneficial reuse of dredged sediment for the purpose of habitat restoration and wetland creation. Chapter 2.6 describes the Susquehanna River Basin Ecological Flow Management Study, which sought to establish the volume and timing of flows to support aquatic species and ecosystems. Chapter 4.2 discusses river and reservoir conditions and implications to the Bay.
P.28	Bruce Michael (DNR) stated that Appendix T of the 2010 TMDLs in the 2010 TMDL anticipated the source trapped behind the Dam. Isn't it true that Appendix T actually showed a sink or trapping of TMDLs? And not a source?	The text for Appendix T of the Chesapeake Bay TMDL can be found on U.S. EPA's website: http://www.epa.gov/chesapeakebaytmdl/ The Conowingo Dam has long served as an effective trap for a portion of the pollution from the Susquehanna River. Should those sediments be released from the dam through scour or dam removal, those sediments would act as a source of pollutants.

Comment Code	Comment	Comment Response
P.29	For Mike Langland (USGS) – The HEC-RAS model is one dimensional. How is this model different from the HEC-6 model, also one dimensional? How is scour accounted for in these one dimensional models? Do you feel comfortable with the scour estimates from those models?	It is true that one-dimensional models have more limitations than two- or three-dimensional models; however, the team has confidence in the estimates provided by each of the models as all the models have been used extensively in the past, including for TMDL development, and have been vetted by the scientific community. Additionally, the models were calibrated with real observations. Additional data from the recommended enhanced monitoring will be used to further refine the models. HEC-RAS is essentially HEC-6 converted from a DOS to a graphical interface. The HEC-RAS graphical interface provides the user with the capability to perform sediment transport and analysis, and display the results. There are some additional changes in some of the algorithms which can produce different computations when compared to HEC-6. Information on the actual "functionality" of the HEC-RAS model is presented in Appendix A.
P.30	What would conditions be like if the Dam had never been built? How would impacts change if the Dam were removed?	If the dam had never been built, the river would carry all the sediments from throughout the watershed to the Bay, including beneficial coarse-grained sediment and any pollutants potentially associated with the sediments. If the dams were breeched or removed, there would be less trapping of nutrients and sediment during lower flows, and scour of the legacy sediments and associated nutrients during the higher flows would continue to occur until the sediments and nutrients had been removed. This would take many years. The river would continue to carry sediment to the Bay from throughout the watershed. Without the dams, fish passage would not be an issue, allowing migratory fish (American shad, river herring and American eels) to swim upstream and spawn.
P.31	A recent scientific editorial in *NY Times* advocated for removing Conowingo Dam and replacing it with smaller hydroelectric and other green energy systems. Dam removal is gaining ground in the US. The ecological benefits to the Susquehanna River and especially Chesapeake Bay would be transformative. Thoughts?	Dam removal was not considered as part of the assessment. One of the main reasons is because the reservoir created by the dam is critical in providing cooling water to the nuclear power plant as well as a providing a supplemental drinking water intake for Baltimore City.
P.32	Is the 2 year period of enhanced monitoring of sufficient duration to provide meaningful input to the 2017 model adjustment?	It is important to note that recommended enhanced monitoring will supplement long-term comprehensive monitoring that has been done over the past several decades. Therefore, the team believes the new data collected will enhance our understanding of the system to allow meaningful input to the 2017 Chesapeake Bay TMDL midpoint assessment.
P.33	In the Executive Summary it seems that “management strategies for reducing sediment from the Susquehanna watershed beyond the WIPs” are not given much consideration, but in the analysis of sources of sediment, the watershed contributions are assessed to be the source of the majority of the sediment load. Doesn’t it make sense to target reductions to the main source, rather than secondary sources?	Yes. The assessment suggests that strategies focused on reducing nutrient pollutant loads from the upstream watershed are likely more effective for improving the health of the Bay than reducing sediment from behind the dams. Additional upstream watershed practices to address Conowingo sediments and nutrients, if necessary and appropriate, will be considered during EPA’s analyses for the Chesapeake Bay TMDL midpoint assessment in 2017. Please see the response to comment P.16. The "E3" scenario, which implements BMPs beyond the WIPs, would not result in enough sediment reduction to justify the cost.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
P.34	We have been doing BMP's "at the source" for decades, yet your graph shows phosphorus levels continue to rise. What makes you think additional BMPs will help cut down that 87% sediment load?	Chapter 2 discusses management activities in the watershed, including Chesapeake Bay agreements and TMDLs. Chapter 5.2 evaluates sediment management strategies that reduce sediment yield from the upstream watershed. Initial agreements to reduce nutrients were non-binding and did not include all the watershed states. However, nutrient and sediment loads to the lower Susquehanna River are significantly lower than what was delivered in the mid-1980s, due to widespread implementation of regulatory and voluntary nutrient and sediment reduction strategies in the Susquehanna River watershed over the past 30 years. The 2010 Chesapeake Bay TMDL allocations for each of the seven watershed jurisdictions were derived by modeling nutrient and sediment pollutant loads that result in achievement of water quality standards. These allocations will be re-evaluated for the 2017 TMDL midpoint assessment.
P.35	We are increasing TMDLs based on information found in this study and the volume of sediments found behind the Dam. Will we increase TMDLs in other systems with large dams or series of smaller dams?	The assessment focuses specifically on sediment storage behind the Safe Harbor, Holtwood, and Conowingo Dams. Conclusions regarding the trapping capacities of other dams will require site-specific studies. As part of the Chesapeake Bay Program Partnership's Chesapeake Bay TMDL 2017 midpoint assessment, the partners are working to factor in hundreds of new dams into the input data for the partnership's Phase 6 Chesapeake Bay Watershed Model. The effects of these dams on the movement of nutrients and sediments through the watershed will be factored into the partnership's decision on the target nitrogen, phosphorus and sediment loads for the watershed jurisdictions' Phase III watershed implementation plans in the 2017 timeframe.
P.36	I'm wondering if you can help put the slide on "estimated sediment load" (the pie chart with 87% - 13% split between Susquehanna watershed and Conowingo reservoir) into perspective. Am I correct that Conowingo's 13% contribution is 13% of Susquehanna load, not 13% of total load flowing into the Bay from all sources? How significant is Conowingo's sediment/nutrient contributing seen from the perspective of total loads into the Bay?	The slide indicates that 13 percent of the sediment load in the Susquehanna River comes from the reservoir behind the Conowingo Dam. The remaining 87 percent originates from the 27,510-square mile Susquehanna River watershed. Sediments and nutrients also enter the Bay from other tributaries. The Susquehanna River contributes about 50 percent of the total freshwater flow to the Bay, which includes about 40 percent of the annual phosphorus load, 25 percent of the suspended sediment load, and 66 percent of the nitrogen load entering the Bay.
P.37	To what extent has Maryland reached its goals for TMDL? Is there anything we citizens can do politically to help move us toward our goals?	Maryland met the 2012-2013 pollution reduction milestones — in large part due to conservation practices such as record cover crops planted, wastewater treatment plant upgrades completed on schedule, and implementation of the Fertilizer Use Act of 2011 — and is on target for meeting the 2014-2015 2-year milestones. The public can help to achieve water quality goals by voicing to governments and organizations in your watershed that you support these goals, and by implementing best management practices at home.
P.38	Is sediment the only carrier of nutrients? If not, why is sediment only mentioned in the report?	Sediments are not the only carrier of nutrients. For example, nutrients may be dissolved in water or carried in the air. Sediments were the focus of the assessment, as the purpose of the assessment was to analyze the movement of sediment and associated nutrients within the lower Susquehanna River watershed through the dams and to the upper Chesapeake Bay.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
W.1	I believe the concern regarding the Conowingo Dam is whether or not the loss of sediment storage capacity will contribute to the recurrence of Hurricane Agnes type ecological impacts on the Lower Susquehanna Watershed. The base weather period you used in your study did not include years and time periods of extreme weather, such as Hurricane Agnes. The TMDL and the model that is used to develop the TMDL, looks at broad average, longer-term impacts, not those from very short-term extreme events. So the question remains: Is a Hurricane Agnes, with excessive delivery of sediment that essentially buries subaquatic vegetation, now more likely to occur or not and, if so, what are we going to do about it, if anything?	The comment is correct that the models did not incorporate the hydrologic period during which Agnes occurred, but they did include other high flow events such as Tropical Storm Lee and the January 1996 high flow event. Chapter 3.3 and Appendix C discuss these model simulations in detail. During scoping, the team did discuss conducting a modeling scenario evaluating an Agnes-sized event; however, this was determined to not be feasible due to high cost, study time frame, and lack of available data for model calibration. The reoccurrence of an event like Agnes (size and time of year) would likely cause severe impacts to the Bay, from which it may take decades to recover. Accordingly, it was not believed that modeling to further clarify the effects would aid in decision-making, and thus it was determined that it was impractical to make the additional effort for synthesizing and/or modifying the modeling tools. Additionally, there is no amount of dredging/in-reservoir management that would reduce the impacts of an Agnes-sized event in any meaningful way. With the current available data, simulations of Agnes would have high uncertainty and would not provide additional management insight. Appendix I-7 contains a discussion of what would be needed to conduct a modeling scenario for an Agnes-sized event. Following the occurrence of Agnes, the storm was calculated to be a 500-year event. However, there is general agreement that the 500-year frequency was overstated. There may have been isolated areas in the Susquehanna River watershed where this was true. But by the 1990's, the return interval was dropped to 200 and 100 years for most parts of the watershed. The lower Susquehanna reservoirs were not designed to be flood storage dams. The reservoirs have a very limited capacity to store water. During high flow events, the Susquehanna River delivers such large volumes of water that are beyond the control of reservoir regulation. In addition, climate change simulations for the Chesapeake Bay watershed out to the year 2100 predict increased precipitation amounts in the winter and spring, as well as increased intensities of precipitation, tropical storms, and northeasters (although their frequency may decrease). The impacts of these events will need to be considered when planning for climate changes.
W.2	Isn't the lower Chesapeake Bay starved for coarse grain sediment as a consequence in part of the dams on the rivers? If so, isn't there a benefit that should be considered of transporting some of this coarse grain sediment to where it is needed for ecological restoration or rehabilitation?	Chapter 5.4.3 of the assessment discusses the beneficial reuse of dredged sediments, including for habitat restoration. Sediment cores taken from behind the Conowingo Dam were composed of 80 percent sand in the upper reservoir, but only 20 percent sand in the lower reservoir. It would not be practical nor cost-effective to sort the coarse grains in the Susquehanna River for reuse in the lower Bay. Additionally, the sediment profile in the lower Chesapeake Bay is typically fed by flows from lower Bay tributaries, and not the Susquehanna River. Section 5.4.4 also discusses the time-of-year limitations for sediment bypassing (there are very limited ecologically bening times when sediments could be placed).
W.3	Will in-situ technology for denitrification be evaluated for managing the increases in nitrogen loadings to the Bay?	The assessment did not evaluate specific technologies for managing nitrogen inputs to the Bay. The Chesapeake Bay Program partnership will continue to consider crediting in-situ technologies for reducing nutrient pollutant loadings as part its "Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model."

Comment Code	Comment	Comment Response
W.4	If the runoff from my driveway makes a big difference, what plans are in effect to control runoff from business lots and our highways?	Chapter 2, Management Activities in the Watershed, describes planned and ongoing actions to limit inputs of pollutants in the watershed. Implementations of these actions vary by jurisdiction, but could include storm water remediation fees and/or best management practices to reduce sediment and nutrient runoff. In Maryland specifically, the current stormwater remediation fund (often referred to as the "rain tax") being implemented by certain jurisdictions assesses fees based upon the size of impervious surfaces (i.e., driveways, parking lots, rooftops, etc.).
W.5	Did the cost analysis for sediment removal consider the ongoing cost for sediment removal in the navigation channels downstream?	No. A direct relationship between material that passes the dam versus what ends up in the channels has not been determined. The material that deposits in the channel is mostly from the Bay bottom nearby, but it is obvious that storms generate sediment. It should be noted that maintenance dredging the channels is much more economical than dredging the reservoirs.
W.6	Will the economic benefit to the use of dredged sediments to replace wetlands being lost as a result of sea level rise?	Chapters 5.4.3 and 5.4.5 discuss the beneficial reuse of dredged sediment for the purpose of habitat restoration and wetland restoration. A qualitative assessment of these options is included in Table 5-5 and some costs are included in Appendix J-2.
W.7	What specifically is the reason for not granting the license to Exelon today? I understood their license ended in September.	Chapter 2.3 of the assessment summarizes Federal Energy Regulatory Commission (FERC) activities with regards to licenses for operations on the Susquehanna River. Exelon's current license from FERC for the operation of the Conowingo Hydroelectric Project was issued on August 14, 1980 and expired in September 2014. Exelon is now operating the dam on a temporary annual license. A license for continued operation of Conowingo cannot be granted to Exelon without a Section 401 water quality certification from the Maryland Department of the Environment (MDE). Issuance of a certification is contingent upon the applicant demonstrating to MDE that the proposed project will comply with state water quality standards. In December 2014, Exelon withdrew its application for Section 401 water quality certification and agreed to fund studies to address MDE's questions/concerns regarding water quality impacts.
W.8	Someone stated that whether or not sediment from scour is good or bad depends upon when the scoring event occurs. Lee was late in the year. Agnes early. Have you examined the possibility of controlled, intentional scours at times of the year when adverse impacts are less likely to occur?	The timing of storm events and sediment scour do make a difference to how these events impact the Bay. Storm events and timing are discussed in Chapters 4.2.2, 4.2.3, and shown in Figure 4-5. Observations and model computations indicate that an autumn event, such as Lee, has the least detrimental impact on Bay water quality. A late spring storm has the greatest impact due to high biologic activity and the height of the SAV growing season (see Table 4-9, Scenario 6) for seasonal impact differences). This assessment did evaluate intentional scour/dredging and bypassing sediment at times of the year that would be least impactful to aquatic life. Chapters 5.3, 5.4, 5.6, and Table 5-7 discuss management strategies for routing sediment or increasing storage behind the dams at different times of the year.
W.9	When Exelon was initially granted the original license were they required to do silt removal? If not, what changed to even discuss the issue with them rather than requiring those up river to be responsible parties and leave Exelon to generate power.	Questions regarding the specifics of Exelon's license to operate the Conowingo Hydroelectric Project should be addressed to the Federal Energy Regulatory Commission. However, it is unlikely at the time the license was granted in 1980 that sediment was considered an issue that would require action by the licensee. In addition, at that time, the reservoir behind the dam was not near full and had ample capacity to store sediments. The assessment indicates that some sediment is scoured from behind the dam, but a large portion of sediment is from the watershed. Future studies as recommended by the assessment will provide better indications of specific quantities from individual sources.

Comment Code	Comment	Comment Response
E.1	Is it true that most of the sediment behind the Dam has already blown through the Shoot-Gates every time they are OPENED during Flooding??? Is there not very much Sediment in BACK of the DAM now??? How about behind the other UPSTREAM Dams??? Do we need another DAM built down-stream of Conowingo...prior to the BAY??? HELP Save the BAY.	Comment noted. The assessment indicates that the reservoirs behind the Holtwood, Safe Harbor, and Conowingo Dams no longer have the long-term ability to store sediment and associated nutrients: a state of dynamic equilibrium now exists. As a result, large periodic storm events that occur on average every 4 to 5 years wash away sediment from behind the dams, increasing associated nutrient loads to the Bay. This creates a short-term increase in storage volume in the reservoirs for trapping sediment and nutrients.
E.2	One of the main findings of the report was that the nutrients associated with the sediments were more harmful to the Bay than the sediment itself. However, the report is unclear as to the effectiveness of dredging on reducing the sediment load to the Bay. There are numerous locations that discuss returning the bathymetry to 1996 levels etc. (for example Table 4-4) but it is not made clear just exactly how much sediment is estimated to be prevented from entering the Bay for each ton of sediment removed from the reservoir. This analysis should include taking the levels back to 1996 and beyond. It should also incorporate the value of strategic dredging to address high deposition areas and targeting removal of the fines (more likely transported). My company, HarborRock, is able to use the fines to make its product and leave the sand fraction in place – a benefit to lowering the scour rate. Reuse is the only option that is sustainable but the report does not clearly articulate or evaluate the long-term value of long-term dredging. We believe the information is within the various appendices etc. but is not being presented with enough transparency to make an informed decision on the value (nutrient reduction) obtained by dredging.	Comment noted. The assessment shows that sediment removal yields minimal, short-lived water quality improvements due to the constant deposition of sediment and associated nutrients that come from the watershed. Long-term, large volumes of sediment are depositing annually. Therefore, the net removal of sediments from the reservoirs via dredging only serves to keep up with deposition. Additionally, water quality improvements from dredging are minimal as the majority of sediment loads come from the watershed during high-flow events. Results of this study suggest that management opportunities in the watershed that reduce nutrient delivery to the Bay, as opposed to sediment only, are likely more effective at reducing impacts to water quality and aquatic life from high-flow events.
E.3	General Comment (see Appendix I-x for complete Petition Language): The Conowingo Dam has played a key role in providing clean reliable electricity to the region for more than 85 years. I am submitting a petition that endorses the work of the U.S. Army Corps of Engineers, numerous Maryland state agencies and many other stakeholders for a science-based approach to developing a course of regional action in improving the water quality in the Chesapeake Bay. On behalf of the more than 11,500 signers of this petition we thank the Corp and those involved for the work already completed on this issue and look forward to the continued work on addressing this regional issue.	Comment noted.

Comment Code	Comment	Comment Response
E.4	Thank you for providing an opportunity to comment on this important report. I attended the December 9 public meeting and have reviewed the LSRWA Draft Report. I believe that the relicensing of the Conowingo Dam Hydroelectric Generating Station presents a unique opportunity to improve the health of Chesapeake Bay. The legacy sediments behind Conowingo Dam contain nutrients and toxins that otherwise would have entered Chesapeake Bay. What needs to happen now is to remove them. This will reduce scour of the legacy sediments into the Bay during storm events and restore capacity to trap new sediments behind the dam. Removal of legacy sediments upstream is an important strategy for protecting and improving the water quality of Chesapeake Bay. This effort should be undertaken not solely by the state of Maryland but with support from all of the states in the Susquehanna River watershed. Maryland governor-elect Larry Hogan explained the importance of this approach during his campaign and I believe this strategy should be incorporated into the relicensing of Conowingo Dam.	Comment noted. The assessment shows that sediment removal yields minimal, short-lived water quality improvements due to the constant deposition of sediment and associated nutrients that come from the watershed. Long-term, large volumes of sediment are depositing annually. Therefore, the net removal of sediments from the reservoirs via dredging only serves to keep up with deposition. Additionally, water quality improvements from dredging are minimal as the majority of sediment loads come from the watershed during high-flow events. Results of this study suggest that management opportunities in the watershed that reduce nutrient delivery to the Bay, as opposed to sediment only, are likely more effective at reducing impacts to water quality and aquatic life from high-flow events.
E.5.1	The report asserts the nutrients associated with sediments have more of an adverse impact than the sediments themselves and that there may be more cost effective means than restoring the Conowingo storage volume to prevent these nutrients from reaching the Bay. It is suggested that in updating the draft study that it be made clear that the study did not quantify the nutrient offsets required nor recommend options and costs for achieving the offsets. It is also suggested that it be made clear that the study does not rule out dredging from behind the dam as an option in future studies. The draft study indicates with the WIPs in full effect (Table 4-9, page 82, Scenario 2) the nutrient load associated with the sediments will be 50.8 tons per day of nitrogen and 4.2 tons per day of phosphorus. These are very large loads. To put them in perspective, if we looked to the 173 wastewater treatment plants in Pennsylvania that are in the watershed to contribute to the nitrogen offset, the most they could provide would be 5 million pounds per year, or 6.85 tons per day. The Phase II WIP already counts on these treatment plants removing nitrogen to achieve effluent concentrations of 6 mg/L to achieve their annual nitrogen wasteload allocation of approximately 10 million pounds. Upgrading these wastewater treatment plants to the limit of technology to achieve 3 mg/L will provide 5 million pounds per year offset. Treating to the limit of technology is a strategy being employed at Maryland's major wastewater treatment plants to achieve a comparable amount of nitrogen removal and the capital costs are in excess of $1 billion. Thus, a very considerable expenditure would be required to remove only 6.85 tons per day using this strategy. It may be that increasing the storage volume is found to be the most cost effective option after all.	Comment noted. The assessment did not quantify nutrient offsets, although this has been included as a recommendation by the report. The assessment presents management options and recommendations. This does not preclude evaluation or implementation of these options in the future.

Comment Code	Comment	Comment Response
E.5.2	In evaluating the impact of sedimentation on the indicators of dissolved oxygen, light attenuation and chlorophyll concentration, the study did not identify the environmental and cost benefits that a reduced sedimentation rate would have on other parameters such as dredging the shipping channels, restoring the oyster population and recreational activities. While the Chesapeake is a national resource, we as Marylanders at the downstream end of the watershed have the most at stake in having a healthy Bay, because it largely defines who we are. It's not the correct question to ask: Is it cost effective to remove the sediment from behind the Conowingo dam? The correct question to ask is: Do we want to restore the Conowingo dam to beneficially serve as a sediment trap as it had for the past 70 to 80 years, or do we want to give up that benefit and essentially allow all sediment to pass through it? It would be a big mistake to accept a well publicized interpretation of the draft Study's findings that there is little benefit to dredging. For example, see Karl Blankensip's *Bay Journal* article dated November 13, 2014 which stated in part: *"The $1.4 million study, released by the Army Corps of Engineers and the Maryland Department of the Environment, also concluded that dredging built-up sediment from behind the 100-foot-high Susquehanna River dam would have huge costs and provide little benefit."* We shouldn't be satisfied to have a sediment-laden, degraded, unhealthy Bay define us. Instead we need to focus our efforts on restoring the dam as a sediment trap. We need to determine the most cost-effective and environmentally responsible means of removing the sediments and to identify the most beneficial re-use for them.	Comment noted. The assessment shows that sediment removal yields minimal, short-lived water quality improvements due to the constant deposition of sediment and associated nutrients that come from the watershed. Long-term, large volumes of sediment are depositing annually. Therefore, the net removal of sediments from the reservoirs via dredging only serves to keep up with deposition. Additionally, water quality improvements from dredging are minimal as the majority of sediment loads come from the watershed during high-flow events. Results of this study suggest that management opportunities in the watershed that reduce nutrient delivery to the Bay, as opposed to sediment only, are likely more effective at reducing impacts to water quality and aquatic life from high-flow events.

Comment Code	Comment	Comment Response
E.5.3	It appears that the draft report is already influencing some Maryland politicians and policy-makers to make the case of why should their jurisdictions be required to control non-point source sediments and nutrients since they won't be further controlled from the very large areas of New York and Pennsylvania? Regardless of what is done to control sediments and nutrients from the Susquehanna, we should not reduce our own activities in Maryland to control non-point source sediments and nutrients, nor reduce our efforts to improve nutrient removal at our wastewater treatment plants. My main concern with draft Study is it may influence policy makers to do nothing about sediments from the Susquehanna and it also may be influencing policy makers to cut back on environmental measures that are already being implemented in Maryland. We must reduce the sediments and nutrients from the Susquehanna in addition to what we are already doing and for funds to be available for each initiative. The Chesapeake is a national resource influenced by several states. As such, it is very reasonable to expect funding to be fairly shared among the federal government, New York, Pennsylvania and Maryland to mitigate the Susquehanna's impacts on the Bay. For this to happen, consideration needs to be given as to what New York and Pennsylvania will receive in return.	Comment noted. The assessment suggests that strategies focused on reducing nutrient pollutant loads from the upstream watershed are likely more effective for improving the health of the Bay than reducing sediment behind the dams. All of the Bay watershed states are required under the Chesapeake Bay TMDL to meet their targeted nutrient and sediment load allocation by the year 2025.
E.6.1	Overall, CBF believes the report's conclusions and recommendations are well supported and grounded in the best available science. The results clearly show that nutrients scoured from the behind the Conowingo Dam during high flow events are contributing to the violation of downstream water quality standards for dissolved oxygen. Results also suggest, however, that implementation of the state Watershed Implementation Plans (WIPs) which complement the Chesapeake Bay TMDL, have a far larger influence on the health of Chesapeake Bay in comparison to scouring of the lower Susquehanna River reservoirs. In addition, results also show that while impacts to the Chesapeake Bay ecosystem from all three dams and reservoirs are important, the majority of the sediment load from the lower Susquehanna River entering Chesapeake Bay during storm events, originates from the watershed rather than from scour from behind the Conowingo reservoir.	Comment noted.
E.6.2	The study also makes recommendations for future research and monitoring needed to address key data gaps. We firmly support these recommendations, particularly those related to enhancing the understanding of the nature, availability, and fate of nutrients scoured from the Conowingo Reservoir. These findings and the additional research are critical to the development of the Section 401 Water Quality Certification by the state of Maryland during the relicensing process and will also serve to inform the 2017 Midpoint Evaluation for the Chesapeake Bay TMDL.	Comment noted.

Comment Code	Comment	Comment Response
E.6.3	We do, however, believe the report would benefit by bolstering the qualitative discussion regarding potential impacts of storms and scouring on submerged aquatic vegetation (SAV) and oysters. We recognize that all LSRWA modeling scenarios listed in Table 4-9 resulted in estimates of full attainment of the SAV and water clarity water quality standards for all Chesapeake Bay segments. And furthermore, that the SAV and water clarity water quality standards were not the drivers behind the TMDL allocations like the DO deep-channel and deep-water water quality standards were. That said, we also know that big storms like Tropical Storms Agnes and Lee do affect underwater grasses. In addition, when the January 1996 "Big Melt" event storm was moved to the June time period, light attenuation was estimated to be greater than 2/m for 10 days, a level of light attenuation that does not support long-term SAV growth and survival (1.5/m is required).	There are some GIS and aerial photography evidence that suggest scour of SAV beds in the Susquehanna Fats occurred during Tropical Storm Lee, but the estimates of scour were unquantified and to date, citations on the SAV scour phenomena from Tropical Storm Lee or other large Susquehanna storms are unavailable in the peer review or grey literature. Additional information on water quality implications for SAV (in general) have been added to the report, as well as a quantification of nutrients associated with the sediments for storm events.
E.6.4	On page 71 there is a brief discussion about effects of storm events on underwater grasses and then the statement that "Appendix K provides further discussion on SAV trends and impacts from storms in Chesapeake Bay." Appendix K, though containing a section on underwater grasses, is more devoted to general background information on the Bay and associated habitats. We suggest this Appendix include more discussion of the findings of Gurbisz and Kemp (2013), Wang and Linker (2005) and any more recent work on this topic including, if possible, a consideration of the relative effects of scouring versus watershed loads, if only in a qualitative sense.	Text has been added to the main report in Chapter 4.2.2 to bolster the discussion of the effects of storm events on SAV. Information from Wang and Linker (2005) and Gurbisz and Kemp (2013) has been included.
E.6.5	Similarly, we suggest a more in depth discussion on oyster impacts. Currently, the report references a post Tropical Storm Lee study indicating the oyster mortality in the northern Bay was due to salinity decreases, not to sedimentation. We are not disputing this finding, but would encourage the study authors to include additional studies and information that support this contention. In addition, we also recommend including a discussion of why some oyster bars are susceptible to sedimentation that may not be, in any way, related to storm events. Questions about effects of scouring from behind Conowingo Dam on SAV and oysters continue to be raised in the public domain. To the extent that they can be addressed more comprehensively in the report, may help to assuage some lingering concerns.	Additional information about oyster impacts has been added to Chapters 4.2.2 and 4.2.3.

Comment Code	Comment	Comment Response
E.7	As you know, an interesting project is evolving as to the Conowingo Dam and the release of sediment laden contaminants (primarily Phosphorous and Nitrogen), from the Susquehanna River into the Chesapeake Bay. Of particular interest to various parties invested in this project, is the approximately 200m cubic yards of sediment behind the dam and the reduced "trapping" capacity of the dam itself. While there are conflicting tactics as to the sort of solution to the sediment/nutrient discharge, The Chesapeake remains in limbo regarding the "best of solutions". This is a seminal project requiring a provocative technological approach tied to cost effective disposal solutions. I am here to report that the dewatering component of the project can be done at a small fraction of traditional costs. Production of tens of thousands of cubic yards per day is achievable. Return water is clean and clear (<20 mg. per ltr.,t.s.s.), with virtually all phosphorous (99%), and most nitrogen removed. Obviously, all organics and clay are captured and dewatered. I have a "dog in this hunt". I am the founder of a company (Genesis Water) that holds recent patents on very high-speed dewatering capabilities. Any eutrophic waterway can be restored as quickly as the dredge can pump. I hope we have the opportunity to discuss the core issues of this unusual project.	Comment noted.
E.8.1	We find that the report, though it summarizes well the science related to issue of management of the Conowingo Dam reservoir for the protection of the water quality of Chesapeake Bay, fails in its argument that the loss of sediment storage capacity in the dam reservoir lacks critical importance to the health of the Bay ecosystem. The critical findings of the studies that underlie the report suggest the opposite. Also not convincing is its assertion that the current approach to water resource management through the Chesapeake Bay Total Maximum Daily Load (TMDL) water quality management process alone will adequately safeguard the resilience of the Bay ecosystem from the impacts of extreme weather events. Though a policy and its implementation process—the TMDL--is conceived and designed to achieve a longer term goal of water quality, this does not in itself argue that the individual steps and components in this highly complicated venture will necessarily succeed. There is uncertainty in any approach and consideration of this uncertainty should be apparent in the study. As the report states--though this admission is buried deep in the body of the report--, the nature of the problem of legacy nutrients in the hydrologic system makes verification of effectiveness of measures implemented as part of the TMDL implementation plans nearly impossible in the short while. The report also fails to identify and examine what the unique opportunities are for changing the management of a key component of the water system presented by this once-in-a-lifetime relicensing of the operation of the dam. This latter should be the focus of this study and should be answered in the report.	Comment noted. Finding #2 of the assessment (Chapter 8) states, "The loss of long-term sediment trapping capacity is causing impacts to the health of the Chesapeake Bay ecosystem." However, the modeling conducted for this assessment indicates that it is the nutrients associated with the enhanced sediment load, and not the sediments themselves, that have the most harmful impact on water quality and aquatic life. Furthermore, between 2008 and 2011, just 13 percent of the Susquehanna River's sediment load came from the reservoir behind the Conowingo Dam, while 87 percent originated from the 27,510-square mile watershed. Therefore, options for managing sediment behind the dam will be less effective than strategies focused on nutrient reductions throughout the watershed. It is recommended that the findings of this report be considered and incorporated into the analyses for the Chesapeake Bay TMDL 2017 midpoint assessment, and that management options that offset Bay impacts from increased sediment-associated nutrient loads be implemented.

Comment Code	Comment	Comment Response
E.8.2	We suggest strongly that a revised report discuss measures to reduce the volume of water, and hence the nutrients and sediment contained within, associated with the kind of extreme weather events that normally occur within the timeframe of the dam electrical plant operating permit and those that become more likely to occur as a consequence of a rapidly changing climate. As the report states, though this too is hidden deep in the body, a Conowingo dam at dynamic equilibrium leads to faster flowing water that carries with it more sediment and nutrients. Hence, expanding the amount of stormwater that can be temporarily stored on the land adjacent or immediately connected to the Susquehanna and its tributaries and otherwise slowing the runoff from these lands should be a major focus of the options for addressing the consequence of Conowingo dynamic equilibrium. Instead the reader is presented with the tautological argument that a policy designed to achieve a policy goal will by definition do so. It does not reconcile this assertion with the admission that the current TMDL and its measures are already out of date and must be revised as a consequence of increasing nutrient and sediment loads from a Conowingo dam that is already at dynamic equilibrium.	Comment noted. The focus of the assessment was to analyze the movement of sediment and associated nutrient loads within the lower Susquehanna River watershed, including the reservoir at Conowingo Dam and the capacity of the dam to trap sediment. As such, the assessment did not evaluate strategies to reduce the volume of water passing the dam, although watershed strategies to reduce sediment will likely also help reduce stormwater flows to Chesapeake Bay. The assessment updated our understanding of the system and produced numerous products that are now available to assist in future watershed planning and management efforts, including informing the Chesapeake Bay TMDL 2017 midpoint assessment.
E.8.3	The finding of a current TMDL already out of date belies the conclusion of the report that the dam and its accumulated sediments are inconsequential to the health of the Bay and the implicit suggestion that a change in the conditions for relicensing of the operation of the dam—whether or not the onus is placed directly on the operator of the dam--are not necessary. Rather than a "[f]uture needs and opportunities in the watershed," as the report suggests, development of management options that offset impacts to the upper Chesapeake should instead be examined in this report in order to take advantage of the relicensing opportunity that is available for only a short period of time.	Comment noted. See response to comment E.8.1. It is also important to note that enhanced monitoring and modeling is recommended for the lower Susquehanna River. This includes studies that Exelon has agreed to fund to address the Maryland Department of the Environment's concerns regarding water-quality impacts from operation of the Conowingo Hydroelectric Project. Information from these studies will feed into decisions regarding relicensing of the dam.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
E.8.4	An assessment was indeed conducted as part of the study but the act of assessing is itself NOT a clear articulation of what the assessment is conducted for. The Executive Summary nor the introductory chapters to the report makes clear what the core questions were that the assessment was to provide information to answer. These should be stated at the outset so that the reader can better evaluate the science and the arguments that underlie the conclusions relating to key public policy choices that pertain to the relicensing decision. Our examination of the body of the report suggests that the major conclusions as stated in the Executive Summary are not well supported by the methods and results. The reader has literally to dig deep into the report to identify the scientific questions that were posed and to discover the scientific findings. Often one set of findings, such as related to extreme weather events, i.e. greater than five years recurrence intervals, and reservoir bed scouring were not sufficiently incorporated into the analyses in another section. What was the perceived problem for which the study was to provide the information to answer? It appears that an answer to this question is provided only later in the press release, not in the introduction or body of the report—what is the importance of loss of sediment storage capacity in the dam reservoir relative to implementation of the Chesapeake Bay TMDL and the environmental problem that it—the TMDL-- is designed to address. It is unclear how the findings and conclusions of the LSRWA will or can be used in the relicensing decision. We hope that the final report will contain a serious examination of conditions and options that should be considered in the relicensing decision.	Comment noted. See response to Comments E.8.2 and E.8.3. Substantial text was added to the executive summary, Chapter 1, and Chapter 4 to clarify the problem.

Comment Code	Comment	Comment Response
E.8.5	We learn elsewhere in the body of the report that the loss of sediment storage capacity behind the dam in the next few years will increase the threat to the ecosystem health from extreme weather events (ever more likely with a rapidly changing climate, such as occurred with Hurricane Agnes just some forty years ago). Also, inconsistent with the conclusions that are presented in the Executive Summary, we learn that the dam and its reservoir are already at dynamic equilibrium and that the TMDL, which the report argues is the answer to water quality concerns, will no longer achieve its intended goals as a consequence of the dam at dynamic equilibrium. Nor do we have an answer as to how at this juncture with the pending relicensing of the Conowingo Dam for electric power use, the management of the dam and its reservoir could or should be changed to ensure that the ecologic damage from a future Hurricane Agnes does not recur. Also disturbing is the absence of a discussion of the value of the sediment that increasingly fills up the reservoir to the ecosystem health of the larger Bay system, particularly in lower sections of the Bay. Here the problem is land disappearing in part because of sediment starvation. Sediment that restores and enriches the land-water interface is instead captured behind the dam. The answer at the public hearing by representatives of the study that "we all agree that we should study the issue more" is, to be blunt, an acknowledgement that this report does not address the prevailing public policy concerns. Calling for another study to do what this study should do does not instill confidence in how this larger issue of protection of ecosystem resilience, as we have articulated it here, will ever be addressed. We are not persuaded by the report's statement that a Conowingo Dam reservoir at dynamic equilibrium with regard to sediment matters little to ecosystem health. There is no discussion in the analytical section of the report of how the dam at dynamic equilibrium may adversely affect ecosystem resilience and the ability of the ecosystem to withstand infrequent, but highly severe insults, such as 40 year or more recurrent interval storms. Should we not be managing components of the system, such as the dam and its reservoir, for resilience? If so, then the study should have examined the ability of the system, with the reservoir at dynamic equilibrium, to withstand infrequent recurrence interval storm events and used these results as the measure against which to compare alternative management strategies. Since the Conowingo Dam license renewal is for some fifty years, fifty years, at least, would seem to be the proper recurrent interval number to be used, not five or ten-year storms.	Comment noted. The executive summary clearly states that the reservoirs are in a state of dynamic equilibrium. See response to comments E.8.2 and E.8.3 regarding dam licensing and TMDL evaluations. The dams do trap course-grained sediments, which provide downstream aquatic habitat and help SAV and wetlands proliferate. Chapters 5.4.3 and 5.4.5 discuss the beneficial reuse of dredged sediment for the purpose of habitat restoration and wetland creation. See response to comment E.8.1 regarding the relative importance of the sediment behind the dam to ecosystem health. See response to comment W.1 with regards to modeling larger, less-frequent storm events (e.g., Agnes).

Comment Code	Comment	Comment Response
E.8.6	The study appears designed to give the answer that implementing regulatory requirements under the Clean Water Act for the Chesapeake Bay to meet the Total Maximum Daily Load (TMDL) goal will address any current and future problem of sediments and nutrients. The implementation plan under the Chesapeake Bay TMDL may or may not eventually result in significant improvements in the ecosystem health of the Bay and its environs. Time will tell. However, choosing to examine only that period of time in the analytical part of the report that compares options that coincides with the current phase of the TMDL and that incorporates only relatively minor storm events of low recurrence intervals that are not of the kind that can be expected to occur during the much longer time period (some fifty years) of the Conowingo Dam relicensing period leads not surprisingly to results supportive of the major conclusions regarding importance of storm-related scour events. Certainly the inclusion of forty or fifty year recurrence interval storm scour events would have been called for and may have likely led to different conclusions regarding the appropriateness of management strategies.	Comment noted. See response to comment W.1 regarding modeling larger, less frequent storm events (e.g., Agnes).

Comment Code	Comment	Comment Response
E.8.7	The assumption in this study that the TMDL implementation occurs flawlessly and on time despite the thousands of required practices conducted by different public and private entities necessary to achieve predicted levels of performance defies logic and almost fifty years of Clean Water Act experience. That this assumption regarding success on the agricultural portion of the TMDL is highly questionable and that it should be bracketed within a large uncertainty range is supported by hundreds of studies conducted under the auspices of the United States Department of Agriculture's Conservation Effects Assessment Project (CEAP)2. Over more than ten years, the top government and academic researchers under the auspices of CEAP examined the effectiveness of agricultural nutrient reduction practices and strategies in watersheds throughout the country and over many decades. The conclusions are that most nutrient reduction practices on agricultural lands, for a variety of reasons that are often location-specific, have not been successful. More effective interventions needed to be implemented as part of a comprehensive management system that is tailored to site-specific conditions with constant reassessment regarding the effectiveness. How this must occur is still the subject of scientific and policy debate. The reason stems in part from the fact that no farm or section of land is the same, nor is any the management of any two farms or sections of land likely to be the same. The problem is one for which there are no certain answers at the moment and that requires more research to resolve. Compounding the problem is the legacy of how the land was managed in previous decades and its impact on nutrient loss from these lands. This is an issue of cutting edge science and policy that has been reduced to almost cartoon simplicity in this report. In any case, the uncertainty regarding TMDL implementation success and effectiveness should be factored into any comparison of alternative options for managing sediment and nutrients to and from the Conowingo Dam. We suggest only that alternative and parallel strategies of managing sediment, such as through dredging or controlled flushing, and actions to expand temporary stormwater storage upland from the dam can potentially be far more certain since sediment management at the dam can be relatively easily implemented and monitored and increased upland water storage quantified using today's new technologies. And, of course, there is a significant cost for all strategies.	Comment noted. The assessment provides an update to our understanding of the Lower Susquehanna River system and makes recommendations regarding future monitoring and management options; however, decisions regarding the most effective strategies for nutrient reductions will need to be made by EPA and their seven Chesapeake Bay watershed jurisdictional partners. Having said this, it is also clear that the agricultural community will have to be key partners in restoring the Bay because agricultural sources are significant contributors and are often the most cost-effective solution.

Comment Code	Comment	Comment Response
E.8.8	For unknown reasons, only the cost of dredging was estimated in detail. The cost of implementing the TMDL was assumed to be a one-time cost that appears lower than the ongoing Net Present Value (NPV) of a stream of costs associated with dredging. How farm management practices to reduce nutrients and sediment can be assumed to be one-time costs is not credible and runs counter to hundreds of economic studies and case studies that argue significant ongoing costs. Moreover, unpublished data generated as part of US Environmental Protection Agency's Chesapeake Bay TMDL cost-benefit analysis suggest that TMDL implementation, if and when fully implemented in the upper sections of the Chesapeake Bay watershed, will also likely cost billions of dollars per year. Clearly, a large range of benefits can be expected to accrue from successful implementation of the TMDL which can justify this costs. But the public policy issue is not either the TMDL or another intervention at the locus of the dam, but rather whether or not an action linked to the dam relicensing and operation can be justified by its costs and benefits.	Comment noted. Chapters 5.3 and 5.6 present the E3 scenario and Scenario 14 for implementing additional BMPs in the watershed to meet TMDLs. The costs provided are concept-level costs and include a range for each BMP, given the uncertainty of site-specific implementation considerations. The E3 Scenario and Scenario 14 were presented as a quick comparison to sediment management strategies. Since the assessment was designed to study the issue of sediment movement and delivery to the Bay, the management strategies evaluated in detail were primarily targeted at sediment removal and bypass.

Comment Code	Comment	Comment Response
E.8.9	The question that should have been the driver for the analysis is instead the caboose in this report in that it finally appears in the "Future Needs and Opportunities.." section of the Executive Summary. The recommendation, i.e. "[d]evelop and implement management options that offset impacts to the upper Chesapeake," should actually be restated as the core question that the study should address. What do you do with the loss of sediment capturing capacity over time since the implication is that the currently required practices under the TMDL are or will no longer be enough to reduce significant increases in nutrient and sediment loads to the Bay? Can there be beneficial uses to the sediment, if dredged or otherwise removed from the reservoir? The town hall meeting that occurred in December 2014, acknowledged these questions. One-time costs assumed by this study become ongoing costs as new requirements on urban communities and on farmers get imposed to offset this loss. It appears that alternative strategies to or along with the TMDL to address the consequence of rising nutrient and sediment loads as a result of the loss of storage capacity behind the dam are treated in a biased manner. The discussion of intentional scouring, for example, was given short shrift and deserves a more unbiased and serious examination. The issue of timing and its relationship to unintended downstream consequences was totally neglected. That these other options are not viable has not been well demonstrated by the analyses presented in this report. The sediment management options were limited to engineering and technological options. Why were no economic options examined? Options for addressing the problem of stormwater flow volume and rate of through the system at times of extreme weather events were not examined. Doing so would consider means for expanding floodwater storage on lands adjacent to the river, such as on agricultural lands. There are likely to be options on temporarily storing water on non-agricultural lands, such as through the management of road culverts, rehabilitation of wetland and of wet lands and forested lands, as well New digital elevation map data could be extremely helpful in identifying these lands for increased storage. Contingent contracting would serve to make these lands available when needed [See the references below.] Another example of an economic approaches is a policy to convert negative economic value of "pollutants" (i.e., sediment and nutrients) to tradeable commodities with positive economic value. This is can be done through labeling and a combination of regulatory and economic measures.	Comment noted. The focus of the assessment was to analyze the movement of sediment and associated nutrient loads within the lower Susquehanna River watershed, including the reservoir at Conowingo Dam and the capacity of the dam to trap sediment. The question going into the study was not as stated in the comment (i.e., to develop and implement management solutions to offset impacts to the Bay). Initially, the current capacity of the reservoirs behind the dam had to be assessed, followed by an evaluation of the associated environmental implications and whether this could be addressed through sediment management. With respect to the sediment management strategies, the assessment conducted a screening level analysis of fairly traditional alternatives. As such, this analysis has its limitations and many potential options were not explored. In general, however, these traditional sediment management alternatives were found to be either cost-prohibitive or technically infeasible due to multiple competing uses of reservoir storage. The issue of timing was discussed separately in Section 4.2.2 on "Storm Effects and Implications" (see Figure 4-5). The assessment did not evaluate strategies to reduce the volume of water passing the dam or the economic approaches identified in the comment. It is recommended that the findings of the assessment be integrated into the ongoing analyses and development of Phase 3 watershed implementation plans as part of the Chesapeake Bay TMDL 2017 midpoint assessment. In reality, a mix of strategies will likely be needed to affect sediment and nutrient reductions.

Comment Code	Comment	Comment Response
E.8.10	No economic cost was assigned to the uncertainty regarding the implementation and effectiveness of TMDL measures as opposed to measures, such as dredging for which the effectiveness and be more quantitatively ascertained. For example, the cost estimates for TMDL measures lack credibility. The report should have made clear that then values were largely drawn from scattered studies of unclear relevance to where they could be implemented in the watershed, along with no credible assessment of the variability of their effectiveness given the myriad site-specific factors that affect performance.	Comment noted. The concept-level costs for the BMPs used in the modeling scenario were obtained from the Chesapeake Bay Program, Maryland Department of the Environment, and/or Maryland Department of Agriculture (see Chapter 5.2.1). Cost and effectiveness of BMPs will be site specific. Given site specific factors for implementation of BMPS, a range of costs is provided for each BMP in Table 5-2. Table 5-3 shows a range of costs for implementing the E3 scenario. It is correct that there is some uncertainty in these costs and that future technologies will also play a role in driving costs that cannot be adequately estimated.
E.8.11	The discussion of the TMDL and its implementation measures uses tautological arguments that are not convincing. The argument repeatedly presented is that, because the TMDL is designed to achieve success and meet water quality goals, implementation of the implementation plans and associated practices must by definition lead to the water quality goals. This is further assured, we are told, because of periodic monitoring that leads to readjustments in implementation plans over time. However, not until chapter four do we learn that this is not possible—in other words, verifiability is not possible--because the nature of the nitrogen and phosphorous pollution problem itself and its legacy effects with the hydrologic system. This same tautological argument can be constructed for every option that one can conceive to address water quality problems in the Bay.	See response to comment E.8.1.
E.8.12	The report, Table 4-1 presents practices that are not defined and hence cannot be independently evaluated as to their likely effectiveness. For example, what does "improved nitrogen management" mean in practice. And if it is so improved, why is the practice not already adopted since nutrients are a cost to a farmer? Similarly, what does "improved conservation practices" mean? Again, if they really are improved, then there should be some discussion as to why they have not been adopted by a rational person.	Table 4-1 represents a very general summary of strategies incorporated into different states' WIPs. For further information on the specifics of the strategies for each state, please see the links (in Chapter 4.1) to the Phase II WIPs for each state.
E.8.13	The report contradicts itself repeatedly. It makes the argument that a Conowingo at dynamic equilibrium is not important but then states a Conowingo at dynamic equilibrium necessitates revision of the TMDL in order to achieve water quality. If a revision to the TMDL is already needed (page 97), then clearly it is important and the conclusions are wrong. Which is it? The science presented in the report suggests that the conclusion is unsupported and thus just plain wrong.	See response to comment E.8.1.
E.8.14	The report fails to acknowledge the unique opportunity to change the management of a key component in the ecosystem of the Bay—i.e., the node at a critical juncture point represented by the Conowingo Dam. Instead of presenting and examining innovative options for how to use this opportunity for improvements in the protection of the resilience of the system, it recycles old tautological arguments for staying the course and just focusing on implementation of the Chesapeake Bay TMDL. In doing so, it sheds no new light on what the path forward should be.	See response to comments E.8.1, E.8.2, and E.8.3.

Comment Code	Comment	Comment Response
E.8.15	For example, there could and should be discussion of options for reducing the volume of stormwater laden with sediment and nutrients that surge through the system at times of extreme weather events. Such options could include arrangements or contracts with farmers and landowners on lands adjacent or directly connected to the river to allow for temporary water storage at times of anticipated high flow. Thus temporary storage could serve to reduce the volume of water at key high flow times through the reservoir and the dam and to slow down and allow for settling out of sediment and associated nutrients in areas upstream from the reservoir. Examining a broader array of options than what the Corps of Engineers traditionally identifies is in fact now since December 2015 a requirement [See http://www.whitehouse.gov/administration/eop/ceq/initiatives/PandG/] For a discussion of how more storage capacity can be effected, please see http://www.jswconline.org/content/55/3/285.short. See also http://www.rff.org/Publications/WPC/Pages/Options-Contracts-for-Contingent-Takings.aspx and On Risk and Disaster: Learning from Hurricane Katrina by Ronald Daniels, Donald Kettl, and Howard Kunreuther.]	Comment noted. The focus of the assessment was to analyze the movement of sediment and associated nutrient loads within the lower Susquehanna River watershed, including the reservoir at Conowingo Dam and the capacity of the dam to trap sediment. As such, the assessment did not evaluate strategies to reduce the volume of water passing the dam, although watershed strategies to reduce sediment will likely also help reduce stormwater flows to Chesapeake Bay.
E.8.16	In conclusion, the report, as it is currently written, does not adequately address public and interested party concern regarding the loss of sediment storage capacity behind the dam nor does it illuminate options for managing the dam for future protection of the Bay ecosystem. We recommend engaging a broader set of stakeholders, such as the National Capital Chapter of the Soil and Water Conservation Society and other professional organizations that deal with the conservation of soil and water resources, in reviewing and drawing new conclusions from the data that exist that pertain to the issue.	Comment noted. Appendix I-1 and I-2 outline public outreach activities. Through press releases, distributed emails, presentations to stakeholder groups, the public meeting, and the public comment period, the study process attempted to engage as many interested stakeholders as possible.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
E.10	The SWQAC commends the U.S. Army Corps of Engineers, Baltimore District (USACE), and the Maryland Department of the Environment (MDE) and multiple partners, on the objective science and research performed and summarized in this document. The report provides much needed information for management decisions to ensure water quality is protected and improved. The SWQAC supports the four specific recommendations outlined on ES-5 and section 8.1 'Future Needs and Opportunities in the Watershed'. Furthermore, the SQWAC recommends that reliable and sustainable sources of funding, staffing and commitments should be secured to ensure the recommendations are fully implemented. In addition, we support the continued efforts of WIPs in recognition that 89 of the 92 Bay segments might achieve water quality goals by 2025, given the Lower Susquehanna is just one of multiple stressors on the Bay. We also recommend that the findings from the Report and any new information on the impacts of Conowingo Dam reaching "dynamic equilibrium" be used to inform the Chesapeake Bay TMDL 2017 Mid-Point Assessment.	Comment noted.
E.11	We appreciate the opportunity to comment on the Lower Susquehanna River Watershed Assessment and want to extend the U.S. Fish and Wildlife Service's support of the findings in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). We agree with the Future Needs and Opportunities in the Watershed and look forward to the reporting of those outcomes. It is critical that we understand how sediment and nutrients impact Chesapeake Bay water quality and health. The Chesapeake Bay is a national treasure and we support any findings to help clean up and restore the health of the Bay and enhance fish and wildlife resources. Again thank you for the opportunity to review and comment on the assessment.	Comment noted.
CCC-L-1	The Maryland counties that have combined their efforts and resources in order to address concerns relative to the improvement of the water quality of the Chesapeake Bay in a meaningful and cost effective manner known as the Clean Chesapeake Coalition ("Coalition") 1 provide their comments and concerns with the Draft Lower Susquehanna River Watershed Assessment ("DLSRWA") 2 collectively instead of separately and individually. The Coalition appreciates this opportunity to provide comments.	The study partners appreciate the coalition's comments on the LSRWA.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
CCC-L-2	The Coalition counties and their representatives have been precluded from participating in the scoping of the study underpinning the DLSRWA report and the quarterly progress meetings reviewing the progress of such studies and the report. At the quarterly progress meetings, critical decisions have been made about the scope and direction of the study, the information to be considered during the study, the underlying assumptions on which the modelling and study efforts have been predicated and the conclusions to be determined and reported based on the study and modelling results. Coalition members have requested to have meaningful input into this process and have been denied that opportunity by U.S. Army Corps of Engineers ("USACE") and the Federal and State agencies and private persons (includ ng Exelon and Exelon's representatives) that are undertaking the Lower Susquehanna River Watershed Assessment ("LSRWA"). Indeed, handpicked "stakeholders" such as Exelon and The Nature Conservancy were afforded several months to review the draft report and appendices before its release while local government officials of the Coalition counties, along with the general public, got their first look in mid-November 2014 and have been pressed to review and analyze the roughly 1,500 pages that comprise the DLSRWA to meet today's public comment deadline.	The study began in September 2011 with the execution of a cost-sharing agreement between USACE and MDE, and the first quarterly team meeting for the study was held in November 2011. The team was first contacted by the Clean Chesapeake Coalition in February 2013. The study process was open to the public. All quarterly team meetings were open to the public and all meeting agendas, materials, and minutes were posted on the study website as soon as available. It appears that through a misunderstanding with one of the study partners, CCC feels that they were denied access to the meeting; however, CCC was not prohibited nor prevented from attending the quarterly meetings. As soon as the coalition's interest was known, CCC was included on the mailing list for email distribution of study notices. The team conducted many stakeholder briefings and presentations regarding the study, its progress, and findings, and attempted to involve stakeholders and the public as much as possible, including through this public comment process. Therefore, there was substantial opportunity to provide input to the study process.
CCC-L-3	Coalition counties have been mandated by the Maryland Department of the Environment and the Maryland General Assembly with planning, funding and implementing nutrient and sediment load allocation reductions in order to enable Maryland to meet the objectives of the U.S. Environmental Protection Agency 's ("EPA") 2010 Chesapeake Bay TMDL ("2010 Bay TMDL"). Given the necessary role of Maryland local governments in the Bay restoration program *(i.e.,* watershed implementation plans), the concerns of the Coalition counties with the DLSRWA must not be ignored. Otherwise, we will continue spending billions of dollars to earn D+ "State of the Bay" report cards from the Chesapeake Bay Foundation for years to come. [3]	Statement noted; no response required.
CCC-L-4	The human environment *(e.g.,* the economic, social and cultural, and natural environments) of the Coalition counties has been and will continue to be directly impacted by the conclusions and results of the LSRWA. Such conclusions and results are being used to direct the Environmental Impact Statement being prepared in the Federal Energy Regulatory Commission's pending relicensing of the Conowingo Hydroelectric Project and the relicensing of other power projects in the lower Susquehanna River, and will inform the EPA's 2017 recalibration of load allocations under the 2010 Bay TMDL.	Concur. The Chesapeake Bay Program partners have publicly committed to factoring in the findings from the Lower Susquehanna River Watershed Assessment within the Chesapeake Bay TMDL 2017 midpoint assessment to inform the collaborative decision-making process.

Comment Code	Comment	Comment Response
CCC-L-5	The USACE and the other Federal and State agencies who have conducted the LSRWA have failed to coordinate with the Coalition member counties in the preparation of the LSRWA and have deprived them of their rights under the National Environmental Policy Act ("NEPA") and the Federal Advisory Committee Act ("FACA") as well violating a number of U.S. Presidential Executive Orders in the manner in which the study and report processes has been conducted to date. The Coalition counties urge USACE and the participating Federal and State agencies to revise their approach as they move forward with the LSRWA.	The activities of the various study committees for this effort are statutorily exempt from FACA, either quite explicitly, or as confirmed by a number of federal court cases. Representatives of the Clean Chesapeake Coalition attended at least some of the public meetings of the main committee, whose minutes were posted promptly on a widely distributed project website (http://mddnr.chesapeakebay.net/LSRWA/index.cfm). The LSRWA does not qualify as a "federal action" for the purposes of NEPA; no official policy is being adopted; no formal plans or programs are being adopted; and no specific projects are being recommended, let alone approved. See Title 40, Code of Federal Regulations, §1508.18.
CCC-L-6	The Coalition counties observe with interest the report detailing the concerns of the Scientific and Technical Advisory Committee (STAC) of EPA's Chesapeake Bay Program with respect to the DLSRWA and generally concur with all of the STAC's comments and concerns, which have yet to be adequately addressed.4 It is disingenuous for any person familiar with the STAC report to suggest that the DLSRWA has been favorably peer reviewed or has been endorsed by the scientific community.	We have checked and ensured that all STAC comments have been addressed and incorporated as necessary into the final report. Please see the Chesapeake Bay Program Partnership's Management Board's formal response back to STAC on how the partnership addressed each comment. We do believe that review by the scientific community has been favorable based on comments submitted by other agencies and organizations. The study partners also realize that there is uncertainty associated with the report findings and that additional monitoring and modeling efforts will be necessary to fully quantify the Conowingo impacts. This information will be reassessed during the 2017 midpoint assessment process to determine any additional steps necessary for reaching full Chesapeake Bay water quality standards attainment by 2025.

Comment Code	Comment	Comment Response
CCC-L-7	We take issue, however, with one observation made by the STAC and with one issue overlooked by the STAC. The STAC suggests that the harm caused by an increased loading of sediments due to scour from the floors of the reservoirs behind the hydroelectric dams in the lower Susquehanna River will not be as harmful as the nutrients bound to the sediments, particularly phosphorus, to the Bay estuary. In their 2012 Native Oyster Restoration Master Plan USACE has documented the harmful impact of sediments to the habitat necessary to allow bivalves (oysters, clams and mussels) to reproduce in the Bay.[5] The watermen working out of the Coalition counties on the Bay will testify about the harmful impact of the massive quantities of sediments entering the Bay during significant storm events such as the storms events of 2011 and how such events have devastated the habitat for bivalve breeding and have suffocated hibernating crabs and destroyed the SAV necessary to protect young of years crabs from predators. We observe that while the scientific credentials of the 11 member STAC team that reviewed the DLSRWA are not disclosed, none appear to have any, or an extensive, background in the marine science of bivalves or blue crabs. The National Oceanic and Atmospheric Administration and the U.S. Fish & Wildlife Service should be consulted before making such sweeping generalizations.	The STAC review does point out that sediment is a problem as well as nutrients, but that suspended sediment is a localized and episodic problem. Whereas, the water quality problems from scoured nutrients are more long-term, persistent, and widespread, i.e., lasting an entire summer hypoxia season and covering the contiguous region of deep-water and deep-channel designated uses in the Chesapeake. Information on the background and affiliation of the STAC team can be found on pg. 5 of their report in Appendix I-7. Coordination was performed with aquatic resource agencies, including NOAA (National Oceanic and Atmospheric Administration), Pennsylvania Fish and Boat Commission, U.S. Fish and Wildlife Service, and Maryland Department of Natural Resources (MDNR). With regard to submerged aquatic vegetation (SAV), after exceeding the goals for submerged aquatic vegetation in the northern Chesapeake Bay (segment CB1TF) for 2008-2010 and reaching a peak of 436.58 hectares in 2009, Bay grass acreage decreased to 342.34 hectares in 2010, to 201.09 hectares in 2011, and to 186.51 hectares in 2012. Since then, SAV area in CB1TF increased to 229.81 hectares in 2013, and preliminary data indicate that 2014 will have more than 2013. Thus, while SAV coverage in CB1TF decreased following Tropical Storm Lee, SAV was not "destroyed" and coverage now appears to be increasing. In addition, while there are occasional storm events that generate large plumes of sediment and deposition in the upper Bay, long-term (1985-2013) and short-term (2003-2013) trends in total suspended sediment measured at the USGS (U.S. Geological Survey) stream gage at Conowingo Dam are not statistically significant. The University of Maryland Center for Environmental Science (UMCES) did conduct an analysis of the sediment distribution from Tropical Storm Lee in the upper Chesapeake Bay. This report indicated that the majority of the sediment deposition was in the upper Bay, directly below the Susquehanna Flats. In general, less than 1.5 cm of sediment was deposited downstream of this area. The UMCES report can be found at Palinkas, C.M., et al., Sediment deposition from tropical storms in the upper Chesapeake Bay: Field observations and model simulations. Continental Shelf Research (2013), http://dx.doi.org/10.1016/j.csr.2013.09.012i . The MDNR assessment was based on observations of live fouling organisms, including barnacles, mussels, and bryozoans, that were found attached to the oysters and shells on oyster bars in the northern Bay. Had the oysters been smothered by sediment, these organisms would not have been able to attach to the oyster shells and would not have survived.
CCC-L-8	Neither the STAC nor the persons conducting the LSRWA have given any consideration to the toxic pollutants that are documented (*see* Susquehanna River Basin Commission reports to the Maryland Department of the Environment) as being in the sediments impounded in the reservoirs behind the hydroelectric power dams: herbicides; pesticides; sulfur and acid mine drainage; coal; PCBs; and other aromatic hydrocarbons and heavy metals, in addition to the nitrogen and phosphorus bound in such sediments. Such toxic pollutants must be accounted for in determining the impact of scour and in undertaking a benefit cost analysis of dredging above the dams in the lower Susquehanna River.	This is not entirely correct. In evaluating whether sediments behind the lower Susquehanna River dams could be used for beneficial reuse, the LSRWA study partners looked at sediment chemical analyses (mostly metals) data. In general, however, the assessment focused on the nutrients associated with sediments and did not evaluate other potential contaminants. Chapter 5.4.3 briefly discusses heavy metals found in sediment cores with regards to the beneficial reuse of dredged sediments. Additional study is needed on other potential contaminants and on the biologic activity of these contaminants, including nutrients, as they are released from sediments. It is expected that sampling over the next 2 years will detail this information.

Comment Code	Comment	Comment Response
CCC-L-9	The initial pages of the attached comments and concerns provide a slightly more comprehensive overview of the comments and concerns of the local government members of the Coalition. The latter pages contain more detailed questions, comments and concerns focused on the individual portions of the DLSRWA and the attached appendices. The Coalition members expect that the comments presented in each section of the attached review will be considered and addressed.	All coalition comments have been considered and addressed.
CCC-L-10	Given the predictive failure of the HEC-RAS and AdH models, upon which the major findings and conclusion of the DLSRWA are predicated and the reported fact that the underlying goals and objectives of the LSRWA were changed in midstream, the DLSRWA undisputedly is a mishmash of information rapidly cobbled together in a report and appendices in order to fulfill a political agenda. The DLSRWA is not scientifically sound and does not achiever valid objectives and outcomes. The Coalition urges the USACE and the other Federal and State agencies utilizing the report in conjunction with relicensing and regulatory objectives to restart the process and to proceed in legal compliance with NEPA, FACA, the regulations of the Council of Environmental Equality implementing NEPA, and the applicable Executive Orders.	All scientific studies contain some uncertainty and the predictive ability of models is heavily dependent upon empirical data. However, the modeling tools used in the assessment are considered by experts to be some of the best available. The question of scientific soundness raised is a matter of opinion made without any substantive evidence to support that opinion. Given that the LSRWA report was independently peer reviewed as to its scientific soundness, the commenters would have to provide more evidence to support their conclusion. As to the study goals, the LSRWA adapted to study findings as they were revealed. Specifically, the finding that the nutrients were more of a water quality issue than the associated sediments influenced both the study direction and overall recommendations. The criteria for the LSRWA were established by § 729 the Water Resources Development Act of 1986, as amended (33 U.S.C. 2267a; 114 Stat. 2587–2588; 100 Stat. 4164, Public Law 99-662). As such, no executive orders were violated in order to execute the terms of the statute. Please see our response to comment CCC-L-5 above. Also, please note that the National Environmental Policy Act of 1969 established the President's Council on Environmental Quality, not the Council of Environmental Equality.
CCC-L-11	There is no denying that the hydroelectric power dams in the lower Susquehanna River have profoundly altered the lower Susquehanna River estuary and the Chesapeake Bay estuary. If the ongoing impact of the dams and the other power projects in the lower Susquehanna River are not addressed, the downstream efforts and expenditures undertaken by Marylanders will not achieve meaningful and lasting improvement to the upper Bay or overall Bay water quality.	Comment noted; this is one of the reasons that the LSRWA was initiated. However, it was found that most of the sediment comes from the watershed, not from scour behind the dams.
CCC-L-12	The Coalition counties have suggestions about how a natural oyster bed cultivation and seeded shell relocation program could serve as a viable and cost effective alternative to full-scale dredging behind the dams. Again, if a proper NEPA process is instituted, such alternatives could be preliminarily scoped and given due consideration. The failure to adhere to such legal mandates will be more expensive and cause greater delay and expense for all involved in the long run.	Comment noted and any suggestions offered by the coalition will be considered. Regarding the NEPA process, please see response to comment CCC-L-5. Note that any "natural oyster bed cultivation and seeded shell relocation program" would have to be located well south of the upper Bay, because oyster growth and reproduction are limited or non-existent in the low salinities areas of the Bay.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
CCC-1	The Lower Susquehanna River Watershed Assessment ("LSRWA") was originally undertaken in 2011, before a number of Maryland counties coalesced to form the Clean Chesapeake Coalition (the "Coalition") in last quarter of 2012 and began to shine the spotlight on the problem of scour from the floors of the reservoirs behind the three major hydroelectric power dams in the lower Susquehanna River: the Safe Harbor Dam (Lake Clarke is the reservoir behind that dam); the Holtwood Dam (Lake Aldred is the reservoir behind that dam) and the Conowingo Dam (the Conowingo Pond is the reservoir behind that dam).1 The Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment, Dec. 29, 2010 ("2010 Bay TMDL") was published in December 2010 and concluded that Lake Clarke and Lake Aldred already had reached dynamic equilibrium,2 but that the Conowingo Pond would not reach dynamic equilibrium until sometime between 2025 and 2030. The United States Environmental Protection Agency ("USEPA"), therefore, erroneously concluded in the 2010 Bay TMDL that 50% of the sediments flowing down the Susquehanna River would continue to be trapped in the Conowingo Pond. The LSRWA study originally was undertaken by the United States Army Corps of Engineers ("USACE") and the Maryland Department of the Environment ("MDE") to begin to consider the impact that the sediments accumulating in the three reservoirs would have once the Conowingo Pond reached dynamic equilibrium some 15 to 20 years down the road. There was no urgency to the study and there was very little in funding procured for the study.	Comment noted.

Comment Code	Comment	Comment Response
CCC-2	The issue of what would happen when dynamic equilibrium was reached was always "the elephant in the room" that the regulatory agencies and NGOs have avoided addressing, because it was too complicated and there is no existing legal framework that empowers the Federal or State regulators to directly address the problems that will result from such eventuality. Today, there is no commitment, plan, responsible party or budget to specifically address the devastating amounts of nutrients, sediment and other contaminants that are scoured into the Chesapeake Bay during storm events and in equally harmful proportions now on a regular basis.	Agencies at all levels have been aware of and discussing the issue of sediment behind the dams for decades. Furthermore, the Chesapeake Bay TMDL and associated watershed implementation plans form the regulatorily binding plans to make sure these sediments and associated nutrients are addressed. The 2010 Bay TMDL also includes an appendix (Appendix T) that specifically identified the issues associated with Conowingo infill, and the 2017 midpoint assessment process will include a refined Bay model and additional monitoring data to address Conowingo Dam impacts. The states, through their Clean Water Act permitting authority, have the necessary mechanisms to make sure that point sources are appropriately addressed by responsible parties. The states' non-point source programs use non-regulatory mechanisms such as funding, cooperative partnerships, and management plans to address those sources. Chapter 2 of the draft LSRWA report described many of these items in detail. Even though the dams have reached dynamic equilibrium, they will act as sinks most of the time and as sources at other times during major storm events. The annual average total suspended sediment loads based on monitoring data from USGS for 1987 through 2012 for the Susquehanna River load monitoring sites at Marietta, PA (USGS gage number 01576000) and Conowingo, MD (USGS gage number 01578310) indicate that loads at Conowingo exceeded Marietta in only two years, 2004 (Hurricane Ivan) and 2011 (Tropical Storm Lee). This is despite an increase in the watershed area, from 25,990 mi^2 at Marietta, PA to 27,100 mi^2 at Conowingo, MD. These data show that in 24 of the last 26 years, sediment loads, on average, decrease from Marietta to Conowingo, which implies that sediment was stored behind the dams unless there was a storm of such magnitude that it results in sediment being scoured from behind the dams. It is estimated that even under the condition of dynamic equilibrium, scour represents 30 percent of the sediment load. Storms large enough to generate large amounts of scour are estimated to have a recurrence interval of 5 years, which is not "now on a regular basis." We recommend that the coalition counties review the complete public record, which shows a 20-year history of the resource agencies addressing this issue. Important documents include, but are not limited to, a 1995 USGS / SRBC report, the SRBC Sediment Task Force Recommendations of 2002, a 2009 USGS report, and the FERC relicensing documents. All of this scientific data and information, including the LSRWA report, will be used to inform the TMDL 2017 midpoint assessment.

Comment Code	Comment	Comment Response
CCC-3	In 2008, the Chesapeake Bay Foundation, in a friendly lawsuit, sued USEPA to make it use its authority under the Clean Water Act to promulgate a total maximum daily load ("TMDL") for the Chesapeake Bay, in order to take control of the agenda for the clean-up of the Bay. In settlement of the lawsuit, USEPA generated the 2010 Bay TMDL and assigned to each Chesapeake Bay watershed state load allocations for the amount of nitrogen, phosphorus and sediments that each state would have to remove from the amount of such pollution currently being discharged to Bay tributaries. After the State of Maryland received its load allocation under the 2010 Bay TMDL, it determined that in excess of $14.5 billion dollars would have to be spent to meet its load allocation obligations. The State was unwilling to redirect its spending and/or to pass the additional taxes and fees necessary to fund this unprecedented obligation. The State, therefore, required each Maryland county to prepare a watershed implementation plan ("WIP") for meeting the 2010 Bay TMDL load allocation assessed against Maryland by USEPA and, among other mandates, passed legislation requiring the largest counties to adopt stormwater management fees (aka "rain tax") to raise the money necessary to implement the WIPs.	The commentors are correct that the stormwater management fee legislation was a key initiative that the state used to assist local jurisdictions in meeting their stormwater permit requirements to restore the Chesapeake Bay. In addition to this fee, Maryland has many other existing fund sources to provide for Bay restoration such as the Chesapeake and Atlantic Coastal Bays Trust Fund, the Chesapeake Bay Trust, and the Section 319 program to address non-point sources of pollution. Also, the Maryland Agricultural Water Quality Cost-Share Program provides farmers with grants to cover up to 87.5 percent of the cost to install best management practices on their farms to prevent soil erosion, manage nutrients, and safeguard water quality in streams, rivers and the Chesapeake Bay. For point sources, the Bay Restoration Fund fee is used to upgrade major wastewater treatment plants and address septic system pollution. The Watershed Assistance Collaborative helps local partners leverage all of these existing fund sources for watershed restoration activities. Other initiatives, such as nutrient trading, are also being pursued to help create market-based mechanisms to fund Bay restoration projects. The combination of funding and market-based approaches are anticipated to fully fund Bay restoration.
CCC-4	As counties undertook the WIP process and began examining what MDE and the Maryland Department of Natural. Resources (MDNR) were doing and requiring counties to do in order to address Maryland's load allocation under the 2010 Bay TMDL, they recognized how useless the regulatory initiatives would be in making any meaningful improvement to the water quality of the Bay and how expensive, unproductive and inequitable Maryland's regulatory initiatives have been and would continue to be. They also recognized that the largest problems contributing to the pollution of the Bay were being ignored.	The Maryland Departments of Environment and Natural Resources do not agree that regulatory programs are useless. On the contrary much of the progress in meeting Maryland's restoration goals are coming through wastewater sector regulation and funding. Water quality data collected and analyzed by MDNR clearly document improvements to water quality following upgrades to wastewater treatment plants to secondary treatment, BNR, and now ENR. Banning phosphate in detergents also played a major role in helping to reduce phosphorus loads to the Bay's tributaries. The data that document these improvements in nitrogen and phosphorus are available on the Chesapeake Bay Program website and CCC is encouraged to review these data. There is only so much that can be done by improving wastewater treatment, which is why it is important to control nutrients and sediment from non-point sources throughout the watershed.
CCC-5	One of the largest problems being ignored was the impact of scour from the floors of the reservoirs behind the three hydroelectric power dams in the lower Susquehanna River during storm events. During storm events, suspended solids that were trapped behind the dams during low flow and normal flow conditions are agitated, become re-suspended in the river and flow into the Bay. Over the course of a 2 - 8 day storm event, including the high flows that are generated by runoff from the storm, as much as one-half-year to 12+ years of the average loading of suspended solids from the Susquehanna River are scoured and dumped in the upper Bay *(i.e .,* the Maryland portion of the Bay) over such 2 - 8 day period. Such massive loading over such a short period of time has a devastating impact, and a much greater impact than if such solids flowed into the Bay when they originally became suspended in the river.	Comment noted. As mentioned in the LSRWA findings, the nutrients associated with the Conowingo sediments have a greater impact on Chesapeake Bay water quality. Based on monitoring data from USGS, the 1981-2012 average annual load measured at Conowingo Dam is 1,886,875 tons per year and the load for 12 years would be 22,642,500 tons, so the 12+ years of average loading must be referring to Hurricane Agnes, which was quite devastating, but also an unusual event (return period of 60 years).

Comment Code	Comment	Comment Response
CCC-6	Reports studying the impact of Hurricane Agnes on the Bay published by the Johns Hopkins University Press in 1978 concluded that 56% of the sediments flushed into the Bay during the hurricane were scoured from the floors of the reservoirs behind the hydroelectric power dams in the lower Susquehanna River- 20 million tons of sediments out of the 32 million tons of sediments flushed into the upper Bay from the Susquehanna River by the hurricane.	Comment noted. See response to comment CCC-5 above.
CCC-7	In August 2012, Robert M. Hirsch of the Department of Interior's U.S. Geological Survey ("USGS") published a report concluding that the Conowingo Pond had virtually reached dynamic equilibrium.[3] In presenting the report, Mr. Hirsch discussed the scour phenomena but advised that the bathymetric data *(i.e.,* raw data of the depth from surface to floor of the reservoirs before and after storm events) did not exist. The bathymetric data necessary to determine the amount of scour during different storm events still does not exist and has never been generated. Exelon, in the pending Federal Energy Regulatory Commission ("FERC") relicensing proceeding for the Conowingo Hydroelectric Project, has requested a year-to-year extension of its current license while it collects the bathymetric data after storm events necessary to engage in meaningful modeling and prediction.[4]	Comment noted. The agencies agree that bathymetric information immediately before and after storms would be useful. Pre and post-storm bathymetry surveys have been incorporated into a multi-agency monitoring program to fill the data gaps/uncertainties. This additional monitoring is currently underway.
CCC-8	Different persons are reporting that the LSRWA Draft Report ("DLSRWA") concludes that scour from the floor of the reservoir of the Conowingo Pond is not a significant source of pollution to the Bay. Such a conclusion, as discussed more fully below, is devoid of any scientific validation and support. The raw data necessary to make such a determination is nonexistent. There is no bathymetric data sufficient to enable a scientifically valid determination of the amount of scour from the floors of the reservoirs behind the hydroelectric power dams in the lower Susquehanna River. There is no scientific data on which to predicate a determination of the volume of nutrients bound to sediments in the Susquehanna River or what percentage of such bound nutrients become bioavailable when such scoured sediments are flushed into the Bay.	This is not entirely correct. The LSRWA collected sediment cores and determined associated shear stresses in order to predict Conowingo scour using the AdH model. The study concludes that reservoir scour does contribute a sizable amount of sediment to the Bay in addition to what is already entering the system from the watersheds. That contribution varies depending on the flow. See response to comment CCC-19. The assessment's modeling efforts estimated that during a major storm event, approximately 20 to 30 percent of the sediment that flows into Chesapeake Bay from the Susquehanna River is from scour of bed material stored behind Conowingo Reservoir. We concur that additional study is needed on the bioavailability of nutrients attached to scoured sediments.
CCC-9	When the LSRWA was undertaken, the impact of scour on the Bay was not an issue. That issue became a hot topic because it was raised in the FERC relicensing proceeding for Conowingo Dam by the Coalition and because the Coalition has focused public attention on the issue.	The LSRWA was undertaken at the request of the project partners, not FERC. While the assessment analyses began in fall 2011, coordination on the sediment scouring issue dates back to the SRBC's Sediment Task Force in 1999, and was identified by the resource agencies early (2009) in the FERC relicensing process as a significant issue that needed to be addressed.
CCC-10	(A) Instead of dredging sediments from behind the dams from the Bay after they have been flushed into and dispersed throughout the upper Bay causing damage to the marine environment and fisheries of the Bay, such sediments should be dredged from above the dams (thus ensuring that such pollution never reaches the Maryland portion of the Bay).	Comment noted. The assessment evaluated strategies for managing sediment behind the dams. Findings are provided in Chapter 8.

Comment Code	Comment	Comment Response
CCC-11	(B) Before Marylanders spend billions of dollars to implement clean-up programs that can be rendered completely useless by scour from a significant storm event and pollution above the dams, the harm caused by above the dam sediments and pollution needs to be addressed. It is a fool's errand to spend money on band-aids to cover superficial cuts before stopping the bleeding from the artery; and that is precisely what is happening when billions of tax dollars are spent on *de minimus* issues downstream while nothing meaningful is done to abate the harm above the dams.	See response to CCC-2. The findings of the LSRWA indicate that high flow events, such as Tropical Storm Lee, can have an impact on water quality (see Chapter 8); however, these impacts were short-lived and confined to locations mostly within the upper Bay. The findings do not support the notion that high flow events from the Susquehanna will render other clean-up programs useless. The Susquehanna River is just one of many tributaries to the Bay that provide sediment and nutrient loading. Although Tropical Storm Lee did result in the release of a significant amount of sediment from behind the dams and from the watershed, it was an unusual event. Flow at Conowingo Dam during Tropical Strom Lee was the “second largest annual maximum daily discharge recorded for water years 1968-2011” as reported in USGS's Scientific Investigations Report 2012-5185. Also note that Marylanders are not the only people being asked to spend considerable amounts of money to clean up the Bay and to imply otherwise is false. In addition, it is estimated that on average the Susquehanna River contributed 27 percent of the sediment load to the Chesapeake Bay during 1991-2000 as reported in USGS's Scientific Investigations Report 2012-5185. That leaves 73 percent coming from other sources which is hardly “de minimus.”
CCC-12	Years worth of the average annual loading of sediments and nutrients have been discharged from the Susquehanna River into the Bay in the matter of days during recent storm events. If the sediments and nutrients are not from scour, they are from upstream (above the dams) sources. None of the other states in the Chesapeake Bay watershed have adopted wastewater treatment discharge limits that are close to as stringent as those imposed on Maryland by MDE. None of the other states in the Chesapeake Bay watershed have stormwater management requirements that are as demanding and expensive to meet as those in Maryland. No other state in the Chesapeake Bay watershed has a "phosphorus management tool" that is as stringent and as costly to comply with as that mandated by the recently re-promulgated Maryland regulations. No other state in the Chesapeake Bay watershed has individual septic requirements that are as stringent and costly to comply with as Maryland. The above has been true for several decades, yet the additional expenditures paid by Marylanders have not resulted in any meaningful overall improvement to the water quality of the Bay. Instead, such regulations and expenditures have driven businesses and residents out of Maryland and caused fatigue among those being taxed to "save the Bay."	See response to CCC-11 and CCC-4. The Chesapeake Bay is comprised of a 64,000-square mile watershed covering six states and the District of Columbia. As a result, the actions by a single state will not result in overall Bay restoration and the collective actions of all states, even if implemented today, have ecological lag times before resulting in improved water quality. Maryland believes that the other states in the Bay watershed will ultimately have to mirror Maryland's programs, and likely go further, to meet the Bay TMDL requirements. However, water quality in Maryland's local streams and rivers will have more immediate responses to actions taken in Maryland. In the Patuxent River, for example, long-term sediment, nutrient and phosphorus levels are decreasing (see USGS studies at http://cbrim.er.usgs.gov/trendandyieldhighlights.html), demonstrating that Maryland's water quality programs are working. The continued success of these programs in Maryland supports local economies, the commercial fishery, and tourism sectors, as well as make Maryland a desirable place to work, live and recreate. Citizens of the headwater states are being asked to do their share to clean up the Bay, even though they do not receive the recreational and economic benefits that Maryland does, so perhaps Maryland should take the lead on implementing stringent regulations to protect their resource. In addition, a pound of sediment or nutrients released from a headwater state does not have the same impact as a pound being released from a Maryland tributary. There are physical and biological processes that mitigate the impact over the miles it takes for sediment and nutrients to reach the Bay from the headwaters.

Comment Code	Comment	Comment Response
CCC-13	The DLSRWA attempts to minimize the significance of scour to the Bay without adequate scientific underpinning. Regulatory agencies and environmental organizations are stating that the DLSRWA concludes that the problems at the Conowingo Dam are not as bad as scientists thought. The statement is almost laughable because the problem had been completely ignored until it was raised by the Coalition. No thought was given to the problem, and now the problem is recognized as real such that MDE has required Exelon to engage in additional data compilation and studies before MDE will even begin its consideration of the Section 401 Clean Water Act water quality certification needed by Exelon in the FERC relicensing process for Conowingo Dam. What is disconcerting for the reasons explained more fully below is that the DLSRWA discusses predicted minimum impacts instead of discussing the full range of impacts discussed in the projections underpinning the report.	See response to comment CCC-9. Also, the findings of the assessment (see Chapter 8) indicate that the loss of long-term sediment trapping capacity is causing impacts to the health of the Chesapeake Bay ecosystem, but that these impacts are due primarily to nutrients associated with scoured sediments. To understand the full range of impacts to the bay, additional monitoring and study is needed as outlined in Chapter 8.1 Recommendations.
CCC-14	The work underpinning the DLSRWA is a misguided exercise in modelling. Considerable time and effort has been spent discussing and manipulating models to generate meaningless results instead of gathering and modeling meaningful information.[5] At least nine (9) different models were used to generate data for use in other models and for making predictions and estimations: (1) The Chesapeake Bay Environmental Model Package (CBEMP) is used to project the water quality of the Chesapeake Bay. That model is predicated on a suite of models consisting of: (a) A watershed model (WSM); (b) A hydrodynamic model (HM); (c) A water quality eutrophication model (WQM); (2) A computational hydrodynamics in a three-dimensions model (CH3D); (3) A USACE integrated compartment water quality model (CR-QUAL-ICM), which model is predicated on a suite of models consisting of: (a) An ICM model; (b) A WQM model; and (c) A WQSTM model;[6] (4) An adaptive hydrodynamics model (ADH), which was used for estimating sediment erosion in the Conowingo Pond based on projected data derived from other models; and (5) A hydrodynamic engineering center river analysis system model (HEC-RAS), which was used to generate a rating curve for use in the ADH.[7]	Yes, these models were used in the assessment analyses. While all models have limitations, the team has confidence in the estimates provided by each of the models as all the models have been used extensively in the past, including for TMDL development, and are vetted by the scientific community. Additionally, the models were calibrated with real observations. Additional data from the recommended enhanced monitoring will be used to further refine the models. All models are limited by both the simplifications inherent in the model development, and the uncertainties associated with parameterization of unknowns, and initial and boundary conditions. This assessment used models to gain insight into the governing processes associated with the Conowingo Reservoir, with full recognition of the limitations of this or any modeling effort. Models provide insight; they do not predict the future. Although more data are always of benefit, the primary conclusions reached by this study are corroborated by multiple modeling efforts and data analyses, and are therefore robust.

Comment Code	Comment	Comment Response
CCC-15	What little raw data was used in the CBEMP model was generated from raw data collected in the period from 1991 - 2000.[8] This outdated data as well as data generated by other models not designed to determine scour was used to run applications under the ADH for 2008 - 2011 timeframe. The ADH was run to project the amount of scour from the floors of the Conowingo Pond and Lakes Aldred and Clarke that serve as the reservoirs behind the three major hydroelectric power dams in the lower Susquehanna River: the Conowingo Dam, the Holtwood Dam and the Safe Harbor Dam.	There are data collected over a wide range of dates, some as recently as 2012, used in this analysis. AdH is only used to analyze scour in the Conowingo Reservoir.
CCC-16	Peter Moskos, a Harvard educated criminologist, author and professor, made a comment that appropriately captures the deficiency of the modelling exercises underpinning the DLSRWA: "And if you have bad data, it doesn't matter what fancy quantitative methods you use. It's putting lipstick on the damn pig of correlation." In short, a modelling conclusion is only as good as the data underpinning the modelling effort. When the data needed to generate a predictive model does not exist, the predictive conclusions generated from a cluster of other models used to generate data for use in the predictive model are meaningless.	The best available models and data were used to develop the LSRWA findings and will be further improved with the current ongoing research for the Conowingo Reservoir.
CCC-17	Nowhere does the DLSRWA concisely list the raw data underpinning the reported results of the ADH modelling efforts. Nowhere does the DLSRWA clearly describe what actual data was used in what manner to generate the data on which particular modelling exercises were run. To provide such data would expose how the findings and conclusions of the DLSRWA are superficial.	Each modeling effort is described in detailed in the individual appendices (A to D) assigned to each model, including the sources of input data. Appendix A describes the HEC-RAS modeling; Appendix B describes the AdH modeling; Appendix C describes the CBEMP modeling (including the WSM, CH3D-WES and CE-QUAL-ICM); and Appendix D describes the TMDL modeling.
CCC-18	The raw data necessary to determine the impact of scour from the pond s/ lakes / reservoir in the lower Susquehanna River on the Bay during storm events simply does not exist.	See response to CCC-8. There are data collected by USGS used to estimate scour in the reservoir by comparing sediment concentrations upstream and downstream of the reservoir. There are also sequential bathymetric surveys, where net bed change can be measured. Both of these are referenced extensively in the LSRWA report.
CCC-19	No bathymetry has been run before and after a major storm event in the Conowingo Pond, Lake Aldred or Lake Clark. Such bathymetry runs would show the elevation of the floor of such lakes and pond before and after a storm. From the difference in depth, the volume of scour could be determined and the amount of scour from a storm event with a peak flow measured in cubic feet per second through each dam could be determined. There is, therefore, no raw data from which to determine the volume of sediments scoured from the floors of such reservoirs during a storm event with a known flow rate.	This comment is correct in that no "direct" before and after bathymetry has been completed in the reservoir system. Several reasons explain the complications in the timing and analysis of the bathymetry data. First, it is difficult to predict when flows are going (guaranteed?) to be excessive and produce "mass scour." Second, subtle changes (even to the tenth of a foot) are difficult to document due to averaging in any currently available volume/capacity program. Third, the available analysis tools (HYPACK and mean capacity change) have reporting limitations. To compensate for these complications, collection of bathymetry data was proposed in the past by USGS to be collected on a shorter time scale, but was never funded. So, the only choice is to document changes from previous bathymetries in combination with analysis of sediment loads upstream and downstream of the reservoirs in a mass-balance approach.

Comment Code	Comment	Comment Response
CCC-20	Measuring bathymetry is not complicated. Sonar technology in conjunction with global positioning system (GPS) technology is relatively inexpensive and widely available. Such technology could be installed on any small and transportable boat and used to rapidly and efficiently chart the bathymetry of the lakes and pond before and after storm events. NOAA has published how its vessels equipped with such technology can record the topography/ bathymetry of floor of the Bay so accurately that NOAA employees can detect if oysters have been illegally harvested from a harvest restricted area of the Bay.[9]	Agree. Sonar technology would be ideal not only to document the depth to bottom more accurately over the entire reservoir, but it could also provide a "picture" of the bottom sediment grain size. The drawback is that it is very expensive technology to purchase. MDNR and NOAA have such equipment and MDNR had conducted a survey in Conowingo last fall (2014).
CCC-21	Further evincing the complete void of data necessary to determine scour from the floor of the Conowingo Pond during storm events and the impact of such scour on the Bay is the December 22, 2014 1etter from Jay Ryan on behalf of Exelon to John B. Smith, Chief of the Mid- Atlantic Branch of the Division of Hydropower Licensing of FERC re: Conowingo Hydroelectric Project, FERC Project No. 405, Response to Letter from Office of Energy Project Regarding Withdrawal of Section 401 Water Quality Certification Application. In the letter, Exelon's representative explains to the FERC why it withdrew its application for a Clean Water Act 401 water quality certification from MDE, why Exelon will keep re-filing and withdrawing the application over the next several years while it accumulates the raw data before and after storm events necessary to meaningful prepare an analysis of the impact of sediment scoured from the floor of the Conowingo Dam during storm events on the Bay, and whyn addition, it is estimated that on average the Susquehanna River contributed 27 percent of the sediment load to the Chesapeake Bay during 1991-2000 as reported in USGS's Scientific Investigations Report 2012-5185. That leaves 73 percent coming from other sources which is hardly "de minimus." implement the WIPs.er the impact that the sediments accumulating in the three reservoirs would have once the Conowingo Pond reached dynamic equilibrium some 15 to 20 years down the road. There was no urgency to the study and there was very little in funding procured for the study.ion in the upper Bay, long-term (1985-2013) and short-term (2003-2013) trends in total suspended sediment measured at the USGS (U.S. Geological Survey) stream gage at Conowingo Dam are not statistically significant. The Uni	Comment noted. Just because Exelon is conducting a more definitive study of the amount of scour released from the dams during storm events does not mean there is a "complete void of data." It is the nature of science and scientists to want additional data to confirm or refute hypotheses and gain a better understanding of how systems function. Storage capacity and changes in bathymetry have been studied by the USGS for decades. In fact, USGS has conducted five extensive bathymetric and sediment coring studies since 1990. A recent report indicated that 70 percent of the sediment load comes from the watershed, 30 percent comes from scour, and that more benefit would be derived from implementing best management practices above the dams than dredging sediment from behind the dams. Please see USGS Open File Report 2014-1235.
CCC-22	For the DLSRWA, scour has been guesstimated by comparing samples of total suspended solids (TSS) taken at various points above and below the Conowingo Dam and guesstimating the portion of such suspended solids attributable to storm water runoff versus the portion attributed to scour from the floor of the Conowingo Pond, Lake Aldred and Lake Clark.	USGS collects and analyzes suspended sediment, not total suspended solids (TSS). USGS has several reports out explaining the difference in TSS and suspended-sediment analysis. They are not the same. Changes in bottom-surface profiles are discussed in the response for comment CCC-19.
CCC-23	There is no analysis or even any discussion from a statistical science perspective of the confidence level of any data generated by any of the models or any conclusions or determinations made based on any of the modelling analysis. Undoubtedly that is because any such discussion would acknowledge that there is insufficient raw data to generate any meaningful modelling data or to draw any meaningful conclusions to a reasonable degree of scientific certainty.	The Lower Susquehanna River Watershed Assessment applied the same models and assessment procedures as was used in the Chesapeake TMDL. The uncertainty of the models and procedures are discussed in the Chesapeake Bay TMDL documentation (2010).

Comment Code	Comment	Comment Response
CCC-24	Michael Langland, one of the USGS scientists, has admitted that there was insufficient data to calibrate the ADH model for river flows greater than 600,000 cfs. The table of predicted scour during storm events generating different flow rates in the lower Susquehanna River evidences the wide range of scour estimates based on the available data and modelling efforts.[10] The existing data and modelling efforts predict that between one-half million (500,000) tons and 1.5 million tons will be scoured from the floors of the lakes and pond during a one-in-five-year storm event (between 21% and 44% of the total sediment load during such a storm event). Thus, a single 1 - 3 day storm event will generate flows sufficient to scour from the floor of the Conowingo Pond and Lakes Aldred and Clarke one-half to 1 year-worth of the average annual sediment loading from the Susquehanna River and deposit such amount in the upper Bay in such 3-day period. The existing data and modelling efforts predict that between I 0.5 million tons and 15.5 million tons will be scoured from the floor of the lakes and pond during a one-in-sixty-year storm event (between 39% and 50% of the total predicted sediment load during such a storm event).[11] Thus, one such 4 - 8 day storm event will scour and deposit from the floor of the Conowingo Ponds and Lakes Aldred and Clarke between 8 - 12 years-worth of average annual sediment loading from the Susquehanna River and deposit such amount in the upper Bay over the course of eight days. The Safe Harbor Dam, the Holtwood Dam and the Conowingo Dam have so altered the flow of the Susquehanna River and sediments in the Susquehanna River that one to twelve years or more of the average annual sediment loading from the Susquehanna River can be delivered over the course of a week or less to the upper Bay.	The peak daily flow through the Conowingo Dam in the AdH 2008-2011 simulation period was 709,000 cfs on September 9, 2011 during TS Lee. The mean flow was 629,000 cfs. The highest suspended sediment sample collected during the storm was 2,950 mg/L at an instantaneous flow of 617,000 cfs on September 8, 2011.
CCC-25	The last 60 year storm event occurred in 1972 *(i.e.,* Hurricane Agnes). The next 60-year storm event will occur during the term of the 40+ year license requested by Exelon from FERC for the continued operation of the Conowingo Hydroelectric Power Project. This means that during the next 20 years, we can expect that scour from the floor of reservoirs behind the three dams in the lower Susquehanna River will completely annihilate the marine habitat in the upper Chesapeake Bay if no action is taken to reduce the volume of sediments in those reservoirs.	This comment is based on a lack of understanding of a return period. Please see Dunne and Leopold, 1978 (Water in Environmental Planning) or http://en.wikipedia.org/wiki/Return_period. Just because an event has a 60-year return period does not mean that it will happen every 60 years, or even within 60 years. A 60-year event could occur several times within the predicted return period, or not at all. Even for an event of that magnitude, a recent paper estimated that the percent scour to total load for Conowingo Reservoir ranges from 39 to 49 percent (USGS Open-File Report 2014-1235), so most of the sediment load would still come from the watershed. Also, what is the scientific basis for "completely annihilate the marine habitat"? Living resources did return to the upper Bay following Hurricane Agnes.
CCC-26	The persons who drafted and edited the DLSRWA inexplicably chose the lowest levels of predicted scour to report in the DLSRWA and upon which to predicate the findings and conclusions made in the draft report without providing any explanation of why the lowest values, as opposed to the highest values or the middle values were selected. What agenda is served and whose interests are benefitted by downplaying the impacts of sediment scour?	This is incorrect. The degree of estimated scour applied was the central tendency of the estimates and avoided the extremes.

Comment Code	Comment	Comment Response
CCC-27	USACE does not want to dredge above Conowingo Dam because it will have to deal with the hazardous and toxic pollutants that are in those accumulated sediments. Currently, when USACE dredges sediments from the navigable channels of the Bay, it does not have to give significant concern to the hazardous and toxic substances found in the sediments in looking for a place to safely deposit such sediments. Such sediments historically have been deposited in impoundments in the Bay such as Poplar Island and other islands composed of dredged sediments in the Bay. Attention will be focused on the hazardous and toxic sediments that are dredged above the dams in the lower Susquehanna River in determining how and what to do with such sediments. The cost, therefore, in properly disposing of such sediments will be magnified, because instead of allowing such hazardous and toxic pollutants to discharge into the Bay and then largely ignoring them when determining where to deposit sediments dredged from the navigable channels, such hazardous and toxic pollutants will have to be addressed up front.	Navigation channels are tested for contaminants during the design stage. Sediments determined to be contaminated or legally designated as such (Patapsco River sediments), are placed in upland containment sites to minimize harm that could be caused by these materials. The use of an upland containment site would increase costs. In making the determination as to a final disposal site, the NEPA process would be followed.
CCC-28	Exelon does not want to dredge sediments from behind the dams because in so doing it will exercise control over such sediments and in so doing will become responsible for disposing of such sediments in a manner that the hazardous and toxic pollutants in such sediments do not leach into the environment. Dredging sediments. under the current legal framework will confer liability on Exelon for such hazardous and toxic substances. In fairness to Exelon, much of the hazardous and toxic pollutants in the accumulated sediments were not generated by Exelon or the power companies acquired by Exelon, so Exelon will fight hard not to dredge.	It is beyond the scope of this assessment to ascertain Exelon's intentions regarding dredging.

Comment Code	Comment	Comment Response
CCC-29	The DLSRWA is devoid of any analysis or meaningful discussion of the nutrients and pollutants that are bound to the sediments resting on the floor of the lakes and pond behind the three dams in the lower Susquehanna River. Studies conducted by the Susquehanna River Basin Commission ("SRBC") for MDE have determined that that the following nutrients and pollutants are bound to such sediments: (1) Herbicides; (ii) Pesticides; (iii) Sulfur and acid mine drainage; (iv) Coal; (v) Polychlorinated Bi-phenyls (PCBs); (vi) Nitrogen; and (vii) Phosphorus. The presence of such hazardous and toxic pollutants comes as no surprise given the extensive agricultural, mining and power generation activities that have historically been conducted in the Susquehanna River watershed.	Studies do indicate that contaminants other than nutrients may be attached to sediments behind the dams. However, the assessment focused on the nutrients associated with sediments and did not evaluate other potential contaminants. Chapter 5.4.3 briefly discusses heavy metals found in sediment cores with regards to the beneficial reuse of dredged sediments. Additional study is needed on other potential contaminants and on the biologic activity of these contaminants, including nutrients, as they are released from sediments.
CCC-30	During the December 9, 2014 presentation on the DLSRWA made at the Harford County · Community College, Dan Bierly of the USACE, with acquiescence from the other panelists (i.e., Bruce Michael from MDNR, Mark Bryer from The Nature Conservancy, Rich Batiuk from USEPA Reg. III, Matthew Rowe from MDE and Michael J. Langland from USGS) acknowledged that such nutrients and toxic and hazardous pollutants were bound to the sediments deposited on the floors of the pond and lakes in the lower Susquehanna River.	Comment noted. See response to comment CCC-29.

Comment Code	Comment	Comment Response
CCC-31	No study has been conducted to determine what nutrients that are bound to the sediments in the lower Susquehanna River estuary are · released into the water of the Bay in the less oxygenated, more saline, more acidic, and warmer Bay estuary. Assumptions, for example, that none of the phosphorus that is bound to such sediments above the Conowingo Dam were released into the Bay estuary when such sediments were transported over or through the dam and into the Bay simply are unfounded. There are 4 - 8 ppm of salt in the Bay waters as far north as Tolchester and phosphorus and nitrogen that are bound to such sediments while they were in the Susquehanna River undoubtedly are released into the water in the Bay once such sediments are scoured and flushed into the Bay. Likewise, the coal, herbicides, pesticides, sulfur and acid mine drainage, and other toxic substances bound to such sediments above the dam probably are released into the Bay when such sediments are flushed through or over the dam. Again, during the December 9, 2014 presentation on the DLSRWA made at the Harford County Community College, Messrs. Bierly and Rowe acknowledged that no such analysis was made and there currently is no scientific basis for determining the impact of the release of nutrients bound to the sediments scoured from the floor of the lakes and te pond behind the dams in the lower Susquehanna River. Mr. Bierly further expounded on the limited scope of the LSRWA, the limited funding for the study and the limited sampling conducted in conjunction with the study.	Comment noted. As identified in Chapter 8.1 Recommendations, additional study is needed on the bioavailability and impacts of nutrients on aquatic ecosystems. This will not change the fact that most of the sediment comes from the watershed and not from scour, even during high flow events.

Comment Code	Comment	Comment Response
CCC-32	Mr. Bierly stated some of the problems with dredging, *e.g.,* there are hundreds of millions of tons of sediments in the pond and lakes behind the three dams that have accumulated over the last 80 ± years and very limited places to deposit such sediments in close proximity to such ponds and lakes. The following concerns were not spoken, but undoubtedly influence the decision making process: (a) USACE only has to dredge the navigable channels in the Bay. Sediments scoured and flushed into the Bay during storm events settle out all over the shallows and non-dredged tributaries in the upper Bay, and so a lesser percentage of such sediments that enter the Bay from above the dams probably need to be dredged by USACE, although no study ever has been conducted to make such a determination. (b) Sediments dredged from the Bay historically have been deposited on manmade islands and containment areas in the' Bay with little to no thought given to the leaching of nutrients and toxic and hazardous pollutants from such islands and containment areas. This historical course of dealing has generally allowed USACE to ignore the impacts of such nutrients and toxic and hazardous pollutants. Withdrawal of sediments above the dams will entail the analysis of such nutrients and pollutants and regulators will not allow the disposal of above the dam sediments until there has been an accounting of how such nutrients and toxic and hazardous substances will be neutralized or responsibly addressed. (c) No one has been willing to answer the question of whether Exelon will assume liability for the nutrients and toxic and hazardous pollutants in above-dam sediments if it undertakes dredging operations. In fairness to Exelon, the dams impact the timing of the release of such nutrient and toxic and hazardous pollutant laden sediments into the Bay and the devastating shock of the massive releases over a short period of time due to the trapping and scour phenomena caused by the dams. With the exceptions of the PCBs and chemicals associated with keeping power company water intakes and discharge lines free and clear of biological life and growth, such nutrients and pollutants were not generated by the power companies, so it is not fair to saddle them with liability for such nutrients and toxic and hazardous pollutants in conjunction with remedial action undertaken to ameliorate the impact from trapping and scour.	(a) True. If Congress authorized USACE to do so, USACE would be able to dredge in an area other than a Federal channel. (b) See response to comment CCC-27. The material would be tested and a NEPA document and the process would be followed. Example: Hart Miller Island was designed to handle contaminated material and the State of Maryland regulates associated discharges under a Clean Water Act permit. (c) The ownership of liability of said sediment was not part of this study.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
CCC-33	Exelon has directly and indirectly contributed millions of dollars to Federal and State campaigns and has made undisclosed contributions, probably in the millions of dollars, to the environmental organizations that were allowed to participate in the decision making process underpinning the preparation of the DLSRWA. Exelon funded a large portion of the study underpinning the DLSRWA. Exelon's consultants, Gomez & Sullivan, had a voice in and directly participated in the decisions made about how to conduct the study, what assumptions to make, what data to use, and what conclusions to report. Exelon undoubtedly expects and demands a return on this investment. Exelon undoubtedly has influenced the politics underpinning the decision making processes that have led to the findings and conclusions reported in the DLSRWA.[12]	Over the course of the assessment, Exelon representatives and its consultants attended the quarterly meetings, along with other members of the public. Neither Exelon nor Gomez and Sullivan were involved in any decisions regarding the conduct of the assessment or its conclusions. See also response to CCC-34.
CCC-34	The studies underpinning the DLSRWA and the preparation of the DLSRWA were not undertaken in compliance with the National Environmental Policy Act (NEPA), the Federal Advisory Committee Act (FACA), the NEPA-implementing regulations of the President's Counsel of Environmental Quality (CEQ), or applicable Presidential Executive Orders. Select special interest groups including Exelon and environmental organizations that probably have been the recipients of significant monetary and non-monetary contributions from Exelon, Exelon executives and officials and non-profits funded by Exelon were granted a seat and voice at the study table. Exelon, directly and indirectly, was given considerable influence over the reported outcomes and there has been no opportunity for persons with countervailing perspectives to influence the decisional process and the reported outcomes. NEPA, FACA and the CEQ regulations were promulgated to preclude exactly what has happened in generating the DLSRWA. The report legally is not entitled to be given any deference in any governmental decision making process.	Please see our response to Comment CCC-L-5 regarding NEPA and FACA. Exelon, as we understand it, did supply information and funds to support the study efforts of the non-Federal sponsor, the State of Maryland, in the event that the federal cash contributions fell short and direct cash contributions were needed instead of Maryland's in-kind services. As Exelon operates the dam for the principal reservoir being studied, it, quite naturally, is a stakeholder, with a right to attend public meetings, receive emails, and make comments like the Clean Chesapeake Coalition or any other member of the general public. It was given no greater access than has been available to any other member of the public who wished to avail themselves of the information being disseminated about the study. The LSRWA report is intended to present general study findings and recommendations about the impact of sediments found in the Lower Susquehanna River reservoirs; any use made of it, if any, let alone deference given to it, is entirely up to the decision-makers involved in any other project or process for the Susquehanna River or the Chesapeake Bay.
CCC-35	Unfortunately, Federal and State environmental and natural resources agencies have conveniently chosen to ignore the impact to the Bay estuary of the hydroelectric power dams in the lower Susquehanna River for over eight (8) decades. USEPA conveniently and quite erroneously predicted in the 2010 Bay TMDL that the Conowingo Pond would not reach dynamic equilibrium and discontinue acting as a net trap of sediments until 2025 or 2030. 13 The same suite of models used to support that erroneous assumption in the 2010 Bay TMDL were used in the "studies" underpinning the DLSRWA.	Previous estimates were for the dynamic equilibrium infill of the Conowingo Reservoir to occur later in the 21st century, with estimates of Conowingo dynamic infill occurring around 2020 to 2030. The previous estimates were incorrect, and it's now known that the Conowingo infill condition of dynamic equilibrium is currently occurring.

Comment Code	Comment	Comment Response
CCC-36	Mr. Batiuk of USEPA Region III, during the December 9, 2014 presentation at Harford 'County Community college, as well as the other presenters (Messrs. Bierly and Michael), admitted that the Conowingo Pond is now in a state of dynamic equilibrium- i.e., the Conowingo Pond no longer acts as a net trap of sediments and pollutants washing down the Susquehanna River to the Bay. They acknowledge that EPA's 2010 Bay TMDL prediction based on the CBEMP was off by 12-17 years.	As documented on pages 10-7 and 10-8 in the December 2010 "Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment" report as well as in the supporting Appendix T, the sediment trapping capacity of the Conowingo Dam and Reservoir was based on the latest available data and findings reported by the USGS (see Langland 2009a, 2009b citations in Appendix T) at the time that the Chesapeake Bay TMDL was under development by EPA and its seven watershed jurisdictional partners. Even though the dam system has reached a state of dynamic equilibrium, to quote Langland (Open-File Report 2014-1235) "The percent scour to total load, based on frequency of streamflow events, ranges from 20 percent to 37 percent (average 30 percent) for streamflows of 400,000-800,000 ft^3/s." Thus, during high flow events, when most sediment is transported, most of the sediment that enters the upper Bay comes from the watershed and not from scour. Also note that on average, the Susquehanna River contributed 27 percent of the sediment load to the Chesapeake Bay during 1991-2000 (SIR 2012-5185), which emphasizes the need to control sediment that comes from other sources and the Susquehanna River.
CCC-37	MDNR and MDE completely ignored the impact of sediment scour from the floors of Lake Aldred, Lake Clarke and the Conowingo Pond in the 20l0 Bay TMDL process and the FERC relicensing process until the Coalition made it an issue that those agencies could no longer ignore. Maryland's WIP makes no mention whatsoever of Conowingo Dam or sediment scour due to storm events. Shamelessly, Bruce Michael of MDNR explained during the December 9, 2014 informational meeting how MDNR and the other regulatory agencies have been aware of the problem for decades, and indeed they have been. Studies prepared and disseminated by the SRBC have documented the problem of sediment scour from the lower Susquehanna River for several decades. Unfortunately, the warnings sounded by such reports have been ignored throughout that period of time.	This issue has not been ignored by MDNR and MDE. The coalition counties have been encouraged to review the FERC record associated with relicensing and specifically the proposed study plans of 2009. MDNR and MDE requested further study of this issue on the public record. The 2010 TMDL stated that Conowingo would be considered in the 2017 midpoint assessment if data suggested the trapping efficiency has been diminished. The authors of the 2010 Bay TMDL were well aware that the Conowingo was reaching full capacity and would potentially have an impact on our ability to meet water quality standards. Therefore, the 2010 TMDL includes provisions under Appendix T that require the Bay Partnership to address the impacts of Conowingo Dam reaching full capacity as part of the 2017 midpoint assessment. The 2017 midpoint assessment allows for the most up-to-date water quality monitoring and modeling information to be incorporated into the TMDL revisions.
CCC-38	The LSRWA has been integrally linked with the FERC relicensing process for Conowingo Dam. The Draft Environmental Impact Statement prepared by FERC repeatedly references the LSRWA and what will be learned and divulged by that report.	Concur. MDNR and MDE have filed public comments with the FERC arguing that the LSRWA should not be used as a surrogate for the sediment study required of Exelon, but the State of Maryland does not have jurisdiction over the FERC process.
CCC-39	At the December 9, 2014 public presentation, Mr. Batiuk of USEPA Region Ill stated that because of the findings of the DLSRWA, USEPA was in the process of recalibrating the 2010 Bay TMDL to recognize that the Conowingo Dam no longer acted as a net trap and, therefore, all waste load allocations would have to recalculated and revised.	The statement at the December 9, 2014 public meeting was that the Chesapeake Bay Program Partnership, as part of its Chesapeake Bay TMDL 2017 midpoint assessment, was enhancing its suite of Chesapeake Bay watershed and tidal water quality models and other decision support tools to reflect the latest understanding and data regarding Conowingo Dam and Reservoir's sediment and associated nutrient trapping capacity. Those enhanced partnership models and tools would be applied in carrying out the stated objectives of the 2017 midpoint assessment.

Comment Code	Comment	Comment Response
CCC-40	By letter dated December 22, 2014 Exelon, in the FERC relicensing proceeding, requested FERC to issue temporary 1-year license renewals while it participated in the LSRWA with MDE in order to determine the impact of its operation on the water quality of the Bay.[14]	Statement noted; no response required.
CCC-41	In short, the LSRWA is the linchpin for two major federal actions that will have significant and far reaching environmental impacts: (1) the FERC long-term relicensing of the Conowingo Hydroelectric Power Project and (2) the USEPA 2017 Chesapeake Bay TMDL recalibration. Given that this study will inform such major Federal actions, it should be conducted in compliance with NEPA, FACA, the CEQ regulations implementing NEPA, and the applicable Executive Orders issued by Presidents of the United States.	"Linchpin" is too strong a word, given the independence of, and the prior work performed for, the two federal actions you mention. The U.S. Army Corps of Engineers has no direct role in either action; USACE's indirect role is limited solely to the information provided by this study effort. See the responses to CCC-L-5, CCC-L-10, and CCC-34, respectively above, regarding NEPA, FACA, executive orders, and the use to be made of this study report.
CCC-42	The Clean Chesapeake Coalition counties are stakeholders in both of the foregoing Federal actions and in myriad efforts to improve the water quality of the Chesapeake Bay. MDE and the Maryland General Assembly have empowered and tasked the counties with developing, funding and implementing WIPs and to implement and fund other local legislative and regulatory programs to improve the water quality of the Bay. The ability of the counties to implement such programs is directly impacted by the TMDL and the FERC relicensing of the Conowingo Dam. Economic development in the counties and the ability of the counties to retain existing businesses (including but not limited to agricultural and fishery dependent businesses) and to attract new businesses and residents is directly dependent on expenditures and programs associated with the WIPs, the 2010 Bay TMDL and the health of the Bay.	Statement noted; no response required.
CCC-43	The members of the Clean Chesapeake Coalition request USACE, FERC and USEPA to set aside the DLSRWA and to reinstitute the study process in full compliance with NEPA, FACA, the NEPA implementing regulations promulgated by the President's CEQ, and a number of Presidential Executive Orders.	Please see the response to comment CCC-L-5 regarding NEPA and FACA, and the response above to comment CCC-L-10 regarding executive orders.
CCC-44	As discussed, the DLSRWA and appendices contain a host of information that was not well organized or concisely and clearly presented as required by NEPA and the NEPA implementing CEQ regulations. What follows, in no particular order, are additional concerns, questions and observations relative to the DLSR WA. The attached "Summary and Comments on Lower Susquehanna River Watershed Assessment Draft Report and Appendices" are by no means meant to be comprehensive or all inclusive; but are expected to be considered and addressed.	Comment noted. See the responses to comments CCC-L-5, CCC-L-10, and CCC-34, respectively above, regarding NEPA, FACA, executive orders, and the use to be made of this study report.

Comment Code	Comment	Comment Response
DR-1	• According to the Draft LSRWA Report ("Draft Report"), an HEC-RAS model was designed primarily for non-cohesive sediment transport (sands and coarse silts) with additional, but limited, capability to simulate processes of cohesive sediment transport (generally medium silts to fine clays). Thus this model may not be suitable for all reservoir simulations, especially in areas of highly variable bed shear stress (the force of water required to move bed sediment) and active scour and deposition. Limitations of the model most likely resulted in less than expected deposition for the 2008 – 2011 simulation and less than expected erosion (scour) for the Tropical Storm Lee seven day event simulation, when compared to other approaches and estimates. (Pg. 33). **Comment DR-1:** A one dimensional model cannot account for scour since there is no lateral variable to account for sediment load on the river basin. This was Langland's (*i.e.* , USGS') same concern regarding Exelon's use of the HEC6 model in their Sediment Transport Study.	The HEC-RAS model can simulate scour by examining the change in load exported out of the reservoir versus the input loads. Any increase or decrease in bed volume would be due to a mass change from the bed.
DR-2	**Comment DR-2:** USACE's two dimensional AdH model computed detailed hydrodynamics and sediment transport in and out of Conowingo Reservoir, and the response of the reservoir and flats area to various sediment management scenarios and flows. According to the Draft Report the AdH simulates hydrodynamics and sediment transport. However, this may not the case given the following limitations: • A one dimensional model, HEC-RAS, was used to provide data for the AdH model; the two dimensional AdH model utilized the HEC-RAS model results (sediment load and flow) from Holtwood Dam as the inflowing sediment load boundary condition. (Pg. 66).	The use of the one-dimensional model as an inflow just means that the inflowing load is uniformly distributed across the cross-section. As the flow proceeds though the two-dimensional domain, it will redistribute laterally according to the modeled physics in the AdH model, and redistribute vertically according to the analytic quasi-3D physics in the AdH model. Since the inflow location is relatively narrow and well-mixed (from turbulence downstream of the Holtwood Dam), the assumption of a uniform distribution of load at the boundary is acceptable,
DR-3	• Through a validation process, the application of the AdH two dimensional model to the Conowingo Reservoir and Susquehanna Flats system was determined to be adequate for simulating general reservoir sediment scour and deposition modelling scenarios for the LSRWA. However, there is some uncertainty that remains with the estimates provided by the AdH model. (Pg. 37). **Comment DR-3:** What was the validation process? Was it consensus at the meeting? By whom?	Model validation for the AdH model is described in Appendix B, Chapter 6. It was the consensus of the assessment team that the AdH model would be sufficient for simulation of hydrodynamics and sediment transport from the Conowingo Reservoir to the Susquehanna Flats.

Comment Code	Comment	Comment Response
DR-4	• The AdH sediment model (a two dimensional model) required bed sediment data. Only 8 bed core samples were taken from Conowingo Reservoir to a maximum depth of only one foot. Core samples were required to determine the inception of erosion (critical shear stress for erosion) and the erosion rate used to develop six material zones. (Pg. 19). The sediment bed in the AdH Model was approx. 3 feet deep. The properties of the lower 2 feet were either approximated from the SEDFlume data results (which is the one foot data) or determined from literature values. **Comment DR-4:** How old is the SEDFlume data? If the age of the data is different than model runs how is this an accurate portrayal? What literature values were used?	The SEDFlume data was collected in spring 2012. The goal of the data collection was to determine the characteristics of how sediment that settles in the reservoir tends to consolidate, and how the erosional properties vary spatially. The exact rates of erosion at a given time would require many more observations. Although having these data would be of great benefit, they would not be any more accurate for determining long-term trends (i.e., whether or not and at what rate the reservoir is approaching dynamic equilibrium), since they would only be strictly valid for the date they were collected. The source for the corrections applied to the critical shear is cited in the text (Whitehouse, 2000).

Comment Code	Comment	Comment Response
DR-5	• The hydrologic period used for these scenarios was 2008-11. This 4-year time period was utilized because it included low (less than 30,000 cfs.) moderate (30,000 to 150,000 cfs.) and high (greater than 150,000 cfs.) flows as well as two major flood events (above 400,000 cfs.). Each HECRAS simulation provided a range of probable conditions and also provided a range of uncertainty in the boundary condition flows. (*See* Appendix A for more details on the HECRAS analyses and model.) (Pg. 33). • The second modelling tool utilized for this LSRWA effort was the AdH model. The AdH model was developed at the USACE's ERDC, located in Vicksburg, MS, and has been applied in riverine systems around the country and world. For this assessment, the AdH model was constructed and applied from Conowingo Reservoir to the Susquehanna Flats just below the Conowingo Dam, as shown in Figure 3- 2. Modelling scenarios were run by ERDC team members. (Pg. 34). Additional details about the AdH model and analyses are available in Appendix B. The AdH model was selected for the LSRWA effort and for use in the Conowingo Reservoir/Susquehanna Flats area (vs. HECRAS) because of the higher uncertainty of conditions and processes in this area, particularly in comparison to the upper two reservoirs which were understood to be in dynamic equilibrium for several decades. (Pg. 35). All AdH simulations that were run for the LSRWA effort were conducted with the same Susquehanna River flow and inflowing sediment boundary conditions. Using the HECRAS input, the 4-year flow period from 2008 - 2011 was simulated in the model. As noted earlier, this time period was utilized because it included low, moderate and high flows as well as two major high-flow events (above 400,000 cfs.). (Pg. 36). The AdH model was also utilized to estimate the effectiveness of selected sediment management strategies to reduce sediment loadstransported through Conowingo Reservoir and Susquehanna Flats. Ultimately, the AdH model output was sediment transport, scouring loads or erosion from the reservoirs which were utilized in Chesapeake Bay Environmental Model Package (CBEMP) to compute the impact of the sediment management strategies on water quality in Chesapeake Bay. (Pg. 37). **Comment DR-5:** AdH output data put into a model that has incorrect data based on 2010 TMDL with incorrect estimates? How can a two dimensional model rely on data generated from a one dimensional model?	See response to comment DR-2.

Comment Code	Comment	Comment Response
DR-6	• Through a validation process, the application of the AdH two dimensional model to the Conowingo Reservoir and Susquehanna Flats system was determined to be adequate for simulating general reservoir sediment scour and deposition modelling scenarios for the LSRWA. However, there is some uncertainty that remains with the estimates provided by the AdH model that were considered in results, as described below. One source of uncertainty was that the AdH model was not capable of simulating sediment passing through the flood gates of Conowingo Dam. Therefore, dam operations are not simulated in detail in the model; these include flood gate operation and Peach Bottom Atomic Power Station sequences. (Appendix K provides a description of dam operations.) For this study Conowingo Dam was modeled as an open boundary with downstream control represented by the water surface elevation at the dam. This limitation impacted how sediment was spatially distributed in the lower reach of Conowingo Reservoir near the dam. To minimize this uncertainty more sophisticated methods would need to be developed to incorporate dam operations in Conowingo Reservoir. (Pg. 37). **Comment DR-6:** How can the two dimensional model (AdH model) provide accurate results with an open boundary approach? This approach is very limited given the cyclical movement of water (kicking up more sediment scour) as it is resisted by the dam.	See response to comment DR-2. It is true that the dam operations are not included. Hence, the influence of dam operations on the distribution and storage conditions of sediments in the lowermost reaches of the reservoir (especially sandy sediments) must be considered an additional source of uncertainty in the results. However, the model was calibrated against scour load data, and against sediment type data (sand, silt, clay) measured below the dam. Hence, the general relationship between discharge and scour from the reservoir is well-represented.
DR-7	**Comment DR-7:** According to Chesapeake Bay Program's (CBP) Scientific and Technical Advisory Committee (STAC): "The AdH application in this study has been developed to the point that scour and deposition is consistent with what is already known from survey and sampling observations. However, the AdH model application does not refine that empirical understanding. The uncalibrated and weakly constrained model application provides an essentially heuristic basis for scenario evaluation and the AdH model has not, as yet, added substantial new understanding of the sediment dynamics of the reservoir. The modelling does not strongly reinforce the existence of a scour threshold at 300,000 and 400,000 cfs. At best, it can be said that an uncalibrated model was found that produces results that are consistent with that particular threshold." (Pg. 22, Attachment I-7). How is the sediment dynamic of the reservoir evaluated and taken into account? Especially during episodic events?	This assessment of the capability of the AdH model application is somewhat too conservative with respect to what can be learned from the modeling. The analysis of the various bathymetries, including the projected bathymetry, is additional information that provides insight into the degree to which dynamic equilibrium exists in the reservoir, and the anticipated changes to the rate of scour over time, including the rate of scour for a large event. These results are consistent with observed trends, but also provide insights that cannot be ascertained from observations alone.

Comment Code	Comment	Comment Response
DR-8	• Another source of uncertainty concerned fine sediment flocculation and consolidation. Sediment transport models in general do not have a sophisticated approach to simulating fine sediment flocculation. Suspended fine sediment can either exist as primary silt and clay particles or in low energy systems such as reservoirs form larger particles in the water column due to flocculation. Particles that flocculate are larger and have higher settling velocities, thus their fate in the reservoir can be quite different than the lighter primary particles (Ziegler, 1995). When fine sediment particles deposit on the reservoir bed they compact and consolidate over time. As they consolidate the yields stress increases, meaning that the resistance to erosion becomes greater. Higher flows and subsequent bed shear stresses are required to scour the consolidated bed. Laboratory results show that sediment that erodes from consolidated beds may have larger diameters than the primary or flocculated particles (Banasiak, 2006). Scour may result in resuspension of large aggregates that re-deposit in the reservoir and do not pass through the dam. To add to the complexity of this phenomenon, the large aggregate particles scoured from the bottom during a high flow event can break down to smaller particles in highly turbulent conditions. Thus the fate of inflowing sediment particles in the reservoir is highly variable and difficult to capture with current modelling techniques. The AdH model has the capability to relate flocculation to concentration but not to other variables such as shear stress which determines flock particle size and the overall fate of the sediment. The ability to predict flocculation dynamics is important to track the fate of sediment in a reservoir. To quantify this uncertainty numerous model simulations were conducted to determine a potential range of values. To reduce uncertainty more sophisticated methods would need to be developed to predict the flocculation dynamics. (Pg. 38). **Comment DR-8**: How many numerous models were used? What is the margin of error pertaining to these models?	Note that text indicates that numerous model simulations were conducted, not that numerous models were used. The margin of error is difficult to quantify, since there are not sufficient observations against which to meaningfully measure the error. Because of this inherent uncertainty, the results being gleaned from the modeling are focused on robust, qualitative trends, and model-to-model comparisons, not on specific quantitative measures.
DR-9	• The last major source of uncertainty was the limited data of suspended loads during storms and bed sediment erosion characteristics. Currently, the suspended sediment samples are collected from one location in Conowingo Reservoir. Because of the danger of sampling during large storms samples are not currently collected at the peak of the largest storms. To verify the estimations of bed scour during large storms improved field methods are required for sampling storm concentrations or turbidity over the entire storm hydrograph. Additionally, more samples of the reservoir bed would provide more data on the erosional characteristics of the sediment which would reduce uncertainty. (Pg.38). **Comment DR-9:** Please explain those improvements to field measurements or methods?	The text notes that it is dangerous to sample during large storms. It is out of the scope of this assessment to speculate on how improvements could be made in the field. With respect to the core samples in the Conowingo Reservoir, they could be used in sediment flume studies to better understand the erosional characteristics of the entire core with depth, and thereby, improve the field measurements.

Comment Code	Comment	Comment Response
DR-10	• CBEMP. The final modelling tool utilized for this LSRWA effort was CBEMP. CBEMP is an umbrella term used to describe a series of models that are applied to the Chesapeake Bay and its watershed. CBEMP was developed by CBP, the state-federal partnership responsible for coordinating the Chesapeake Bay and watershed restoration efforts. CBEMP has had almost three decades of management applications supporting collaborative, shared decision-making among the partners (USEPA, 2010b). This suite of environmental models has an unrivaled capacity to translate loadings in the watershed to Clean Chesapeake Coalition Summary and Comments on DLSRWA and Appendices Page 5 of 53 5 water quality in the Chesapeake Bay (Linker et al., 2013). CBEMP includes the same models and was applied using the same scenario development and simulation methods for this LSRWA effort as were used in the development of the 2010 Chesapeake Bay TMDL (USEPA, 2010a, Appendix D). (Pg. 39). In addition, the full suite of Chesapeake Bay models has been regularly updated and calibrated based on the most recently available monitoring data, about every 5 to 7 years over the past three decades. Linker et al. (2013) provides a complete description of the different phases and versions of the Chesapeake Bay models. Used properly, CBEMP provides the best estimates of water quality and habitat quality responses of the Chesapeake Bay ecosystem to future changes in the loads of nutrient and sediment pollutants. For this LSRWA effort, CBEMP had two major applications. The first application was a series of modelling runs conducted by USACE ERDC documented within Appendix C. These CBEMP application scenarios were utilized to estimate water quality impacts of selected watershed and land use conditions, reservoir bathymetries, a major storm (scour) event (January 1996) at different times of year, and selected sediment management strategies. Sediment erosion or scour from the bed of Conowingo Reservoir estimated from AdH was utilized as input for selected CBEMP scenarios. The second CBEMP application was a series of modelling runs conducted by CBP, as described, *infra* , in more detail in Appendix D. • Chesapeake Bay WSM Model. The Chesapeake Bay WSM simulates the 21-year period (1985 - 2005) on a 1-hour time step (USEPA, 2010b). Nutrient inputs from manure, fertilizers and atmospheric deposition are based on an annual time series using a mass balance of U.S. Census of Agriculture animal populations and crops, records of fertilizer sales and other data sources. Best management practices (BMPs) are incorporated on an annual time step; nutrient and sediment reduction efficiencies are varied by the size of storms. Municipal and industrial wastewater treatment and discharging facilities and onsite wastewater treatment systems' nitrogen, phosphorus and sediment contributions are also included in the Chesapeake Bay WSM. (Pg. 39). **Comment DR-10:** How is this model run protective of scour entering Maryland's waters?	The question is difficult to understand. Model runs in and of themselves are insufficient to be protective of water quality. It's the decisions that managers make with the model runs that have the potential to be protective of water quality.

Comment Code	Comment	Comment Response
DR-11	• Chesapeake Bay Estuarine Models. The hydrodynamic model computes intra-tidal transport using a three dimensional grid framework of 57,000 cells (Cerco et al., 2010). The hydrodynamic transport model computes continuous three dimensional velocities, surface elevation, vertical viscosity, and diffusivity, temperature, salinity, and density using time increments of 5 minutes. The hydrodynamic model was calibrated for the period 1991 – 2000 and verified against the large amount of observed tidal elevations, currents, and densities available for the Chesapeake Bay. Computed flows and surface elevations from the hydrodynamic model were output at 2-hour intervals for use in the water quality model. Boundary conditions were specified at all river inflows, lateral flows and at the mouth of the Chesapeake Bay. • The eutrophication model, referred to as the Chesapeake Bay Water Quality/Sediment Transport Model 6, computes algal biomass, nutrient cycling and DO, as well as Clean Chesapeake Coalition Summary and Comments on DLSRWA and Appendices Page 6 of 53 6 numerous additional constituents and processes using a 15-minute time step (Cerco and Cole, 1993; Cerco, 2000; Cerco et al., 2002; Cerco and Noel, 2004). In addition, the Chesapeake Bay Water Quality/Sediment Transport Model incorporates a predictive sediment diagenesis component, which simulates the chemical and biological processes which take place at the bottom sediment-water interface after sediment is deposited (Di Toro, 2001; Cerco and Cole, 1994). (Pg. 40). • The Chesapeake Bay Water Quality/Sediment Transport Model simulates water quality, sediment, and living resources in three dimensional in 57,000 discrete cells, which extend from the mouth of the Bay to the heads of tide of the Bay and its tidal tributaries and embayments, as depicted in Figure 3-5. The primary application period for the combined hydrodynamic model and eutrophication model covers the decade from 1991 - 2000. For LSRWA applications the 1991 - 2000 hydrologic record was retained as this is the hydrologic period that CBEMP is based upon. Additionally, this is the same hydrologic period employed by the CBP partners in development of the 2010 TMDL (USEPA, 2010a). • 1996 January High-Flow Event Scenario. The January high-flow event in 1996 was selected as the event to observe water quality impacts for LSRWA scenarios requiring a storm event because it is the highest observed flow within CBEMP's 1991 – 2000 hydrologic period. High flow events wash in loads (sediment and nutrients) from the watershed; if there is high enough flow these events scour additional loads from the reservoir beds behind the three dams on the lower Susquehanna River. (Pg. 44). • A one-dimensional HEC-RAS model computed hydraulic conditions and sediment transport in the reservoir system and sediment loads to Conowingo Reservoir for use in the two- dimensional model the Adaptive Hydraulics (AdH) model.	Comment noted.

Comment Code	Comment	Comment Response
	Comment DR-11: MDE admitted that this data was limited in terms of the number of core samples and the depth taken at the DLSRWA Public Hearing Meeting in December 2014 at Harford Community College.	
DR-12	• Model was not capable of passing sediment through the gates, therefore, for this study the dam was modeled as an open boundary with downstream control represented by the water surface elevation. (Pgs. 38 and 149). • Flow rates capped at approximately at 620,000 cfs. - 640,000 cfs. for Tropical Storm Lee. (Pg. 62; *see* Figure 4.1). Table 4.3- Pg. 63 shows an event of 798,000 cfs. having an occurrence of 1 in 25 years. • Each reservoir bed consists of a number of layers. The lowermost layer is considered an inactive layer that will rarely, if ever, scour to any degree. Above that, there is an "active" scour and depositional zone. The surface of the active layer consists of a relatively thin mixing layer that is unconsolidated and may have a high potential for scour Clean Chesapeake Coalition Summary and Comments on DLSRWA and Appendices Page 7 of 53 7 at flows less than the scour threshold. For modelling purposes, the active layer is estimated to have a depth of approximately of 2 to 3 feet; however, it is spatially variable due to bed composition and consolidation. (Pg. 65). **Comment DR-12:** How do 8 core samples with a depth of 1 foot delineate the reservoir bed in a 14 mile reservoir?	See response to comment DR-4. The study team believes the data were sufficient for the modeling effort, with respect to the goals of the study. While, more cores would provide greater insight into the existing spatial variability of the reservoir, they would not provide significantly more insight into historical or projected conditions of the reservoir. So although more cores would always be of benefit, eight cores are adequate to determine the erosional characteristics of the Conowingo reservoir.
DR-13	• Sediment transport is directly related to particle size. (Pg. 60). Storms can potentially scour the silts and clays, which are easier to transport, while frequently leaving behind the coarser, sand-sized sediment. For example, in the lower portion of Conowingo Reservoir in 1990, particle size analysis from 2-foot deep sediment cores indicated the area had about 5 percent sand; in 2012, it was projected to have 20 percent sand based on all previous cores. The reservoir sediment data collected show that generally there is more sand in the bed upstream and silts and clays are more prevalent closer to the dam for all three reservoirs. Silt is the dominate particle size transported from the reservoir system with little sand (less than 5 percent) transported to the upper Chesapeake Bay (*see* Appendix A for further discussion). (Pg. 60). **Comment DR-13:** Was this 20 year old data used to address the inadequacies of the 8 core samples?	The eight SEDflume cores were used to characterize the bed. The only parameter that was corrected was the critical shear stress, which was corrected according to literature values (Whitehouse, 2000, reference in report).

Comment Code	Comment	Comment Response
DR-14	**Comment DR-14:** Core samples used in model runs from Conowingo Pond are inadequate given discussion later in the DLSRWA on Pg. 60. Generating data from a one dimensional model to be used in a two dimensional model is uncomforting and frightening. In addition, the following statements quoted below from the DLSRWA shows the lack of data in the models as it relates to scour. Such statements attempt to justify insufficient data in the model runs: • "…more samples of the reservoir bed would provide more data on the erosional characteristics of the sediment which would reduce uncertainty." (Pg. 38). • "Uncertainties in the total sediment load entering Conowingo Reservoir will affect scour and deposition, and thus affect the total load output to the Bay. Consequently, to provide more information on reservoir mass balance, future sampling program should extend both upstream and downstream of Conowingo Dam. To quantify the uncertainty of the limited data available to the LSRWA effort numerous model simulations were conducted to determine a potential range of values." (Pg. 38).	See response to comments DR-2 and DR-4.
DR-15	• "In summary, of all the modelling uncertainties that exist, three are most critical for interpreting the Conowingo Reservoir modelling results. These include the potential for flocculation of sediment flowing into the reservoir, the potential for large sediment aggregates to erode from cohesive beds and dam operations. Because of these uncertainties the AdH model may potentially over-predict to some degree the transport of scoured bed sediment through the dam to the Chesapeake Bay. Appendix B provides further detail on the uncertainty associated with AdH, as well as documentation of the model inputs, outputs and calculations." (Pg. 39). **Comment DR-15:** Over-predict? The Corps is saying that the lack of data is somehow portraying the problem in a negative light to undermine the severity of this problem. How could there be an over-prediction of the transport of scour bed sediment when model runs are capped at 600,000 - 640,000 cfs. instead of running the models at the more appropriate level of 900,000 cfs.?	The assertion that the model may over-predict scour is because each of the uncertainties listed has a tendency to result in the increased retention of sediment in the reservoir, relative to the modeled condition (i.e., relative to the modeled approximation of that uncertainty). According to USGS observations, a discharge of 900,000 cfs is on the order of a 50-year event, whereas the discharge associated with Tropical Storm Lee is on the order of a 20-year event. Hence, although the load for a given event would be higher for 900,000 cfs, the resulting impact to the Bay would have a lower probability of occurrence. Figures 4 and 5 in Appendix B-1 integrate the frequency together with the load. These figures demonstrate that, on an annually averaged basis, the 900,000-cfs event does not have a significantly greater impact than an event on the order of 600,000 to 700,000 cfs.

Comment Code	Comment	Comment Response
DR-16	• Chesapeake Bay Environmental Model Package ("CBEMP" – Chapter 3 of the DLSRWA). This model is used to determine dredging effectiveness. (Pgs. 136-140). Developed by CBP and based on computed loads from the watershed at key locations in the reservoir system including the Conowingo inflow and outflow. Watershed loads at the Conowingo outfall computed by the Watershed Model ("WSM") were supplemented by bottom scour loads estimated through AdH and through data analysis. The WSM is considered part of the CBEMP. • CBEMP includes the same models used in the development of the 2010 Chesapeake Bay TMDL, and is based on land use, management practices, wastewater treatment facility loads, and atmospheric deposition from the year 2010. (Pg. 39). This run is considered to represent existing conditions to provide assistance with projected land use, management practices, waste loads, and atmospheric deposition upon which the 2010 Chesapeake Bay TMDL was based. (Pg. 45). • CBEMP produces estimates, not perfect forecasts. Hence, it reduces, but does not eliminate, uncertainty in environmental decision-making. There are several sources of uncertainty summarized and discussed in more detail in Appendix C. (Pg. 49). • One source of uncertainty is the exact composition of nutrients associated with sediment scoured from the reservoir bed. Two alternative sets of observations are presented in Appendix C, one based on observations at the Conowingo Dam outfall in January 1996 and one based on observations collected at Conowingo Dam during Tropical Storm Lee in September 2011. The nutrients associated with suspended solids differ in the two events with 1996 being lower. In fact, both data sets represent a mixture of solids from the watershed and solids scoured from the bottom so that neither exactly represents the composition of scoured material alone. The 2011 observations are consistent with samples collected in the reservoir bed (Appendix C, Attachment C-1), are more recent and represent a typical tropical storm event rather than the anomalous circumstances of January 1996. For this reason nutrient composition observed at Conowingo Dam in 2011 is preferred and was utilized to characterize the future and is emphasized in the DLSRWA. Several key scenarios were repeated with the 1996 composition, however, to quantify the uncertainty inherent in the composition of solids scoured from the reservoir bottom. (Pg. 50).	Comment noted. The statement that "the 2010 TMDL needs to be revised" is incorrect.

Comment Code	Comment	Comment Response
	• Another source of uncertainty is the availability (*i.e.* , bioavailability) and reactivity of the nutrients scoured from the reservoir bottom. The majority of analyses of collected data at the Conowingo Dam outfall and from within the reservoir bed sediment quantify particulate nitrogen and particulate phosphorus without further defining the nature of the nitrogen or phosphorus. For the LSRWA effort, modelers opted to maintain the accepted, consistent particle composition that has been employed throughout the application of CBEMP. Uncertainty in the particle composition, and consequently, the processes by which particulate nutrients are transformed into biologically available forms still exists. (Pg. 50). • Some uncertainty in computed storm effects on Chesapeake Bay would result from considering solely a January storm. Bay response to storms in other seasons might vary. To reduce this uncertainty the January storm was moved to June and to October. The June storm coincides with the occurrence of the notorious Tropical Storm Agnes, which resulted in the worst recorded incidence of storm damage to the Bay. The October storm corresponds to the occurrence of Tropical Storm Lee and is in the typical period of tropical storm events. (Pg. 50). • CBEMP evaluated water quality impacts from a single large flow event (January 1996). Lower flow, more frequent events may also have a cumulative impact over time in the future. Future modelling work could investigate the potential effects of smaller more frequent events to reduce uncertainty and expand understanding of how various flows influence Chesapeake Bay water quality. (Pg. 50). **Comment DR-16:** This study has a schizophrenic analyses and discussion considering that the 2010 TMDLs need to be revised and yet the models that established those numbers are acknowledged and used to determine the effectiveness of dredging in the DLSRWA.	

Comment Code	Comment	Comment Response
DR-17	• Chesapeake Bay Estuarine Models – used to compute the impacts of sediment and nutrient loads to the estuary on light attenuation, SAV, chlorophyll, and DO concentrations in Chesapeake Bay tidal waters. (Pgs. 39-40). • The eutrophication model, referred to as the Chesapeake Bay Water Quality/Sediment Transport Model6, computes algal biomass, nutrient cycling, and DO, as well as numerous additional constituents and processes using a 15-minute time step. (Pg. 40). • In addition, the Chesapeake Bay Water Quality/Sediment Transport Model incorporates a predictive sediment diagenesis component, which simulates the chemical and biological processes which take place at the bottom sediment-water interface after sediment is deposited (Di Toro, 2001; Cerco and Cole, 1994). (Pg. 40). • The primary application period for the combined hydrodynamic model and eutrophication model covers the decade from 1991 - 2000. For LSRWA applications the 1991 - 2000 hydrologic record was retained as this is the hydrologic period that CBEMP is based upon. Additionally this is the same hydrologic period employed by the CBP partners in development of the 2010 TMDL (USEPA, 2010a). **Comment DR-17:** More predictions and scientific buzz words in establishing variables and definitely less science. Why not used data from the same years or timeframe as the other model runs? The eutrophication model does not include Tropical Storm Lee given the timeframe of 1991 - 2000.	The LSRWA report is clear on the application of the January 1996 "Big Melt" high-flow event on the Susquehanna River, which is an event consistent with the same time period of calibration and application (1991-2000) of the Chesapeake Bay Program models. Other large storm events are also discussed.
DR-18	• In order to compute water quality impacts with CBEMP, nutrient loads associated with sediment (in particular, nutrient loads carried over Conowingo Dam as a result of sediment scour from the reservoir bottom) were calculated by assigning a fractional nitrogen and phosphorus composition to the scoured sediment (solids). The initial fractions assigned for nitrogen and phosphorus were based on analyses of sediment cores removed from the reservoir (Appendix C, Attachment C-1). However, further analysis was done to ensure the most appropriate nutrient composition of loads was being utilized. (Pg. 46). **Comment DR-18:** Are these the same core samples that were limited to 1 foot? If not, from where were these sediment core samples taken? And why weren't these samples used in the AdH Model run?	The sediment cores described in the text of the draft LSRWA report were used to characterize the nutrient content of reservoir bottom sediments for use in the CBEMP. These were not the same cores collected for the SEDflume analyses and utilized in the AdH application. The locations of the cores used in the CBEMP can be found in Appendix C-1 and references therein. The cores analyzed for nutrient content were collected in studies which preceded this one and were neither available nor suited for use in the SEDflume.

Comment Code	Comment	Comment Response
DR-19	• "SAV species in the upper Bay were strongly affected by Hurricane Irene and Tropical Storm Lee which increased river flow and sediment loads in this region for almost two months (Gurbisz and Kemp, 2013). However, the dense SAV bed on the Susquehanna Flats persisted through the storms demonstrating how resilient SAV beds can be to water quality disturbances (CBP, 2013)." (Pg. 71). • Regarding oysters, Maryland's 2011 oyster survey conducted after Tropical Storm Lee indicated that those high freshwater flows from heavy rains in the spring and two tropical storms in late summer impacted oysters in the upper Bay, although ultimately representing a relatively small proportion of the total oyster population. The lower salinities proved to be beneficial to the majority of oysters in Maryland by reducing disease impacts to allow the yearling oysters to thrive (MDNR, 2012). (Pgs. 71-72). **Comment DR-19:** How was sediment scour ruled out given that this analysis seems to be based on observations? Who at DNR made these observations? Do DNR field notes exist that make such an observation?	Please see the referenced report or contact MDNR for more information on this topic. With regard to SAV, after exceeding the goals for submerged aquatic vegetation (SAV) in the northern Chesapeake Bay (segment CB1TF) for 2008-2010 and reaching a peak of 436.58 hectares in 2009, Bay grass acreage decreased to 342.34 hectares in 2010, to 201.09 hectares in 2011, and to 186.51 hectares in 2012. Since then, SAV area in CB1TF increased to 229.81 hectares in 2013 and preliminary data indicate that 2014 will have more than 2013. Thus, it appears that SAV beds in the upper Bay are resilient to disturbances in water quality. Please see http://www.vims.edu/research/topics/sav/ for annual SAV monitoring reports. Sediment scour was ruled out due to the fact that other upper Bay benthic organisms survived after TS Lee. The DNR assessment was based on observations of live fouling organisms, including barnacles, mussels, and bryozoans, that were found attached to the oysters and shells on oyster bars in the northern Bay. Had the oysters been smothered by sediment, these organisms would not have been able to attach to the oyster shells and would not have survived.
DR-20	• "The "Big Melt" event occurred in January 1996. The instantaneous peak flow for this event was 908,000 cfs. (Pgs. 73-74). • Hurricane Agnes was the largest flood in the Susquehanna River basin since 1896, when recording of flow began at Harrisburg, PA. During the Agnes event the flow over Conowingo Dam peaked at 1,098,000 cfs. • "As discussed in Chapter 3, the LSRWA modelling efforts included Tropical Storm Lee and the January 1996 high-flow event because these storms were included in the hydrologic period of the modelling tools utilized for this effort and because there was existing collected data available for these storms." (Pg. 74). • Attachment 4 of Appendix J includes detailed information on "Septic Systems." (Pgs. 29-33). **Comment DR-20:** Septic systems are not discussed at all in the corresponding tables for the cost analysis in Attachments 2 and 3. Why not?	Septic systems are estimated to contribute about 5 percent of the nitrogen load to the tidal Chesapeake on an average annual basis and have no phosphorus or sediment contributions whatsoever. In the high-flow events described in the LSRWA report, the septic loads are negligible. The focus of the BMP assessment was sediments, not nutrients. The discussion regarding septic systems was included in Appendix J by mistake and has been deleted.
DR-21	**Comment DR-21:** However, the flow rate for model runs was set at approx. 620,000 cfs. – so how does the LSRWA modelling account for these storms? Figure 4.7 seems to undermine the "1996 Big Melt" by capping the flow rate at 600,000 cfs.	See response to comment DR-15.

Comment Code	Comment	Comment Response
DR-22	• "On average, flows above 800,000 cfs. produced a scour load that comprised about 30 to 50 percent of the total load entering the Bay. Flows of this magnitude are rare with a recurrence interval of 40 years or more." (Pg. 76). Keep in mind, that Pg. 63 shows an event of 798,000 cfs. having an occurrence 1 in 25 years. The assumptions and conclusions regarding the potential number of storm events in a given interval are inconsistent and result in minimizing the adverse impacts on the Bay. • SAV, Chlorophyll and light attenuation relied on three model storms: January, June and October. (Charts on Pgs. 80-83). • The June scour event had an estimated increase in deep-channel DO water quality standard nonattainment (negative impact) of 1 percent, 4 percent, 8 percent, and 3 percent in segments. (Pg. 93). • The severity of the DO hypoxia response estimated by the degree of nonattainment of the deep channel and deep-water DO standards was greatest in the June storm scenario, followed by the January and October storm scenarios. The seasonal differences in water quality response, despite the same magnitude of nutrient and sediment loads in the June storm, October storm, and January storm scenarios, is thought to be because of the fate and transport of nutrients in the different seasons. (Pg. 94). • CBEMP does not model direct storm wave damage to aboveground or belowground SAV tissue, nor direct impacts of excess storm bottom erosion and deposition upon SAV. Accordingly, to consider these other effects of major storms on SAV, it was appropriate to consider the CBEMP model outputs as well as other recent and historical information in this study. Effects of storms can differ based on SAV bed health, size, and density. (Pg. 95). Admission. **Comment DR-22:** To investigate the effect of the storm season, scenarios were completed with the January 1996 Susquehanna storm flows and loads moved to June and October 1996. (Scenario 6 from Table 4-9, with three CBEMP model runs). Only one model run occurred during the growing season. Effects are discussed in terms of light attenuation, chlorophyll and DO. (Pg. 91). The models do not account for direct storm wave damage to above ground or below ground SAV. (Pg. 95).	Correct. The WQSTM does not simulate wave damage to SAV.

Comment Code	Comment	Comment Response
DR-23	• "Nitrogen loads associated with the scoured sediment exceed the phosphorus loads, as noted in Table 4-9. The excess of nitrogen over phosphorus in Conowingo Reservoir bed sediment indicates that the scoured nitrogen load will exceed the scoured phosphorus load any time bottom material is scoured (eroded), regardless of the quantity of bottom material." (Pg. 96). Sediment Management Strategy • "Storms will continue to occur and will vary in track, timing and duration. Due to global climate change it is predicted that there will be increased intensity of precipitation in spring and winter potentially causing more frequent scour events." (Pg. 99). • "Watershed loads of sediment, nitrogen and phosphorus will continue to decrease compared to today due to the continued implementation of Pennsylvania, New York and Maryland WIPs to meet the 2010 Chesapeake Bay TMDL allocations. Predicted higher temperatures and continued warming of Chesapeake Bay's tidal waters could have negative implications on DO causing intense hypoxia to occur substantially earlier or end substantially later in the year making it more difficult to meet Chesapeake Bay water quality standards, potentially increasing costs to achieve the Bay TMDL." (Pg. 99). • "In reducing the amount of sediment available for a scour event, water quality could be improved and impacts to aquatic life could be reduced." (Pg. 100). **Comment DR-23:** According to the Draft Report: "It is important to note that if suspended sediment was passively transported (*e.g.* , via modification of reservoir operations, flushing, sluicing, or agitation) as discussed in this section, a permit may not be required. However, if sediment transport were done actively through dredging or a pipeline, a permit would be required (Elder Ghigiarelli, MDE, Deputy Program Administrator, Wetlands and Waterways Program, Water Management Administration, personal communication, 2013). (Pg. 107) Does the Study group still believe that a permit would not be required under a new Maryland Gubernatorial Administration?	Correct. The Maryland Department of the Environment believes that the change in administration will not change existing permitting requirements.
DR-24	• "There are hundreds of combinations of ways to dredge, manage and place material. However, there are two main types of dredging – hydraulic dredging and mechanical dredging". (Pg. 110). **Comment DR-24:** What type of dredging did the Draft Study focus on in their cost estimates?	Both forms of dredging (hydraulic and mechanical) were investigated as shown in Table 5-6 on page 129.

Comment Code	Comment	Comment Response
DR-25	• Quarries appear to be the best option for material placement due to: (1) they can accept wet or dry material; (2) large volumes could be placed; and (3) there are several quarries nearby that can have material pumped in directly from Conowingo Reservoir without the need for costly re-handling or trucking. (Pg. 120). • Additional analyses characterizing sediment to be dredged including grain size, plasticity and percent moisture, metals, non-metals, pesticides, PCB's and PAH's, paint filter, and elutriate tests. (Pg. 120). • Must meet state regulations (PADEP for PA and MDE for MD). Transport containers must be watertight. Long transport distance. Water may need to be decanted, requiring another pipeline to return the effluent to the Susquehanna River. Mine owners contacted had no interest in sediment because of limitations on their mining permits. (Pg. 124). <u>Dredging Effectiveness</u> • It was assumed that 3 mcy (2.4 million tons) were removed by dredging from an area above the Conowingo Dam on the eastern side of the reservoir approximately 1 to 1.5 miles north of the dam. This dredging area was selected because large amounts of sediment still naturally deposit at this location. Although changing the dredging area location will likely influence results, removing such a relatively small quantity of sediment will have a minimal impact on total load delivered to the Bay when large flood events occur. (Pg. 136). The estimated scouring of sediment and nutrients was reduced by 32 percent in comparison to scour with a 2011 bathymetry (with all other parameters remaining the same). Dredging had little effect on model simulated water quality conditions in the Chesapeake Bay. (Pg. 136). • CBEMP estimated a decrease (a positive improvement) of 0.2 percent nonattainment in the deep channel DO water quality standard for segments. (Pg. 137). • The results imply that if 31 mcy (25 million tons) of sediment were removed, there would be a 9 percent decrease in total load to the Bay (from 22.3 to 20.3 million tons), a 40 percent decrease in bed scour (from 3.0 to 1.8 million tons) and a 50 percent increase in reservoir sedimentation or deposition (from 4.0 to 6.0 million tons). (Pg. 139). **Comment DR-25:** Please provide the data and models used for this analysis.	The models used in the watershed assessment are summarized in Chapter 3 of the main report. Extensive details about each model, including the input data, are provided in Appendices A through D.

Comment Code	Comment	Comment Response
DR-26	• "However, these calculations do not take into account that the storage capacity would be increasing and thus more incoming sediment could be depositing." (Pg. 139). • It was assumed that the average Susquehanna River flow during the winter months was 60,000 cfs., approximately twice that of the median flow of about 30,000 cfs. At 60,000 cfs., the average suspended sediment measurement below the dam was assumed to be about 12 mg/L, which equates to a daily load of about 1,940 tons of sediment passing through the dam. (Pg. 140). **Comment DR-26:** CBEMP model is being used to determine dredging effectiveness. How could this be the case given that the CBEMP model has many uncertainties? (*See* Pgs. 3-4 of this outline). Moreover, calculations do not take into account that storage capacity is increasing in the reservoir behind the dam.	The comment states "CBEMP model is being used to examine dredging effectiveness." This statement is incorrect. Page 139 of the draft LSRWA report, under the heading 5.6.3 Long-Term Strategic Dredging states "For this analysis, no models were used instead it was a desktop analysis using information from other modeling runs." Moreover, the other modeling runs referenced for this analysis were conducted using the AdH sediment transport model of Conowingo Reservoir. The CBEMP was not utilized in this analysis at all.
DR-27	<u>Findings</u> • "Sediment bypassing results in increased suspended solids computed in the Bay during the bypassing period. The bypassed sediment settles quickly after bypassing stops." (Pg. 141). • "CBEMP estimated that deep-channel DO and deep-water DO water quality standards were seriously degraded as a result of nutrients associated with the bypassed sediment." (Pg. 141). • "Bypassing costs are still high but not as high as dredging. Bypassing is just as effective as dredging at increasing sediment deposition and reducing available sediment for scour events. However, this method increases total sediment loads to the Bay. The environmental costs (diminished DO, increased chlorophyll) are roughly 10 times greater than the benefits gained from reducing bed sediment scour in Conowingo reservoir." (Pg. 142). **Comment DR-27:** NEPA is required for these investigations. "It should be noted that the LSRWA effort was a watershed assessment and not a detailed investigation of a specific project alternative(s) proposed for implementation. That latter would likely require preparation of a NEPA document. The evaluation of sediment management strategies in the assessment focused on water quality impacts, with some consideration of impacts to SAV. Other environmental and social impacts were only minimally evaluated or not evaluated at all. A full investigation of environmental impacts would be performed in any future, project-specific NEPA effort." (Pg. 143).	Please see the response to Comment CCC-L-5 regarding NEPA. Additional text regarding impacts to SAV and oysters has been added to Section 4.2.3. Text to further address environmental implications has also been added throughout the document.

Comment Code	Comment	Comment Response
DR-28	<u>Public Participation Concerns</u> • "The team sent out study coordination letters to various federal and state resource agencies in February 2012 to inform agencies of the initiation of the study and to request Clean Chesapeake Coalition Summary and Comments on DLSRWA and Appendices Page 15 of 53 15 the level of involvement each agency would like to have with the study. Two response letters were received requesting involvement in the study as well as various emails from agencies confirming their willingness to participate in study. A study initiation notice was distributed via email in February 2012 as well." (Pg. 147). • "The team held quarterly meetings to discuss, coordinate, and review technical components of the assessment, as well as management activities. These meetings were open to all stakeholders to attend. Agendas and handouts were provided to stakeholders via email prior to the meeting and the meeting summary with items presented at quarterly meetings was posted to the public website after quarterly meetings. A total of 10 quarterly meetings were held from November 2011 to January 2014, with attendance ranging from 30 to 50 participants. These participants represented 19 different stakeholder groups." (Pg. 147). • "Throughout the duration of the assessment, the LSRWA team coordinated with other pertinent Chesapeake Bay groups, so as to be included on their agendas to provide updates and get feedback on the LSRWA. Feedback received from these other Chesapeake Bay groups was reported back to the rest of the LSRWA team and was incorporated into this LSRWA report." (Pg 147). • "Throughout the duration of the assessment, email updates were sent out periodically to interested stakeholders on study progress and news. This email distribution list was started by the original Sediment Task Force (included interested stakeholders) that Susquehanna River Basin Commission led in 1999 and 2000. The team has been updating this list since 2009 with people interested in this effort." (Pg. 147). • "Prior to public release the draft LSRWA report was reviewed by the agencies involved in quarterly meetings. Additionally, the STAC sponsored an independent scientific peer review of the draft LSRWA report in June - August of 2014. STAC provides scientific and technical guidance to the Chesapeake Bay Program on measures to restore and protect the Chesapeake Bay. More information about STAC is located here: www.chesapeake.org/stac. Appendix I, Attachment I-7 contains the comments and LSRWA team responses to the LSRWA quarterly group's reviews and the STAC sponsored independent scientific peer review." (Pg. 147). • At least one public meeting is expected to be held later in 2014. Once that meeting is held, a description of the meeting(s) will be placed here and will include a location, date, participants, and feedback received. All comments will become part of Appendix I, Attachment I-7. (Pg. 147).	Neither NEPA nor FACA applied to this study; please see our response to comment CCC-L-5 for more information. The public participation element of the assessment is described in Chapter 6 of the main report, as well as Appendix I.

Comment Code	Comment	Comment Response
	Comment DR-28: Please explain how this study group involved public participation. How does the LSRWA's approach address NEPA public participation requirements and those required by the Federal Advisory committee Act (FACA)?	
DR-29	• Recommendation – U.S. EPA and Bay watershed jurisdictional partners should integrate findings from the LSRWA into their ongoing analyses and development of the seven watershed jurisdictions' Phase III WIPs as part of Chesapeake Bay TMDL 2017 midpoint assessment. (Pg. 160). **Comment DR-29:** Having such findings integrate with 7 watershed jurisdictions requires a FACA approach. Was FACA ever discussed? If not, why not? If so, how was FACA addressed?	EPA and its seven watershed jurisdictional partners have already publicly committed to integrating the findings from the LSRWA into the partnership's Chesapeake Bay TMDL 2017 midpoint assessment in numerous public forums and publicly accessible documents. Please also see the response to comment CCC-L-5 regarding FACA.

Comment Code	Comment	Comment Response
DR-30	Finding #1: Conditions in the Lower Susquehanna reservoir system are different than previously understood. (Pg. 151). • Conowingo Reservoir is essentially at full capacity; a state of dynamic equilibrium now exists. Previously, it was thought that Conowingo still had long-term net trapping capacity for decades to come. • Storm event based scour of Conowingo Reservoir has increased. Previously, it was not fully understood how scouring was changing as the reservoirs filled. (Pg. 152). • The LSRWA modelling efforts indicate that the scour threshold for the current Conowingo Reservoir condition ranges from about 300,000 cfs. to 400,000 cfs. (Pg. 152). • Modelling simulations comparing current conditions of the Conowingo Reservoir to the mid-1990s indicate that a higher volume of sediment is scoured currently at flows above 150,000 cfs. in comparison to the mid-1990s, with the threshold for mass scouring occurring at about 400,000 cfs. (Pg. 152). • Sediment transport is related to particle size. Storms can potentially scour the silts and clays (easier to transport) leaving behind the coarser sand-sized sediment. (Pg. 152). Finding #2: The loss of long-term sediment trapping capacity is causing impacts to the health of the Chesapeake Bay ecosystem. (Pg. 153). • The assessment indicates that the ecosystem impacts to the Chesapeake Bay result from the changed conditions and are due primarily to extra nutrients associated with the scoured sediment as opposed to the sediment itself. **Comment DR-30:** Modelling estimates showed that the sediment loads (not including nutrients they contain) from Conowingo Reservoir scour events are not the major threat to Bay water quality. The models do not account for the sediment smothering that is occurring. Low DO was estimated to persist in the deeper waters of northern Chesapeake Bay for multiple seasons due to nutrient storage in the Bay's bed sediment and recycling between the bed sediment and overlying water column. (Pg. 153). This needs to be reviewed and there needs to be concern with the bed sediments and smothering.	Concur with the commenter's summation that nutrients are the primary concern with Conowingo infill. In addition, studies now underway will improve the assessment of the water quality influences of Conowingo infill. However, "SAV smothering" was unobserved in measurements following Tropical Storm Lee.
DR-31	• Full WIP implementation won't fully restore the Chesapeake Bay given changes to the Conowingo Reservoir sediment and associated nutrient trapping capacity. (Pg. 154). • The Susquehanna River watershed, not the Conowingo Dam and its Reservoir, is the principal source of adverse pollutant impacts on upper Chesapeake Bay water quality and aquatic life. (Pg. 154). **Comment DR-31:** So why has the U.S. EPA not declared the Susquehanna River (in Pennsylvania) impaired?	The Pennsylvania Department of Environmental Protection has been delegated the authority to assess the quality of the commonwealth's waters and make determination, consistent with the federal Clean Water Act, as to whether specific stream and river segments are supporting their designated uses as defined within Pennsylvania's water quality standards regulations. EPA does review and approve Pennsylvania's list of impaired waters on a biennial basis. EPA is currently working with Pennsylvania Department of Environmental Protection on enhanced monitoring and assessment of the Susquehanna River in support of Pennsylvania's future assessments of the quality of the Susquehanna River's waters.

Comment Code	Comment	Comment Response
DR-32	• On average flows above 800,000 cfs. produced scour load that comprised about 30 to 50 percent of the total load entering the Bay; however, an event of this magnitude is extremely rare with a recurrence interval of 40 years or more. (Pg. 155). **Comment DR-32:** *See* Figure 4.1. (Pg. 62). Table 4.3 shows an event of 798,000 cfs. having an occurrence of 1 in 25 years. (Pg. 63). Exelon's relicensing application with FERC is for a 46 year license. So how is such an occurrence of flows above 800,000 cfs. a rarity? Why weren't the model runs conducted with a flow rate of at least 798,000 cfs., having an occurrence of 1 in 25 years?	Text has been clarified. Paragraph 2 on page 155 (October 2014 version, now on page 162) has been changed. Line 4 now indicates "...recurrence interval of less than 40 years at the Marietta, PA gage).... Line 8 has been changed to " flows above 800,000 cfs at the Marietta, PA gage produced scour...." Line 10 has been changed to "... an event of this magnitude has a recurrence interval ....).
A-1	**Comment A-1:** Two one dimensional models were used instead of more and current data and considering a three dimensional model. Statements Regarding the Use and Limitations of Models in the DLSRWA • Due to data limitations two one dimensional model simulations were produced: one for the modelling period 2008 - 2011 (representing net deposition) and a second for a high streamflow event using Tropical Storm Lee to represent net scour. (Pg. 1). • Each simulation used the same model data inputs but model parameters were changed. The depositional model resulted in a net deposition of 2.1 million tons while the scour model resulted in a net loss of 1.5 million tons of sediments. (Pg. 1). • Dynamic equilibrium results in increased loads that may have a greater impact on sediment and phosphorus that tend to transport in the particles phase and have less of an impact on nitrogen which tends to transport in a dissolved phase. (Pg. 4). • It is implied that increasing concentrations and loads are due to the loss of storage capacity from a decrease in the scour threshold. These increases are not certain but likely involve changes in particle fall velocities, increased water velocity, transport capacities, and bed shear. (Pg. 4). • The HEC-RAS one dimensional model simulates the capability of a stream to transport sediment, both bed and suspended flow, based on yield from upstream sources and current composition of bed. The HEC-RAS transport equations are designed mainly for sand and coarser particles. (Pg. 13).	There was only one HEC-RAS model (one-dimensional) used for this study, but two simulations based on the <u>same</u> input and calibration data. The AdH model, also used in this study, is a two-dimensional model.
A-2	**Comment A-2:** How does the HEC-RAS model account for clay sediments? • Sediment loads entering and leaving a reservoir can be determined from a sediment (*i.e.* , transport) curve or from actual concentration data from upstream and/or downstream sites(s). (Pg. 11).	There is detailed information on the particle size" groupings" and on the particle size parameters used in calibrating the model in Appendix A.
A-3	**Comment A-3:** Figure 6 (Pg. 1) portrays the discharge flow rate capped at 425,000 cfs., which triggers data manipulation concerns. Figure 7 portrays flow rate at approximately 625,000 cfs. The core samples utilized for the Conowingo Reservoir were limited to 8 samples of less than 12'' in depth. *See* Figures 7 and 8.	See responses to comments DR-4 and DR-15.

Comment Code	Comment	Comment Response
A-4	• At the time that this assessment began, there was concern about the issue of the reservoirs and their reduced trapping capacity because of the implications to sediment and the associated nutrient loads to the Chesapeake Bay and management of those loads. More specifically, there were significant implications to the then ongoing development of the Chesapeake Bay TMDL by EPA working collaboratively with the six watershed states and the District of Columbia. In the 2010 Chesapeake Bay TMDL report, EPA and its seven partner watershed jurisdictions documented their assumption that the Chesapeake Bay TMDL allocations were based on the Conowingo Dam and Reservoir's sediment and associated nutrient trapping capacity in the mid-1990s, the midpoint of the 10 years of hydrology (1991-2000) used in the underlying model scenarios (USEPA, 2010a). EPA documented within its 2010 Chesapeake Bay TMDL main report and supporting technical appendix that if future monitoring shows the trapping capacity of the dam were reduced, then EPA would consider adjusting the Pennsylvania, Maryland, and New York sediment and associated nutrient load reduction obligations based on the new delivered loads to ensure that they were offsetting any new loads of sediment and associated nutrients being delivered to Chesapeake Bay (USEPA, 2010a). (Pg. 9). **Comment A-4:** Admission. It is interesting that they don't discuss this assumption in terms of its impact on the models.	It is unclear what the commenter means by this statement. Since the Bay TMDL was developed using the 1991-2000 hydrologic period as well as with a critical period of 1993-1995 for water quality standards attainment, it is a given that the bathymetry, sediment storage capacity, and transport from Conowingo Reservoir during that period is what is established in the TMDL. As those conditions change with the reservoir reaching dynamic equilibrium, the models must be revisited using newer data to accurately reflect the changed conditions. This iterative adaptive process is built into the Chesapeake Bay TMDL through the 2017 midpoint assessment. Also, the additional data collected in 2015 and 2016 with the new and enhanced monitoring will ensure that there are additional empirical data to calibrate/validate the updated Chesapeake Bay watershed and estuarine water quality models. The trapping efficiency was incorporated in the HEC-RAS model by use of the sediment duration curve and actual estimated loads, both of which inherently contain a gain or loss of sediment due to trapping.
A-5	• According to the DLSRWA the 52 flood gates that span the dam begin to open at a flow rate greater than 86,000 cfs. Each flood gate generally has the capability to pass up to about 15,000 cfs. (Pg. 14). • During a large flood that requires the majority of the gate to be open, the spatial distribution of discharge shifts from the western side of the dam where the power plant resides, to the center of the channel. This shift in flow distribution and subsequent sediment load causes the sediment load on the eastern side of the reservoir t increase resulting in a high deposition rate in the area. (Page 14). "Thus depending on the reservoir inflows the spatial and quantitative fate of sediment in Conowingo Reservoir can be quite variable and difficult to stimulate with current modelling methods." **Comment A-5:** Concerns expressed in the DLSRWA that the Conowingo Reservoir is quite variable and difficult to simulate. So how is the simulations conducted?	See response to comment DR-6.

Comment Code	Comment	Comment Response
A-6	• A report prepared for the LSRWA study discusses modelling uncertainties in Attachment B-1. (Pg. 14). • Susquehanna River Inflows- the AdH (2 dimensional) simulations used flow rates from 2008-2011- all but one - **Question:** what was the one's flow rate? (Pg. 15). • Tropical Storm Lee (September 2011) with a peak discharge of 700,000 cfs. (Pg. 15) - 776,000 cfs. (Pg. 66). **Comment A-6:** Peak flow rate is marginalized at 776,000 cfs. This rate seems to change throughout the report as a way to run the models with marginalized flow rates. The bathymetric discussion on Pg. 67 makes no sense.	See the responses for comments CCC-24 or B-9 for full explanation of flows, and the response for comment DR-15 about the frequency relationship.
A-7	• The HEC-RAS one dimensional model sediment rating curve produced two sediment inflow scenarios: scenario one no scour from upper reservoirs and scenario 2 with 1.8 million tons of scour from the upper two reservoirs for a total inflow load of 24 million tons. (Pg. 16). **Comment A-7:** How are these numbers derived given the statement on Pg. 14 that stated the Conowingo Reservoir is quite variable and difficult to simulate?	The numbers are derived from HEC-RAS modeled results. They were adjusted somewhat for the AdH input, to ensure a conservative estimate of the total load coming into the Conowingo Reservoir (i.e., they were increased by 10 percent: this is conservative with respect to making sure the load was not underpredicted by the HEC-RAS model). It is recognized that this is a source of uncertainty in the results.
A-8	• The one dimensional model HEC-RAS was used to provide data for the AdH model (two dimensional model). (Pg. 17). Figure 6 shows a sediment rating curve with this data at a flow rate slightly above 600,000 cfs. (Pg. 17). What does this purport to represent? • In addition, the AdH sediment model requires bed sediments. This data was also manipulated as only 8 bed core samples were taken from the Conowingo Reservoir to a maximum depth of only 1 foot. Core samples were required to determine the inception of erosion (critical shear stress for erosion) and the erosion rate (Pg. 18) used to develop six material zones (Pg. 19). According to the DLSRWA the sediment bed in the AdH Model was approximately 3 feet. (Pg. 23). The properties of the lower 2 feet were either approximated from the SEDFlume data results (which is the one foot data) or determined from literature values. (Pg. 23). **Comment A-8:** A general trend was established with this tenuous data which is used to account for sediment size and critical shear stress. Figure 11 is a not based on core samples but rather approximations. (Pg. 26). Figure 12's presentation of suspended sediment concentrations undermined Tropical storm Lee to 600,000 cfs. given that it relied on approximations from Figure 11.	The sediment data happened to be taken at slightly higher than 600,000 cfs (the sample was taken on September 8, 2011 at an instantaneous flow of 617,000 cfs); this does not mean that 600,000 was the highest flow that occurred, or the highest that was modeled. The actual flows for the event were modeled in the LSRWA analyses.
A-9	**Comment A-9:** Because of the uncertainty of measured model boundary conditions the AdH two dimensional model was validated by comparing model output to the total suspended sample measurements below the Conowingo Dam. (Pg. 23). Where is this data from? How could these flow rates above the dam correlate with flow rates below the dam?	The sediment data were taken below the dam. The flow above the dam must equal the flow below the dam (with a short time-lag factored in), unless the dam is storing water (i.e., the stage/elevation in the dam is changing). The model is computing this according to its internal physics.

Comment Code	Comment	Comment Response
A-10	• "The hydrodynamics were successfully implemented in the AdH; however, the model was not capable of passing sediment through the gates, therefore, for this study the dam was modeled as an open boundary with downstream control represented by the water surface elevation at the dam. This limitation impacted how sediment was spatially distributed in the lower reach of the Conowingo Reservoir near the dam." (Pg. 60). **Comment A-10:** This is an important factor to consider in the two dimensional AdH Model, yet the dam is somehow removed for the model run and flow rates above the dam are compared to flow rates below the dam. How does this account for scour from behind the dam and the circular river flow motion against the dam?	See response to comment DR-6.
B-1	**Comment B-1:** "Conowingo Reservoir currently is approaching a dynamic equilibrium state and continues to store inflowing sediments from non-flood periods." (Pg. 2) This discussion is not consistent or current throughout the DLSRWA as the Dam has indeed reached a state of dynamic equilibrium.	The first comment relates to what was known previously from observations alone; the second comment (that the reservoir has effectively reached dynamic equilibrium) relates to what was learned from this study.
B-2	• "The USGS estimates that the average inflow of sediment is about 3.2 million tons per year into the Conowingo reservoir, with deposition ranging from 1.0 to 2.0 million tons per year." (Pg. 5). HEC-6 model one dimensional mode under-predicted the trap efficiency. (Pg. 5). **Comment B-2:** Exelon's report is cited as a good summary, which is concerning given that Exelon revised the USGS HEC-6 model and conducted a series of simulations to evaluate scour potential of the three reservoirs. (Pg. 5-6). Please keep in mind this is the same model (Exelon's HEC-6 model) that Langland criticized in his notes and review of the FERC required Exelon Sediment Transport Study.	On page 6, the usage of the word "summary" is not meant to say the report provided "a good summary", but rather "a good summary of the report" is provided. Report had been changed to "A summary of…"
B-3	• Models: Two dimensional model: AdH and HEC-RAS. (Pg. 7). • Data: "The USGS provided reservoir surveys from 1996 and 2008 with Exelon Corporation providing the most recent 2011 survey. The survey was modified by USGS to represent a sediment capacity condition." (Pg. 7-8). "The 4-year flow period from Clean Chesapeake Coalition Summary and Comments on DLSRWA and Appendices Page 22 of 53 22 2008 - 2011 was simulated in the model. The flow and sediment entering the upstream model boundary (the channel below the dam of Lake Aldred) were provided by USGS from HEC-RAS (one dimensional model simulations of the 4 year period)." (Pg. 8). **Comment B-3:** Not only is Exelon providing the model data to establish a full sediment capacity condition but the 1996 - 2008 reservoir data is being used with 2008 - 2011 flow data. The one dimensional model is not taking into account the impact of scour no matter what data manipulation is being considered. Why not use the USACE's bathymetric changes from 2008 - 2011 data (see Pg. 1) instead of Exelon's data? Wasn't there USGS data to consider?	Several different bathymetries were used together with the same set of boundary conditions to ascertain to what degree the system is approaching dynamic equilibrium. The USGS modified the 2011 data provided by Exelon to approximate a full reservoir conditions; hence, USGS generated the full reservoir bathymetry,

Comment Code	Comment	Comment Response
B-4	• A report was prepared for the DLSRWA effort discussing modelling uncertainties. (Pg. 14). **Comment B-4:** Where is this report?	As noted on page 14 of Appendix B, the report is located in Attachment B-1.
B-5	• One dimensional models are typically utilized when depth and laterally average conditions can provide adequate results to a problem. Two dimensional models are appropriate when lateral sediment transport conditions need to be resolved. Model results are depth averaged with model results available throughout the domain area. Two dimensional models can be used to stimulate sediment transport over years or decades for long term simulations. Three dimensional models are the most complex and provide problem resolution in all three dimensions (*i.e.* , depth, lateral and longitudinal). However, three dimensional models are computationally intensive and require long periods of simulation time to rum relatively short problem durations. If the goal of a study is to better understand reservoir stratification in low flow, low turbulence conditions than a three dimensional model is required to differentiate vertical properties. • "During a large flood that requires the majority of the gates to open, the spatial distribution of discharge shifts from the westerns side of the dam where the power plant resides, to the center of the channel. This shift in flow distribution and subsequent sediment load causes the sediment load on the eastern side of the reservoir to increase resulting in a high deposition rate in this area." (Pg. 14). According to Exelon: a flow rate greater than 86,000 cfs. the 52 flood gates that span the dam begin to open. Each flood gate generally has the capability to pass up to about 15,000 cfs." (Pg. 14). **Comment B-5:** Having all gates operating at full capacity the flow rate would allow for 780,000 cfs. In addition two dimensional models are limited in the short term and are using data obtained from a one dimensional model.	The capacity of the gate does not indicate the actual flow that passes the gate for a given event; it merely indicates how much flow the gate is capable of passing. Also, see response to comment DR-2.

Comment Code	Comment	Comment Response
B-6	<u>Model Flow and Sediment Boundary Conditions</u> 2008-2011 Time Period • First two years had relatively low flows of approximately 300,000 cfs. The last two years had flows that reached or surpassed the scour threshold of 400,000 cfs. Tropical Storm Lee occurred in September 2011 with a peak discharge of approximately 700,000 cfs. (Pg. 15). o HECRAS Output Sediment 1st scenario indicated no scour from the upper two reservoirs and inflow of sediment into Conowingo of 22 million tons. o HECRAS Output Sediment 2nd Scenario indicated approximately 1.8 million tons of scour from the upper two reservoirs with inflow of sediment estimated at 24 million tons. **Comment B-6:** According to the DLSRWA Tropical Storm Lee had a peak discharge of 776,000 cfs. (Page 66). The approximation marginalizes this storm by lowering the peak discharge to 700,000 cfs. Keep in mind that models aren't even running the flow rate at 700,000 cfs., but rather the 620,000 cfs. (Page 22).	For clarification, the text in the main report on page 66 (October 2014 version; now page 68) has been changed to include the daily peak flow value of 709,000 cfs for Tropical Storm Lee, along with the instantaneous peak value of 778,000 cfs. The text on page 15 of Appendix B refers to the daily peak flow value of 709,000 cfs which is approximately 700,000 cfs.
B-7	• The scour load from the upper two reservoirs is needed because the maximum load may influence transport capacity in Conowingo and thus impact bed scour potential. Therefore, the 24 million ton HECRAS load was increased by 10 percent to reflect a potential maximum scour load from the upper reservoirs." (Pg. 17). **Comment B-7:** What is the model or science behind this 10% increase?	See response to comment A-7.
B-8	• "Figures 6 and 7 show loads increasing exponentially after the 400,000 cfs. Scour threshold…" (Pg. 17). **Comment B-8:** Figure 6 shows that the AdH model is only considering a 600,000 cfs. flow rate and not a 700,000 cfs. that was initially discussed. (Pg. 17). Keeping in mind that as this is increasing exponentially these lower marginalized numbers significantly lower the scoured sediment amounts. How did these number associated with Tropical Storm Lee get to 600,000 cfs.? Again the actual numbers regarding Tropical Storm Lee (*i.e.* , the USGS number for Tropical Storm Lee is 709,000 cfs. (*see* Pg. 2 of Hirsch 2012 Report)) are being marginalized.	Figure 6 describes the data used to create the sediment rating curve. The sediment sample was taken at roughly 600,000 cfs (the sample was taken on September 8, 2011 at an instantaneous flow of 617,000 cfs), but this was not the largest value of discharge modeled. Figure 5 indicates that the peak flow of 709,000 cfs was indeed modeled. The sediment rating curve is an exponential equation fitted to the data in Figure 6, so the load associated with 709,000 cfs (that was indeed applied in the model) is much greater than the load seen for 600,000 cfs.

Comment Code	Comment	Comment Response
B-9	<u>Model Validation</u> • SEDflume analysis of bed sediments. The AdH sediment model requires bed sediment properties for each layer in the bed. Eight bed core samples were taken from Conowingo. "The bed was sampled to a maximum depth of only one foot because the resistance of the more consolidated sediments at deeper depths." (Pg. 18). **Comment B-9:** Figure 12 states 630,000 cfs. as the mean daily flow for Tropical Storm Lee. These numbers are being downplayed. The USGS number for Tropical Storm Lee is 709,000 cfs. (*See* Hirsch 2012 Report, Pg. 2). (Pg. 25). When simulated in the so-called Hydrodynamic Model" Tropical Storm Lee's flow velocity near the peak event was now 600,000 cfs. (Pg. 54). This data was used to address the sediment releases on the Susquehanna Flats SAV. One foot core sample limit makes no sense when other reports included much deeper samples.	For Tropical Storm Lee, the peak mean daily discharge at the Marietta, PA gage was 629,000 cfs, while at Conowingo the peak daily discharge was 709,000. Both numbers are correct; in the assessment analyses, the Marietta flow is for the starting (inflow) and the Conowingo flow represents the ending (outflow) point. Flow values in Section 4.2 have been revised and the accompanying text clarified to show that the noted values are for peak daily values at the Conowingo gage. A very specific coring method is used for SEDFLUME analyses, to ensure that the sample is undisturbed and retains as closely as possible the in situ erosional characteristics. This method requires that the depth of penetration obtainable by the gravity coring method (self weight core penetration) is the limit of sampling that one can employ.
B-10	• "A relatively small number of bed samples were taken from Conowingo Reservoir. Eight samples were used to represent the entire domain. Analysis of these samples revealed how the sediment size distribution coarsened with distance from the dam, and the subsequent variation of the critical shear stress and erosion rate. With such a small data set it was necessary to conduct a parametric model study in which variables were varied or adjusted to reflect the potential variation in bed properties." **Comment B-10:** The meeting notes reveal that the core sample number was originally set at 16 instead of 8 and was reduced only due to cost concerns. (Pg. 28). Keep in mind that the HECRAS model was one dimensional and that the AdH model was used for a two dimensional approach to address lateral sediment transport conditions. Two dimensional model results are depth averaged throughout the domain area (which was stated earlier on Pg. 12) and are inadequate during well-mixed turbulent conditions. Not only is this model inadequate in predicting scour in high flow rate conditions but the data needed for the depth averaged in the domain area relied on only 8 samples of 1 foot depth. Due to the inadequate amount of samples, data had to be obtained from another model and assumptions had to be made. Given the foregoing what are the margins of error? This is a very serious concern given the limitations of both one dimensional and two dimensional models when considering sediment transport during turbulent conditions. (Pg. 12). The explanations associated with data and models have not shown model validation but rather the reverse.	The commenter's reference to 16 core samples being reduced by cost could not be found in the meeting notes. There is a mention of 16 samples of sand/silt/clay samples (and 391 samples of sand/fines), but that refers to a different data collection effort. See also response to comment DR-2. The AdH model is depth-averaged, but includes several quasi-3D parameterizations of sediment concentration variability in the vertical, which are appropriate for quasi-steady flow conditions. The turbulence question raised by the comment is presumably associated with the inability to model resuspension due to turbulence at the dam, but the general agreement between the modeled and observed grain fractions downstream of the reservoir (Figures 14 and 15, Appendix B) and the scour load (Figure 16) indicate that the model is transporting sediment through the reservoir in a manner similar to what has been observed.

Comment Code	Comment	Comment Response
B-11	<u>Model Simulations – Impact of Temporal Change in Sediment Storage Capacity</u> • The scour load during Tropical Storm Lee comprised of 20% of Tropical Storm Lee's total load (*i.e.* , about 3 million tons of the 14.5 million tons). (Pg. 45). The reservoir will have more capacity as a result of this scouring. The large periodic storms like Tropical Storm Lee will continue to transport large quantities of sediment to the Bay which are much higher than the reduced scour loads resulting from sediment removal operations. (Pg. 45). **Comment B-11:** The August 2012 USGS Hirsch Report determined sediment loads of 4 million tons from scour and 19 million tons of suspended solids. Why is this data different and why are these numbers being marginalized?	In late September 2011, the USGS said 3.5 million tons was scoured, based on a regression equation. The error bars were 2.5 to 4.1 million tons. The estimate of about 3 million tons of scour from the total sediment load of 14.5 million tons during Tropical Storm Lee (AdH results from this report) is comparable to what Bob Hirsch estimated (WRTDS method) in his 2012 report (4 million tons of scour from the total sediment load of 19 million tons) when you consider the differences in the period of record being analyzed in this study compared to the Hirsch study and the fact that there are no confidence intervals in the WRTDS results. In 2015, the USGS should be able to provide confidence intervals on WRTDS results.
B-12	<u>Simulation of Sediment Management Alternatives</u> • "Impact of Sediment Removal - assumed the removal of 2.4 million tons of sediments above the dam. Total outflow load to bay was reduced by about 1.4% from 22.3 to 22 million tons, scour load decreased by 10 % (from 3.0 to 2.7) and the net reservoir sedimentation increased by about 5.0% (4.1 to 4.3 million tons). For this simulation, the Clean Chesapeake Coalition scour load decreased approx. 3.3 percent for every million cubic yards removed." (Pg.47). • "Although changing the dredging area location will likely influence model results, removing such a relatively small quantity of sediment will have a minimal impact on total load delivered to the Bay when large flood events occur." (Pg. 47). **Comment B-12:** Simulation was run on inadequate data. *See* discussion, *infra* , in Section 6.	The LSRWA team disagrees that the data or models were inadequate. However, models do have uncertainties and limitations. Chapter 4 of Appendix B-1 describes modeling uncertainties for the AdH model.
B-13	<u>Conclusions</u> • "A number of conclusions can be drawn from the modelling study. Although the uncertainty of the modelling is high due to the uncertainty of sediment boundary conditions and model limitations, the existing versus alternate approach to simulations reveals change in sediment transport based on the alternate condition scenario." (Pg. 57). **Comment B-13:** What is the meaning of this statement? That modelling uncertainty is high?	It means that, although the uncertainty is high, the reliance on model-to-model-comparisons (rather than absolute predictions) cancels some of the effects of these uncertainties, and allows us to draw conclusions about how the system will respond to certain changes (such as the continued infilling of the reservoir).
B-14	• The AdH sediment transport model results only estimated the transport and fate of sediments that enter the reservoir and scour from the bed. The model does not predict nutrient transport and does not imply any predictive relationship between nutrients and sediment transport. (Pg. 59). **Comment B-14:** Nutrient transport is model limited and there is no relationship between nutrients and sediments.	The referenced text on pg. 59 correctly characterizes the model results.

Comment Code	Comment	Comment Response
B-15	<u>Recommendations to Improve Future Modelling Efforts</u> • The AdH model was not capable of passing sediment through the gates, therefore, for the study the dam was modeled as an open boundary with downstream control represented by water surface elevation. (Pg. 60). This limitation impacted how sediment was spatially distributed in the lower reach of the Conowingo Reservoir near the dam. **Comment B-15:** In this statement the DLSRWA admits its severe limitations. The model's limitations impacted how sediments were spatially distributed in the lower reach of the Conowingo Reservoir near the dam.	Comment noted.
B-16	• Sediment transport models in general do not have a sophisticated approach to simulate fine sediment flocculation. The AdH model has the capability to relate flocculation to concentration, but not to other variables such as shear stress which determine flock particle size and overall fate. The ability to predict flocculation dynamics is critical to track the fate of sediment in a reservoir system. (Pg. 60). **Comment B-16:** This is an admission by the DLSRWA regarding the inadequate modeling scheme utilized.	The LSRWA team disagrees that the data or models were inadequate. However, models do have uncertainties and limitations. Chapter 4 of Appendix B-1 describes modeling uncertainties for the AdH model.
B-17	• Field data collection needs to continue both upstream and downstream of the Conowingo Dam to provide more information on reservoir balance. Currently, the suspended sediment samples are collected from one location near the power plant. (Pg. 60). **Comment B-17:** This is an admission by the DLSRWA regarding the inadequate data.	The referenced statement provides a recommendation on how to improve future modeling efforts.

Comment Code	Comment	Comment Response
B-17 (2)	<u>Attachment B1 – Evaluation of Uncertainties in Conowingo Reservoir Sediment Transport Modelling, October 2012, Baltimore District Corps of Engineers, Stephen Scott</u> The Impact of Conowingo Dam on Hydraulics and Sediment Transport: • "The Presence of the dam creates a backwater effect, reducing the energy slope, thus reducing velocities and encouraging sedimentation. In the area adjacent to Conowingo Dam, circulation of water and sediment is directly impacted by both the Dam face and how water is discharged through the Dam. • "There are 52 flood gates with a crest elevation of 89.2 feet NGVD 29. For flows exceeding 86,000 cfs., both the power plant and flood gates pass flow up to 400,000 cfs. At higher flows the power plant is shut down with all flow passing through the gates." Significance of Low Flow Sediment Transport: • "Wind and wave action may impact how sediment moves through reservoir system." • Suspended sediment transport is an inherently three dimensional process. Correction factor was used in the two dimensional model (AdH model) to account for three dimensional stratification by simulating three dimensional suspended sediment transport. **Comment B-17:** How was this correction factor obtained? Does the correction factor also address the open boundaries once the dam was removed in the model run?	The correction factor is based on an equation developed from analytic and semi-analytic principles. It is a non-equilibrium form of the Rouse equation , which is a very well-established approximation of the vertical sediment profile. The reference for this equation is given here http://dx.doi.org/10.1061/(ASCE)0733-9429(2008)134:7(1010)

Comment Code	Comment	Comment Response
C-1	• "Application of the Chesapeake Bay environmental Model Package to examine the Impacts of Sediment Scour in Conowingo Reservoir on Water Quality in Chesapeake Bay," Report of the US Army Corps of Engineers. • This report examines the impact of reservoir filling on water quality in the Chesapeake Bay with emphasis placed on chlorophyll, water clarity and DO. • Models: numerous, predictive environmental models and transfer of information between the models. (Pg. 2). • CBEMP consist of three independent modes: (1) Watershed Model (WSM 5.3.2); (2) Hydrodynamic model; and (3) WQM- Water Quality or Eutrophication Model. • Analytical Model: Steady state – Reservoir volumetric inflow must equal volumetric outflow and sediment sources must equal sediment sink. Bottom shear stress is the product of shear velocity and fluid density. (Pg. 9). • Results from Analytical Model: When volumetric flow is below the erosion threshold the solids concentration in the reservoir is independent of depth. (Pg. 10). As reservoir depth decreases the flow required to initiate erosion diminishes. (*Id*). When the erosion threshold is exceeded, the sediment concentration in the outflow is inversely proportional to depth. (Pg. 11). One significant insight is that the reservoir is never completely filled. Solids accumulate continuously until an erosion event occurs. As the reservoir fills, however, the flow threshold to initiate an erosion event diminishes. Erosion events become more frequent and severe. Equilibrium implies a balance between suspended solids inflows and outflows over a time period defined by erosion events. The conventional threshold for erosion of ≈ 11,000 m3 s-1 has a recurrence interval of five years (Langland, 2013) implying the equilibrium exists over roughly that period. If we believe the threshold for erosion is below 11,000 m3 s-1, when volumetric flow is below the threshold, the solids concentration in the reservoir is independent of depth. (Pg. 10). As reservoir depth decreases, the flow required to initiate erosion diminishes **Comment C-1:** The use of existing models and practices that the LSRWA points out as being advantageous to the DLSRWA since these tools could not be developed within the time and budget limitations of the LSRWA. The individual models within Chesapeake Bay Environmental Model Package (Watershed Model, Hydrodynamic Model, and Water Quality Model) are documented, reviewed and used. CBEMP relies on the flawed TMDL model.	The Chesapeake Bay TMDL relied on the application of WQSTM, not the other way around as suggested by the commenter.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
C-2	• "The resources necessary to acquire raw observations, create model input decks, execute and validate the individual models within the CBEMP for the years 2008 - 2011 was beyond the scope of the LSRWA." (Pg. 17). • Data limitations: "…[M]eans were required to transfer information from the 2008 – 2011 AdH application to the 1991 - 2000 CBEMP." (Pg. 17). **Comment C-2:** What kinds of means were required?	A method was required to compute sediment scour for the January 1996 event, represented in the CBEMP, from two 2011 events represented in AdH. The method is described on page 24 of Appendix C. "A procedure to apply ADH calculations to the 1996 storm was developed based on the volumetric flow in excess of the threshold for scour, ≈ 11,000 m^3 s-1. The year 2011 contained two erosion events, an un-named event in March and Tropical Storm Lee, in late August. The excess volume for each event was computed by integrating flow over time for the period during which flow exceeded 11,000 m^3 s-1. The amount of solids eroded during each event was taken as the difference between computed loads entering and leaving Conowingo Reservoir. Solids loads leaving the reservoir in excess of loads entering were taken as evidence of net erosion from the bottom. Net erosion for January 1996 was calculated by linear interpolation of the two 2011 events, using excess volume as the basis for the interpolation."
C-3	• "The crucial transfer involved combining scour computed by AdH for Tropical Storm Lee with watershed loads computed by the WSM model for a January 1996 flood and scour event represented by the CBEMP. (Pg. 17). "The WSM provides computations of volumetric flow and associated sediment and nutrient loads throughout the watershed and at the entry points to Chesapeake Bay. Flow computations are based on precipitation, evapotranspiration, snow melt, and other processes. Loads are the result of land use, management practices, point-source wasteloads, and additional factors. The loads computed for 1991 - 2000 are no longer current and are not the loads utilized in the TMDL computation. To emphasize current conditions, a synthetic set of loads was created from the WSM based on 1991 - 2000 flows but 2010 land use and management practices. The set of loads is designated the "2010 Progress Run." The TMDL loads are a second set of synthetic loads created with the WSM. In this case, the 1991 - 2000 flows are paired with land uses and management practices sufficient to meet the TMDL limitations." (Page 17). **Comment C-3:** Limited observations of sediment associated nutrients are available at the Conowingo outfall during the 1996 flood event.	Concur.
C-4	• Major storm events occur at different times of the year. In order to examine the effect of seasonality of storm loads on Chesapeake Bay, the January 1996 storm was moved, within the model framework, to June and to October. The loads were moved directly from January to the other months. No adjustment was made for the potential effects of seasonal alterations in land uses. New Chesapeake Bay hydrodynamic model runs were completed based on the revised flows, to account for alterations in flow regime and stratification within the Bay. (Pg. 18). **Comment C-4:** Limitations on the impact on growing cycles. Table 3-1 needs to reference the flow rate used in model runs. (Pgs. 20-21) What were the flow rates?	The commenter requests the flow rates for the January 1996 storm and suggests they should be included in Table 3-1. The peak flow rates for the storm are given in the two paragraphs which immediately follow the paragraph cited by the commenter. On page 18, the report states "The January 1996 event included the second highest daily flow observed at Conowingo since the inception of the modern management era in 1985, 17,600 m3 s-1" and "Peak instantaneous flow was 25,000 m3 s-1." The daily flows observed at Conowingo for January 1996 are presented in Figure 3-2. Watershed Model flows for the interval are summarized in Table 4-1. In view of the material already in the report, no revision of Table 3-1 is necessary.

Comment Code	Comment	Comment Response
C-5	• Loads from the watershed are calculated by the CBP WSM for two configurations: existing conditions (2010 Progress Run) and total maximum daily load (TMDL). (Pg. 21). • Nutrient loads associated with bottom erosion were calculated by assigning a fractional nitrogen and phosphorus composition to the eroded solids. The initial fractions assigned, 0.3% nitrogen and 0.1% phosphorus, were based on analyses of sediment cores removed from the reservoir (Cerco, 2012). (Pgs. 24-25). **Comment C-5:** Sediment core samples from the reservoir were limited to 8 samples at less than 1 foot deep.	Concur.
C-6	• Dilemma discussed in Appendix C (Pg. 25): Employment of the 1996 nutrient composition to characterize the nutrients associated with sediment eroded in 1996 results in reasonable agreement between observed and computed nutrients at the Conowingo outfall (Figures 4-5, 4-6) but presents a dilemma. Which nutrient fractions should be used in subsequent scenario analysis? The 1996 composition, which accompanied the 1996 event and was observed during the 1991 - 2000 scenario period? Or the 2011 composition which is more recent and characterizes a typical tropical storm event? In view of the dilemma, several key scenarios have been run with alternate composition, presenting a range of potential outcomes. • The ADH model was run for several bathymetry sets including: existing (2008) bathymetry; equilibrium bathymetry; bathymetry following 1996 storm; and bathymetry resulting from dredging 2.3 x 106 m3 (3 million cubic yards). • In all cases, the procedure for determining the scour load followed the same steps: Solids loads into and out of Conowingo Reservoir using the hydrologic record for the period 2008 to 2011were provided by the ADH model; Solids scour for two events in 2011 was determined by the excess of outflowing solids loads over inflowing solids loads; Scour for the 1996 hydrologic record was estimated by interpolation based on excess volume; Nutrient composition was assigned to the scoured solids based on 2011 observations; and For key scenarios, an alternate set of nutrient loads was constructed based on 1996 observed nutrient fractions. **Comment C-6:** Mixing 1996 data for the ADH model that used the hydrogeological record for 2008 - 2011. When reviewing the tables in report please keep in mind that 1 cubic meter per second = 35.3146667 cfs. Table 4-3 (Pg. 29) sets the highest flow rate at 17,479 cubic meters per second multiplied by 35.3 result in 617,009 cubic feet per second, which is well below Tropical Storm Lee's flow rate. Table 4.4 (Pg. 30) is not much better at 621,986 cubic feet per second.	The Big Melt event's peak daily flow value for the Conowingo gage was 622,000 cfs while Tropical Storm Lee's peak daily Conowingo flow value was 709,000 cfs, according to the published USGS gage data (USGS water data site, http://waterdata.usgs.gov). Table 4-3 is titled "Particle Composition Observed at Conowingo Outfall 2010 to 2011." On September 8, 2011, the flow rate at <u>the time</u> of sample collection was 17,749 m3 s-1, according to data provided by USGS. This value does not correspond to the peak daily flow value for the event (709,000 cfs) which occurred a day later on September 9, 2011. Table 4-4 is titled "Observed and Derived Concentration at Conowingo Outfall, January 1996." On January 21, 1996, the reported flow rate was 17,620 m3 s-1 (621,986 ft3 s-1). This value matches the recorded peak daily flow value of 622,000 cfs for the January 1996 event.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
D-1	• The Susquehanna River delivers about 41 percent of the nitrogen loads, 25 percent of the phosphorus loads, and 27 Percent of the suspended solids on an annual basis (CBOP 1991 - 2000 simulation period). **Comment D-1:** The simulation period is flawed. Why was that simulation period, which doesn't take into account episodic event, such as Tropical Storm Lee, considered? As for the Phase 5.3.2 Watershed Model this relies on 2010 TMDLs. Doesn't the 5.3.2 model also have a problem with nutrient load estimations?	Tropical Storm Lee of 2011 was outside the simulation period of the CBP models which run from 1985 to 2005. Updates to the CBP models for use in the Conowingo decisions for 2017 TMDL midpoint assessment will expand the CBP model simulation period from 1985 to 2013 and will include the simulation of Tropical Storm Lee.
D-2	• The mid-point assessment of the Chesapeake TMDL is planned for 2017 to account for Conowingo Dam infill and to offset any additional sediment and associated nutrient loads to the Bay. (Pg. 3). **Comment D-2:** Although the TMDL model is admittedly flawed for nutrient and sediment load, why is it still being used by the LSRWA team to estimate influence of the Conowingo reservoir infill on the Bay's water quality? Modelling for the Chesapeake Bay TMDL consisted of an assessment of the entire hydrologic period of 1991 - 2000, which only takes into account one high flow rate of the big ice melt in 1996. Why isn't flow rate ever discussed in terms of magnitude and velocity in the model? (Pg. 8).	The CBP TMDL models have been thoroughly reviewed and vetted; these models are fully capable of estimating sediment and nutrient loads. Measurements of flow are thoroughly discussed and documented in the report.
E-1	• May, 2, 2012 – Maryland Geological Survey (MGS) conducted 16 sediment grab samples (surficial grab samples) taken in the Susquehanna Flats area of the upper Chesapeake (Figure 1). (Pg. 2). • Sample locations were determined through consultation with USACE based on existing sediment sample data available. (Pg. 2) Two samples sites located in the Susquehanna were not sampled because of concerns regarding bedrock. • Sediment grab samples were analyzed for water content, bulk density and grain size. Two homogenous splits of each sample were processed with one for bulk property analyses and the other for gain-size characterization. (Pg. 4). **Comment E-1:** How deep or what was the depth of these samples?	Depths of samples are annotated in the fourth column of Table 3, page 8 of Appendix E.
E-2	• Shephard's (1954) classification of sediment types presented in Figure 2. (Pg. 7). **Comment E-2:** What is "1954 classification data"? Haven't the characteristics of sediments changed in the last 60 years?	The system used to classify sediment characteristics has not changed. Certainly, sediments change, but the structure to classify them remains consistent making for valid, comparable datasets over the last half a century. The defining document for sediment classification was written in 1954 by Shepard. The reference to that document is in the reference section of Appendix E.
E-3	• Table 3 – Results shows the field data of grain size based on the grab samples. **Comment E-3:** The table emphasized the fact that samples were too shallow or very difficult to get. How were these limitations addressed?	Sample sites #1 and #2 were eliminated because they were rock. There were no sediments present. The lack of sediment is data. The suggested location for Site #6 was in extremely shallow water (< 0.5 feet) and not navigable waters. Site #6 was collected as close as possible in what would be a sedimentary area in 0.5 feet of water depth (400 meters from office-chosen location). The collected coordinates for site #6 are documented. Site #12 was moved due to an emerged point bar at the office-chosen location. Site #12 was collected as close as possible to the intended location (approximately 700 meters east of office-chosen location).

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
F-1	• Need for updated chemical and physical measurements of suspended sediment flowing through Conowingo Dam. • During four storm flow events in water year 2010 (October 1, 2010 - September 30, 2011) large volume samples were collected to support analysis of detailed suspended sediment with six fractions and physical and chemical measurements of sediments. **Comment F-1:** What model runs used the USGS data described above?	These are used in the suspended grain size and total load calibration efforts for the AdH model.
F-2	• Ten samples were taken during four high flow events during water year 2011. The U.S. Department of Interior (MD-DE-DC Water Science Center, Baltimore, MD). **Comment F-2:** At which high flow events were the ten samples taken during water year 2011?	Samples were collected for high-flow events on 10/3/2010, 12/3/2010, 3/8/2011, 3/12/2011, 4/18/2011, 4/30/2012 9/8/2011, 9/10/2011, and 9/12/2011. These samples were collected at streamflows ranging from 233,000 to 617,000 cubic feet per second.
F-3	• Table 4. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310) were determined by cold vapor atomic absorption spectrophotometry. **Comment F-3:** Were hazardous constituents such as PCBS also monitored in the ten samples? If not, why not?	No measurements of hazardous organic compounds were made on the suspended sediment samples. That sort of analysis was well outside of the scope and budget limits of the program.
G-1	• October 2011, Gomez and Sullivan Engineers conducted bathymetric surveys of the Conowingo Reservoir. These 2011 bathymetry survey data and methods were evaluated and approved by the USGS for the LSRWA's effort. Their efforts included: measured depth data combined with water surface elevation (WSE); the unit measured bottom depths several times per second, recorded averages. To account for the WSE difference, the WSE gradient between Conowingo Dam and Peach Bottom was used to determine the WSE throughout Conowingo Pond. (Pg. 3). **Comment G-1:** How are the influences by Holtwood and the Muddy Run operations accounted for in this analysis? How were depth measurement points calculated between the two measurement areas?	The bathymetric surveys that were performed by Gomez and Sullivan were solely of the Conowingo Reservoir area. Bathymetric surveys are simply a survey of the elevation of the reservoir bottom using depth data and water surface elevation. The Holtwood and Muddy Run facilities are upstream of Peach Bottom, and thus would not affect the analyses. The methodology for the bathymetric surveys is detailed on pages 2-4 of Appendix G.
G-2	• Sediment volume change for each cross section was calculated using the weighted and unweighted water volume methodologies. (Pg. 5). **Comment G-2:** This study relied on a comparison of 2008 and 2011 data to get some insight into the sediment transport process focusing in the Conowingo Pond.	For the LSRWA effort, the AdH model was utilized to estimate the system's sediment transport response to a wide range of flows for four different reservoir bathymetries (1996, 2008, 2011, and calculated "full," in which the system no longer has sediment storage available). The years 1996, 2008, and 2011 were selected for bathymetry input, because in these years, bathymetric surveys had been conducted and data were available.
G-3	**Comment G-3:** Although these samples were taken in a short period of time they cannot really provide what the sediment transport rate would be with one major episodic event.	As noted in previous responses, there are some limitations to data used in this analysis.
G-4	**Comment G-4:** Gomez and Sullivan stated that the 2011 cross-section data may serve as a reference point for future surveys. (Pg. 7). What additional surveys would be recommended by Gomez and Sullivan if these surveys were used as a reference point?	This question should be directed to Gomez and Sullivan.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
G-5	**Comment G-5:** According to Gomez and Sullivan's findings and conclusions, it appears that the zone of dynamic equilibrium has expanded farther downstream that in previous surveys, extending to about 3.7 miles upstream of the Conowingo Dam. (Pg. 8). Did any of the model runs account for this recent observation and conclusion? If not, how will this impact the model runs? Will scour amounts be adjusted to address this recent observation?	The model runs determined that, even if the reservoir fills (effectively) completely, the scour load does not change significantly. That is, the reservoir has approached dynamic equilibrium. Hence, this observation does not significantly alter the findings.
H-1	• A question that was not addressed in the DLSRWA is related to the various techniques for sediment management explored in the literature review of Appendix H. While different kinds of dredging are mentioned in the Appendix and in the body of the report, a technique known as hydro-suction dredging is mentioned several times in the Appendix but not mentioned explicitly in the DLSRWA. This technique would be especially useful for sediment bypassing because it makes use of the huge natural head difference between the reservoir and the river below the dam to maintain flow through a dredging pipe or bypass tunnel. (Pg. 35, Appendix 1-7). **Comment H-1:** Was this technique considered in figuring the relatively low cost of bypassing, or not? Would it make a difference?	This specific technique was not considered. However, this is a subset technique of sediment bypassing. Detailed cost analyses were not performed for the sediment bypassing because there are limited times of the year that are not critical to some species (fish, SAV, etc.). As such, it was considered an nonviable alternative. Similar ideas were also mentioned in the same appendix with the cost estimates.
H-2	• The literature review in Appendix H ignored nutrients." (Pg. 35, Appendix 1-7). • A literature search was conducted on managing watershed/reservoir sedimentation in Appendix H. Findings and lessons learned from the literature search were incorporated into refining sediment management strategies for this Assessment. Results of this literature search are presented in Appendix H. **Comment H-2:** How could findings and lessons learned from case studies in which there is no consistency in the data presented for each LSRWA? For example, many of these case studies have no data for cost/funding or amount of sediment removed.	The intent of the literature search was to investigate how other regions and countries had historically and recently approached watershed and reservoir sedimentation management, with an eye to potential use in the lower Susquehanna River watershed. The compilation of case studies was simply a presentation of the information from the documented efforts. It was not intended to be an exhaustive design and cost review.
H-3	**Comment H-3:** Please explain why the case studies in Appendix H actually include the Susquehanna River Dams (*see* Pg. 26, No. 19). Oddly, the information contained for the Susquehanna River Dams is based on 1990 data. Why wasn't this information updated? How is old information and data useful and or important for the DLSRWA? If the Susquehanna River Dam information is outdated, how can the Study group ensure that case studies in Appendix H contain current and accurate information? Is this just a data dump that includes dams and reservoirs or was most of this information used for the DLSRWA? If it was used for the DLSRWA, how was it used?	The intent of the literature search was to investigate how the Chesapeake region, other regions, and other countries had historically and recently approached watershed and reservoir sedimentation management, with an eye to potential use in the lower Susquehanna River watershed. The compilation of case studies was simply a presentation of the information from the documented efforts. Pertinent strategies were then further evaluated as discussed in Chapter 5.

Comment Code	Comment	Comment Response
H-4	• From the research found, especially overseas, warping technique was found to be often used where river water with high sediment loads is diverted onto agricultural land. The sediment deposition on the land enhances its agricultural value. (Pg. 52). **Comment H-4:** Doesn't the warping technique increase the potential for erosion and greater sediment and nutrient runoff?	The warping technique was determined to be nonviable for the lower Susquehanna River. A detailed evaluation of the warping technique is outside the scope of this assessment.
H-5	**Comment H-5:** Why does Appendix H include overseas sites located in China, Switzerland, Pakistan, etc.? Where is the value regarding such information?	The assessment team wanted to include as many examples as possible, including opportunities to learn from international projects.
H-6	• Minimizing Sediment Deposition includes a description of alternatives such as selectively diverting water. (Pg. 51). **Comment H-6:** When these potential alternatives were identified, was there consideration given to the multiple uses of the Susquehanna reservoirs? For example the Peach Bottom Nuclear Plant relies on reservoir water for cooling, which begs the question: do these alternatives impact the industrial use of the Susquehanna River?	The assessment team was very much aware of the multi-purpose nature of the lower Susquehanna reservoirs. The sediment management strategies that were investigated for concept-level plans and costs, as detailed in Chapter 5 of the main report, are not expected to impact the industrial uses of the water. Prior to implementation of any strategy, the impacts on the other users of the reservoirs would be considered during the NEPA process.
H-7	**Comment H-7:** One case study that was not listed in Appendix H is the Plainwell Impoundment located on the Kalamazoo River, Plainwell, Michigan. The dredged sediments associated with the Plainfield Impoundment contained levels of PCBs. Please keep in mind that recently EPA expressed this concern regarding the Conowingo sediments. This Plainwell Impoundment provided detailed cost data that could be very useful in the event that detectable levels of PCBs are present in the Conowingo sediments. Why was the Plainfield Impoundment overlooked? More information regarding the Plainfield Impoundment can be obtained from the following EPA Region V URL site: http://www.epaosc.org/site/site_profile.aspx?site_id=2815.	The assessment team was unaware of the Plainwell Impoundment action. A review of the noted website indicates that the Plainwell Impoundment action involved dredging/excavation operations and simple dam removal. Both of these actions were already considered in the evaluation of sediment management strategies. The Plainwell Impoundment (13 feet high, 123 acres) is much smaller than the Conowingo Reservoir (94 feet high, 8,625 acres), so the cost information is difficult to scale up to the Conowingo situation.

Comment Code	Comment	Comment Response
I-6-1	• The LSRWA revisited the goals that were developed for the study early on in the scoping process of the LSRWA in order to refine these goals. The purpose of the goals are to create bounds and focus for the team on what will be accomplished with the LSRWA and to communicate to stakeholders what the LSRWA will accomplish. Such goals included evaluating sediment management, and to determine the effects to the Chesapeake Bay from the sediment and nutrient storage located behind the dam. (Pg. 5). • Exelon, the owner and operator of the dam, must undertake a variety of studies as requested by state and federal resource agencies to get an understanding of impacts of the dam. Several of the requested studies deal with sediment transport and accumulation in the dam system which relates to LSWRA efforts. At this time, most of the relicensing studies dealing with sediment transport and accumulation undertaken by Exelon are simply a compilation of existing literature and data. Their study findings were that 400,000 cfs. (cubic feet per second) is not the threshold where sediments are scoured from behind the Conowingo Dam and that overall Tropical Storm Agnes did not scour sediments but ended up depositing more sediment behind Conowingo Dam. Mike said that this latter finding is not supported by USGS at this time. (Pg. 5). **Comment I-6-1:** Knowing that Exelon was responsible for studies dealing with sediment transport and accumulation behind the Dams as part of the license requirement, why did the LSRWA workgroup deicide to take on this task? Why would tax payer funds be used to perform these tasks when the burden was clearly on Exelon?	It is a matter of public record that the state agencies discussed the issues with the FERC re-licensing. Due to the issue being raised during the FERC re-licensing processs, there was an assertion made that more detailed sediment analyses may be helpful to the process. Because USACE has unique technical abilities and tools to conduct these analyses at this scale, the LSRWA was conducted. The Maryland agencies also suggested that FERC require Exelon to complete all aspects of the study, but subsequent FERC filings suggested that the LSRWA would be used in their EIS. Now that the regulatory burden has been put on the State of Maryland, additional information is needed before a Section 401 water quality certification can be approved. Exelon has agreed to fund the additional study, so no public funds are being used for this expanded effort. Since the study findings could influence Maryland's TMDL requirements and associated responsibilities, the state felt that it was critically important to take leadership on this effort. Furthermore, the study was a bigger picture analysis that included the dams above Conowingo, contributions from the lower Susquehanna River watershed, as well as an analysis of management actions to address sediments and associated nutrients.
I-6-2	• Mike Langland noted in the past, USGS utilized a one dimensional HEC-6 model to assess sediment deposition and transport in the entire reservoir system including sediments from the watersheds. Mike noted that there were shortcomings to this model. As part of his LSRWA efforts, Mike will construct and calibrate an updated one dimensional HEC-RAS model that will route inflowing sediment through the reservoirs, accounting for both sediment deposition and erosion in the upper reservoirs. The output of this model will provide boundary conditions for the two dimensional model simulations that Steve will be conducting as part of his scope in the Conowingo Reservoir. **Comment I-6-2:** STAC commented on limitations of the HEC-RAS and AdH models. These limitations were not made sufficiently clear in the DLSRWA. The HEC-RAS modelling effort was largely unsuccessful and the HEC-RAS simulation was largely abandoned as an integral part of the DLSRWA. (Pgs. 8-9, Appendix I-7). What were the limitations associated with the HECRAS model? Was USGS able to obtain a level of comfort with this model?	The limitations of the HEC-RAS model are presented in detail in Appendix A. By identifying the limitations, the USGS was able to gain a better understanding of where the model was misrepresenting the simulations. While USGS recognized that the model was not able to calibrate to the "total" mass of sediment transport, the model did perform well for particle size distribution and flow simulations. .

Comment Code	Comment	Comment Response
I-6-3	• Bruce Michael noted that there was minimal scouring during the spring 2011 high flow events. However, this was the worst year on record for hypoxia and second highest flow on record. (Pg. 8). **Comment I-6-3:** Please provide the data that Bruce Michael based his observation on in the spring of 2011.	There was a 2011 spring scour event as flows at Conowingo Dam were greater that 400,000 cfs. Although this was a significant flow event, it was less than the TS Lee event in September 2011 of over greater than 700,000 cfs. Sediment load data are available on a USGS website (http://cbrim.er.usgs.gov/). Mean monthly loads for the spring of 2011 indicate that sediment loads at Conowingo, MD exceeded those at Marietta, PA by an average of 22,000,000 lbs/day in March and by an average of 8,500,000 lbs/day in April. Some of the difference would be accounted for by the increase in watershed size between the two locations and some represents scour. It should be noted that sediment deposition occurred at the dams during eight months in 2011 and ranged from an average of 950,000 lbs/day in February to an average of 20,800,000 lbs/day in May. Although the first June and second July 2011 cruises indicated record bad dissolved oxygen volumes below 2 mg/L for 1985 through 2011, for the dissolved oxygen reporting season of June through September, the volume of dissolved oxygen below 2 mg/L was the fifth worst year on record. Dissolved oxygen data for the Bay are available on the EPA's Chesapeake Bay Program web site (http://www.chesapeakebay.net/).
I-6-4	• Jeff noted that scouring occurred during Tropical Storm Lee from behind the Conowingo Dam. These sediments appeared to bypass the upper Bay and accumulated more in the middle Bay. The approach channels to the C&D Canal were scoured according to Philadelphia District and there did not appear to be significant burial of organisms since sediment was widely dispersed. (Pg. 8). **Comment I-6-4:** Please provide the data source for Jeff's comments.	See response for comment I-6-1.
I-6-5	• Discussion ensued about the status of federal funding for this study. The study received funding for FY12 by mid-February. [Update: $300,000 received in February 2012.] The FY13 budget will be coming out in a few weeks and then it will be determined if funding is available for next FY. [Update: This project is not in the president's FY13 budget.] (Pg. 3 – January 23, 2012 Meeting at MDE). **Comment I-6-5:** Again please explain why taxpayer money being used when the study should have been conducted by Exelon as part of the FERC relicensing application.	See response for comment I-6-1.
I-6-6	• Dave added that it is important as we finalize the watershed assessment that we make sure to refer back to the public outreach plan and follow what we have laid out to engage the public in the LSRWA. (Pg. 5). **Comment I-6-6:** Why weren't the public involvement procedures established by the Federal Advisory Committee Act (FACA) followed and adhered to? What is this public outreach plan that is discussed above? Please provide a copy of this plan.	Please see the response to comment CCC-L-5 regarding FACA. A copy of the public outreach plan may be found in Appendix I, Attachment I-1. Chapter 6 has since been updated to include more information on stakeholder involvement.

Comment Code	Comment	Comment Response
I-6-7	• Shawn Seaman will contact Michael Helfrich to notify him of quarterly meetings to see if he can attend. (Pg. 2). **Comment I-6-7:** Is this how the public outreach plan works? There seems to be exclusivity involving who can participate.	When specific individuals interested in the assessment were identified to the team, the LSRWA team did try to reach out to them individually. In addition, numerous state and federal agencies, local governments, non-governmental organizations, and business groups were included by providing regular updates of the assessment's progress. These groups were identified through prior communication and the team's knowledge of appropriate groups, or by request from the group. A project website was created to try to reach as many stakeholders as possible. Presentations/briefings were provided to interested groups, as requested. The process and study products have been made fully available to the public.
I-6-8	• Herb mentioned that he, Secretary Summers (MDE) and Paul Swartz (Executive Director, SRBC) met with the Maryland delegation from the Eastern Shore. He noted that feedback from these meetings was that there is a lot of interest in water quality in the Bay; farmers feel like they are being picked on (it will be important to engage agriculture groups in study); and the costs of the implementation of the TMDL and the proposed "flush tax" to cover the cost of implementation of TMDL. (Pg. 5 – 2/16/2012). **Comment I-6-8:** How were agriculture groups engaged in the DLSRWA? If not, why not?	The study team tried to engage as broad a group of stakeholders as possible. Emails were sent to all interested stakeholders and presentations were given whenever possible if requested (e.g., to soil conservation districts).
I-6-9	• The Conowingo Dam has been undergoing the 5-year FERC relicensing process. Out of this relicensing process Exelon (owner and operator of Conowingo Dam) was required to conduct several studies that relate to sediment accumulation and transport. Year 2 study reports are due by January 23, 2012. Several contractors of Exelon attended the quarterly meeting and provided results of these studies to the LSRWA team. Marjie from URS explained that the objective of the sediment transport and accumulation study they conducted was to provide data that will be useful in the future development of an overall sediment management strategy for the Susquehanna River and Chesapeake Bay. **Comment I-6-9:** Was Exelon's sediment transport and accumulation study relied upon or used in the overall sediment management study? Why didn't any workgroup member state that Exelon should be responsible for the LSRWA study given Exelon's contractor's (*i.e.* , URS) comment?	See response for comment I-6-1.
I-6-10	• Anna will send out an update via the large email distribution list that started with the original Sediment Task Force (includes academia, general public, federal, nongovernment organization (NGO), and state and counties representatives) notifying the group of LSRWA kick-off meeting and study start and will periodically update this group as the LSRWA progresses. (Action Items from November Meeting.) **Comment I-6-10:** Was this update distributed? Did this update include future dates for meetings for all to attend? If so, why didn't the Clean Chesapeake Coalition receive this notice?	Yes, the update was distributed. Following each quarterly meeting, the USACE study manager (Anna Compton) emailed the large email distribution list with notification about the meeting minutes. The minutes were posted on the project website for public access.

Comment Code	Comment	Comment Response
I-6-11	• Shawn will notify the team when the most recent Exelon study reports are released. Status – Recent report was sent out to the team; ongoing action. Shawn was not in attendance so Tom let the group know that the Exelon application for the Conowingo Dam license will be filed with FERC at the end of August [2012] and all required studies will be completed by the end of September with the exception of two fish studies. (Pg. 3 – 8/16/2012). **Comment I-6-11:** Did LSRWA workgroup members review Exelon's required studies? If so, were deficiencies identified and discussed with Exelon and or its consultants?	Yes, the LSRWA workgroup members were provided the report for review. Also, see response to comment I-6-1.
I-6-12	• The LSRWA identified their mission as: "To comprehensively forecast and evaluate sediment and associated nutrient loads into and from the system of hydroelectric dams located on the Lower Susquehanna River above the Chesapeake Bay and consider structural and non-structural strategies to manage these loads to protect water quality and aquatic life in the Chesapeake Bay." (Pg. 4 – 8/16/2012). **Comment I-6-12**: Did anyone on the LSRWA team question this mission, given that this was Exelon's obligation in the FERC relicensing application? How many scientists in the LSRWA were involved in this comprehensive study? Please provide their names and degrees. Did the LSRWA consist of any hydro engineers?	Yes, the team critically evaluated the study's mission relative to Exelon's obligations and decided that since the study findings could influence Maryland's TMDL requirements and associated responsibilities, it was critically important for Maryland to take leadership through the study agreement with USACE on this effort. Furthermore, the study was a bigger picture analysis that included the dams above Conowingo, contributions from the Lower Susquehanna River watershed, as well as an analysis of management actions to address sediments and associated nutrients, since Exelon's obligation was to study the Conowingo Pond only. The original intent of the LSRWA was to look at the issue from a regional perspective, including Lake Clarke and Lake Aldred, and to provide an unbiased report to support the public record. The primary members of the study team and their technical function are listed on page 185 of the main report. Additional modeling staff are listed within the modeling appendices.
I-6-13	• Matt Rowe will compare the results from the analysis of sediment cores taken from behind the Conowingo dam in 2006 to the decision framework criteria laid out in the 2007 IRC report to help the team better understand the suitability of the sediments in the lower Susquehanna river watershed for innovative reuse options. (Pg. 2 – 12/26/2012). **Comment I-6-13:** How does comparing 2006 data help in the decision making process? Doesn't Tropical Storm Lee in 2011 have a significant impact on this data?	This task of comparing the 2006 data was intended serve as an exploratory analysis. The objective of this effort was to compare the data compiled in the 2006 SRBC report to the 2007 IRC decision framework with the goal of evaluating innovative reuse options. The analysis showed that innovative reuse could not be ruled out as a possible sediment management strategy; therefore that option was discussed in the final report. To our knowledge, it is unknown if any high flow events, such as Tropical Storm Lee, have altered the chemical composition of the Conowingo reservoir sediment. However, any permitted use of the sediment would be subjected to other state and federal requirements and demand further environmental analysis, regardless of any additional sediment scoured or deposited in the reservoir.

Comment Code	Comment	Comment Response
I-6-14	• Currently the law firm Funk and Bolton is proposing and accepting money from counties for a study to be conducted by this law firm on the Bay TMDL. (Pg. 3 – 12/26/2012). Michael added that there has been concern raised by this coalition that MD has county WIPs while PA does not. Pat Buckley noted that PA has "WIP planning targets" in lieu of "County WIPs". **Comment I-6-14:** Is there a reason why the Clean Chesapeake Coalition wasn't invited to attend this meeting? How does the Clean Chesapeake Coalition's attendance interfere with the LSRWA's mission to comprehensively forecast and evaluate sediment and associated nutrient loads into and from the system of hydroelectric dams located on the Lower Susquehanna River above the Chesapeake Bay and consider structural and non-structural strategies to manage these loads to protect water quality and aquatic life in the Chesapeake Bay? How is Funk & Bolton even relevant to this study?	This comment references a quarterly team meeting held on November 19, 2012. Clearly, from the comment, the assessment team did not have advance knowledge of the coalition or their interests in order to extend an invitation to the meeting, as the coalition had just been formed. All quarterly team meetings were open to the public, and all meeting agendas, materials, and minutes were posted on the study website, and the coalition was added to the study mailing list as soon as its interest was known (see response to comment CCC-L-2). The study partners value all stakeholder input, including that of the coalition. That said, it is unlikely that the coalition's particular thoughts related to TMDLs (as referenced in the comment) would have influenced the direction of the study, given that TMDLs were, at best, indirectly related to the study's purpose. Had these inputs been raised at the meeting, the coalition would undoubtedly been referred to EPA and its state TMDL partners for a separate conversation on that topic.
I-6-15	• Carl noted that his previous efforts involved running modelling scenarios that removed Conowingo from the system to understand what it would look like with all sediments flowing into the bay and no longer being trapped by Conowingo. With this latest simulation, Carl looked at what the system would look like (*i.e.,* impacts on water quality) if there were a scouring event. More specifically, he took the system's current condition (Conowingo still trapping) with WIPs in place, using bathymetry from after the 1996 scour event. (Pg. 5 – 03/22/2013). **Comment I-6-15:** How is a scoring event measured if the dam is removed in the model runs? How is the circular flow hitting the dam and scoring sediments adjusted in such a model run?	This comment is based on minutes of a March 22, 2013, project meeting. Carl Cerco stated that the phase of his work involved with scenarios which removed Conowingo from the system was completed. He was moving into a new project phase involving simulation of scour events. The scour events were simulated with Conowingo Dam in place. No simulations of scour events with the dam removed were conducted.
I-6-16	• Lew Linker noted that the results may not represent effects on SAV; a period of reduced light could really impact SAV. Carl noted that for the final report these final outputs need to be remedied. (Pg. 8 – 06/07/2013) **Comment I-6-16:** Were these final outputs ever obtained? If so, please provide a copy of this study.	As described in Wang and Linker (2005), the duration of high light attenuation after extreme storms is an important influence on SAV biomass. The study described the extreme event (Hurricane Juan) caused a light attenuation to exceed 4 m^{-1} for a period of weeks after the storm. The estimated influence on SAV biomass from the extreme event in different seasons was fully documented in Wang and Linker (2005). Follow-up reports which will incorporate the current Conowingo research and monitoring program into the CBP modeling work will more fully document the period of extreme event high light attenuation and its influence on SAV. <u>Source</u>: Wang, P. and L. Linker, 2005. "Effect of Timing on Extreme Storms on Chesapeake Bay Submerged Aquatic Vegetation" in K.A. Selner (ed.), 2005. Hurricane Isabel in Perspective. Chesapeake Research Consortium, CRC Publication 05-160 Edgewater, MD.

Comment Code	Comment	Comment Response
I-6-17	• Michael Helfrich noted that Carl's modelling is using the 4th biggest event we have on record to show storm scouring (the 1996 winter storm event). What about the storms that have occurred on record that were larger than this event? Also the loads (nutrient and solids) shown in condition 6 (scour event in summer, fall, and winter) are less than loads in Conditions 3 - 5, which all included a simulation of the same storm event. Why is this? (Pg. 9 – 06/07/2013). **Comment I-6-17:** Please provide an answer to Michael Helfrich's statement	As noted in the meeting minutes following this statement, "Carl explained that Condition 6 used HSPF and CBP WSM model (which can take into account sediments from the watershed as well) while Conditions 3-5 used the ADH model, so results vary and should not be compared directly. Condition 6 sheds light on impact of the timing of event while Conditions 2-5 show impacts of a full reservoir, WIPs in place, and a storm event."
I-6-18	• "The group determined that data on nutrient (and sediment) in water outflows from Conowingo Pond was inadequate, and collecting data to fill gaps was scoped into the study. It was recognized that it would be useful to have additional information on Conowingo Pond bottom sediment biogeochemistry, particularly with regard to phosphorus. However, it was determined that existing information/data was adequate for study modelling purposes, and it was decided to not undertake such investigations in light of need to control study costs." (Pg. 3 – 09/24/2013). **Comment I-6-18:** How does the use of old data to fill in the gaps effect the LSRWA's mission to comprehensively forecast and evaluate sediment and associated nutrient loads into and from the system of hydroelectric dams located on the Lower Susquehanna River above the Chesapeake Bay and consider structural and non-structural strategies to manage these loads to protect water quality and aquatic life in the Chesapeake Bay?	Collection of new data is not always needed. Using existing data is an efficient, economical, and reasonable way to conduct studies. Virtually every scientific or engineering study employs "old" data to some extent. Data evaluation for a study involves reviewing available data, obtaining critical new data, and identifying data gaps. This study followed that process. Available data on pond outflows and bottom composition was assembled (e.g., Attachment C-1). Critical new data was obtained (e.g., cores for analysis in the SEDflume Attachment B-2). In the course of the study, gaps in our understanding were identified (e.g., reactivity and biological availability of scoured sediments, Appendix C, chapter 7). A field and laboratory study is underway and aimed, in part, at filling some of the data gaps identified during this study.
I-6-19	• With regard to (P) phosphorus biogeochemistry, Carl had identified Jordan and others (2008) as presenting a concept applicable to utilize for our situation. P is generally bound to iron in fine-grained sediments in oxygenated freshwater and of limited bioavailability. Under anoxic/hypoxic conditions iron is reduced and P can become more bioavailable. Prebinds to iron in sediments if oxygen is again present. P adsorbed to Conowingo Pond bottom sediments would remain bound to those sediments in the freshwater uppermost Bay. In saltwater, biogeochemical conditions change. Jordan and others (2008) indicate that as salinities increase above about 3-4 ppt/psu (parts per thousand/practical salinity units, P is increasingly released from sediments and becomes mobile and bioavailable to living resources, which is likely due to increased sulfate concentrations in marine water (*e.g.* , Caraco, N., J. Cole, and G. Likens, 1989. Evidence for Sulphate-controlled Phosphorus Release from Sediments of Aquatic Systems. (Pg. 3 – 09/24/2013). **Comment I-6-19:** More recent studies show phosphorus is released and no longer bound to sediments in the presence of higher salinity in water. Why weren't these more recent studies evaluated?	The comment repeats the statement recorded in the minutes. Both the minutes and the comment agree that phosphorus is likely more mobile in saltwater. The minutes cite Caraco et al. (1989), one of the fundamental references on this subject. The minutes also cite a more recent publication by Jordan et al. (2008). The modelers are aware of additional recent publications on this topic (e.g., Hartzell et al. (2010) Estuaries and Coasts 33:92-106; Hartzell and Jordan (2012) Biogeochemistry 107:489-500) and have considered them in their work. These and other publications are simply not cited in meeting minutes.

Comment Code	Comment	Comment Response
I-7-1	• The charge from STAC to the review team was: "You should focus your comments on the following [questions], but you are encouraged to provide additional comment that would improve the analyses, report or its recommendations." (Pg. 6). **Comment I-7-1:** How were the questions developed that the review team focused on?	For the STAC peer review of the LSRWA report, STAC requested that the LSRWA team provide questions to focus their review. The LSRWA team worked together to determine these questions so that they would provide the most useful information for the LSWRA efforts+C116.
I-7-2	• "The science associated with assessing the evolving condition of the Lower Susquehanna River and its effects on the Chesapeake Bay is exceptionally challenging. As far as the reviewers are aware the Conowingo situation is truly unique. A major reservoir that had been an effective trap for fine sediment and associated nutrients has largely transitioned to one that no longer has an ability to perform this long-term function." (Pg. 6). **Comment I-7-2:** If this were the case, how could the science associated with the LSRWA continuously flip flop back and forth on whether the reservoir still has trapping capacity or whether reservoirs are in dynamic equilibrium?	Comment noted. The assessment indicates that the reservoirs behind the Holtwood, Safe Harbor, and Conowingo Dams no longer have the long-term ability to store sediment and associated nutrients: a state of dynamic equilibrium now exists. As a result, large periodic storm events that occur on average every 4 to 5 years wash away sediment from behind the dams, increasing associated nutrient loads to the Bay. This creates a short-term increase in storage volume in the reservoirs for trapping sediment and nutrients.
I-7-3	• "The goals stated in the main report (which stress both sediment and nutrient management) are inconsistent with the methodological approach taken by LSRWA (which mainly emphasized sediment) and appear not to be the study's original goals. This review recommends that the original goals of the study (*i.e.* , sediment management to extend the life of Conowingo Dam more than nutrient management to protect Chesapeake Bay water quality) be presented in the introduction followed by a fuller explanation of how and why the focus of the study evolved in time." (Pg. 7). **Comment I-7-3:** If that is the case how adequately does the draft report stress both sediment and nutrient management?	See response to the referenced STAC comment provided in Appendix I-7, on p. 2 of the STAC comment responses.

Comment Code	Comment	Comment Response
I-7-4	• "It must also be stressed early and repeatedly that the dollar costs associated with alternative sediment management approaches specifically focus on the cost of reducing the amount of total sediment behind the dam, not on the cost of managing the impact of associated nutrients on the Chesapeake Bay. Further analysis would be required to appropriately rank the alternative strategies based on a more environmentally relevant total cost in terms of dollars per pound of nitrogen and/or phosphorus reduction." (Pg. 8). **Comment I-7-4:** Such an analysis is extremely important and lost in the DLSRWA. If conducted, will the relevant total cost in terms of dollars per pound of nitrogen and/or phosphorus reduction be compared to all the BMPs and activities discussed in the DLSRA?	See response to the referenced STAC comment provided in Appendix I-7, on p. 3 of the STAC comment responses. This assessment included a survey-level screening of management strategies to address the additional loads to Chesapeake Bay from the reservoirs' bed sediment scour. The costs presented were not calculated for strategies focused on nutrient removal/reduction. More analysis is warranted on nutrient-specific reductions and costs. This is included as a recommendation in the report. No further cost information will be added to the report.
I-7-5	• "Although the report lists and discusses sources of uncertainty, it expresses the expected confidence intervals on its model predictions less often. Although there is no single accepted procedure for reporting uncertainty in the context of scenario modelling, a part of the report should more explicitly explain why confidence intervals on predictions are generally not provided." (Pg. 8). **Comment I-7-5:** Why isn't there any reporting of uncertainty in the context of scenario modelling? Are the uncertainties that significant in terms of considering a margin of error analyses?	See response to the referenced STAC comment provided in Appendix I-7, on p. 4 of the STAC comment responses. A full discussion of the assessment's uncertainty was provided in the LSRWA documentation.

Comment Code	Comment	Comment Response
I-7-6	• "Key areas of concern which are expanded upon in response to Questions 3 and 4 include: (1) Stated sediment discharges from the Conowingo Dam are inconsistent with the literature. The report authors should either correct their numbers or present a clear explanation that reconciles why their estimates are significantly different from other estimates that are based on analysis of observed data. (2) Reduced deposition associated with reservoir infilling has been neglected. The fundamental issue motivating the LSRWA study is that the net trapping efficiency of Conowingo Reservoir has decreased dramatically over the past 15 to 20 years. Net trapping efficiency is the sum of increases in average annual scour and decreases in average annual deposition. However, the simulations and calculations in the study only considered the increase in scour. (3) Grain size effects within and exiting the reservoir were not sufficiently considered. The combination of two grain size effects – (i) changing grain size in time in the reservoir and (ii) the greater effects of fine sediment in transporting nutrients - mean that the effects of the reservoir on water quality have not reached a full dynamic equilibrium. However, the report did not address whether reservoirs were in dynamic equilibrium with respect to nutrients other than by assuming that if sediment was at equilibrium, then nutrients were also. (4) Limitations of the HEC-RAS and AdH models were not made sufficiently clear in the main report. The HEC-RAS modelling effort was largely unsuccessful, and the HEC-RAS simulation was largely abandoned as an integral part of the main report. Although consistent with four observed, integrated sediment-related properties of the system, the AdH model was not fully validated, and the AdH model was forced by boundary conditions outside the range of observed values. This means that the AdH model alone was not reliably predictive, and until the AdH model has been improved, observations should instead be emphasized to support the most important conclusions of the LSRWA study." (Pgs. 8-9). **Comment I-7-6:** These are serious concerns and misinformation, how will this comment be addressed in the DLSRWA? The inconsistencies in data that pertains to sediment discharge, low rates, trapping capacity, dynamic equilibrium, grain size has a significant impact on model runs. How will this be addressed? How can Models be analyzed and compared with such inconsistencies? The DLSRWA authors should correct the fact that the Conowingo Dam is no longer trapping.	See responses to the individual parts of the referenced STAC comment provided in Appendix I-7, starting on pg. 4 of the STAC comment responses.
I-7-7	**Comment I-7-7:** If the AdH model alone was not reliably predictive, and needs substantial improvement, how can observations instead be emphasized to support the important conclusions of the study that relied heavily on the AdH two dimensional model? Does this statement mean that observations trump scientific data? Or does the statement mean that scientific data is not required?	The observations support the trends observed in the AdH model. Further observations over time can be compared back to these results, to confirm or cast doubt on their veracity. It is not clear what is meant by observations trumping scientific data; observations are scientific data. If modeling is what is meant, then no, modeling does not trump data, but it can provide insight that can help to interpret data.

Comment Code	Comment	Comment Response
I-7-8	• "Many of recommendations for future work and modelling tool enhancement are very good and are consistent with the views of this review." (Pg. 9). **Comment I-7-8:** How could this statement be made given the statements above and the data inconsistencies and that the AdH model alone was not reliably predictive?	The Chesapeake Bay Program's Scientific and Technical Advisory Committee made the subject statement. As such, it is the opinion of that committee.
I-7-9	• "…[T]he HEC-RAS modelling effort was ultimately unsuccessful, and results of the HEC-RAS simulation did not form an integral part of the main report, and (ii) the existing application of the AdH model, although generally consistent with the validation data used, was not reliably predictive beyond constraints provided by a few integrated observations of sediment-related properties of the system." **Comment I-7-9:** How can STAC say that these models did not provide an integral part of the report? If these models were not integral, why were they discussed and used? Why were these models used to identify concerns and also used to discuss the financial value of sediment management strategies if they were ultimately unsuccessful?	The Chesapeake Bay Program's Scientific and Technical Advisory Committee made the subject statement. As such, it is the opinion of that committee. The assessment team considered the models to be an integral part of the watershed assessment, and important to the overall conclusions of the watershed assessment.
I-7-10	• The purpose of this assessment was to analyze the movement of sediment and associated nutrient loads within the lower Susquehanna watershed through the series of hydroelectric dams (Safe Harbor, Holtwood, and Conowingo) located on the lower Susquehanna River to the upper Chesapeake Bay. This included analyzing hydrodynamic and sedimentation processes and interactions within the lower Susquehanna River watershed, considering strategies for sediment management, and assessing cumulative impacts of future conditions and sediment management strategies on the upper Chesapeake Bay." A similar "purpose" statement appears in the Introduction. (Pgs. 5-6). Note that the word "nutrient" appears only once in the above statement, and the purpose of the study was mainly to address "sediment management". **Comment I-7-10:** How was that purpose conducted through the use of unsuccessful modelling?	While all models have limitations, the team has confidence in the estimates provided by each of the models as all the models have been used extensively in the past, including for TMDL development, and are vetted by the scientific community. Additionally, the models were calibrated with real observations.
I-7-11	• "The report only briefly states that during the course of the study it became clear that nutrients were more important than sediment. More background is needed in the introduction regarding how and why this judgment was made and how the course of the study then evolved." (Pgs. 11-12). **Comment I-7-11:** Once again the Report relies on assumptions. Is there any scientific background to this concern?	The Chesapeake Bay Program's Scientific and Technical Advisory Committee made the subject statement. As such, it is the opinion of that committee.

Comment Code	Comment	Comment Response
I-7-12	• "Although it is not specifically described as such in the draft report, the overall economic analysis in the LSRWA is in essence a cost-effectiveness analysis (CEA). In contrast to cost-benefit analysis in which the positive and negative impacts of alternatives are expressed and directly compared in monetary terms, CEA expresses some key impacts in non-monetary but still quantitative terms." (Pg. 14). **Comment I-7-12:** Will a cost-benefit analysis be performed on this DLSRWA in terms of BMPs and sediment management strategies?	This assessment included a survey-level screening of management strategies to address the additional loads to Chesapeake Bay from the reservoirs' bed sediment scour. No further cost-benefit analyses will be performed.
I-7-13	• "The report should also emphasize that further analysis would be required to appropriately rank the alternative strategies based on a more environmentally relevant total cost in terms of dollars per pound of nitrogen and/or phosphorus reduction." (Pg. 15). **Comment I-7-13:** The Clean Chesapeake Coalition agrees with this comment. Will the final DLSRWA include alternative strategies based on environmental relevance with total cost in terms of dollars per pound of nitrogen and phosphorus reduction?	The LSRWA team agrees that costs in the report focus on sediment management removal/reduction. Nutrient reduction specific strategies and associated costs warrant further analysis. The premise for sediment management strategy development was: "The focus was on managing and evaluating sediment loads with the understanding that there are nutrients associated with those sediment loads; thus, in managing sediments, one is also managing nutrients. However, it must be noted that the relatively low importance of sediment from the dam as a stressor to Chesapeake Bay water quality and aquatic life versus nutrients was not known until late in the study process. For that reason, management measures focused primarily or solely on nutrients were not considered in this assessment." Therefore, the costs of nitrogen and phosphorus reduction will not be included in the final report.
I-7-14	• "Although there is no single accepted procedure for reporting uncertainty in the context of scenario modelling, a part of the report should more explicitly explain why confidence intervals on predictions are generally not provided." (Pg. 16). • **"**In many of the modeled scenarios, the changes in attainment of water quality criteria with fairly large management actions would appear to a non-technical reader to be very small. For instance, p. 135 states: "…estimated…nonattainment…of 1 percent, 4 percent, 8, percent, 3 percent…" One should ask if such estimates are statistically significant. Similarly, in appendix A, p. 25, the net deposition model indicated that ~2.1 million tons net deposition in the reservoirs occurred in 2008-11. This is the difference of two order-of-magnitude larger numbers (22.3M tons entered the reservoir, 20.2M tons entered the Bay). There is a rule-of-thumb in sedimentology: ±10% in concentration or transport is 'within error'." (Pg. 16). **Comment I-7-14:** Does the precision of the computed difference fall within the margin of error in these metrics?	The problem of uncertainty in this context is incorrectly stated. The "rule-of-thumb in sedimentology [that a] ±10 percent in concentration or transport is within error" refers to the measurements of sediment in rivers. However, the LSRWA scenarios were done by difference with a base scenario in order to examine only the aspect of scour for the Conowingo and its influence on Chesapeake water quality. In this case the same uncertainty is in the scenarios with Conowingo scour and without Conowingo scour and essentially cancel out.

Comment Code	Comment	Comment Response
I-7-15	• On p. 113 the report states, "A close inspection of the model simulation results indicate that trace erosion does occur at lower flows (150,000 to 300,000 cfs.), which is a 1- to 2- year flow event. This finding is consistent with prior findings reported by Hirsch (2012)." The Hirsch (2012) findings are different from what is expressed here. The relevant statement from Hirsch (2012) is: "The discharge at which the increase [i.e., the increase in suspended sediment concentrations at the dam] occurs is impossible to identify with precision, though it lies in the range of about 175,000 to 300,000 cfs. Furthermore, the relative roles of the two processes that likely are occurring – decreased deposition and increased scour – cannot be determined from this analysis." **Comment I-7-15:** Does the DLSRWA and the model runs account for such a discrepancy? If so, how? If not, why not?	This discussion of trace erosion is specific to sediment particle size. The difference between the low end of 150,000 cfs and 175,000 cfs is minimal in light of what Bob Hirsch indicates "the discharge at which the increase in sediment concentrations is IMPOSSIPLE to identify with precision...".
I-7-16	• "Also on p. 190, the report indicates that, "The total sediment outflow load through the dam… increased by about 10 percent from 1996 to 2011…" These results are so strongly at odds with other published numbers on this subject that some explanation and discussion is certainly required. Hirsch (2012) reports an increase in flow-normalized flux over the period 1996-2011 of 97 percent (*see* Table 3 of Hirsch). Also, Langland and Hainly (1997) published an estimate of change in average flux from about 1997 to the time the reservoir is full of 250%. Reporting a 0% increase in light of these two other findings appears erroneous." **Comment I-7-16:** Why weren't Hirsch's and Langland's numbers used instead of 10%?	The last sentence in the last paragraph on page 154 has been revised to: "The total sediment outflow load through the dam, which consists of the Conowingo Reservoir bed sediment scour load, the bed sediment scour load of the upper two reservoirs, and the pass-through Susquehanna River watershed load, increased by about 10 percent from the 1996 bathymetry to the 2011 bathymetry for the 4-year simulation (2008-2011)". So for the same boundary conditions, there was a 10-percent increase im sediment outflow using the two different bathymetries. The modeled results were used because they were consistent with USGS observations of long-term reservoir trends, suspended sediment concentrations, and net reservoir storage determined from sequential bathymetric surveys.
I-7-17	• From STAC: "p. 138 Paragraph 2: Oysters are discussed here within a section that otherwise discussed the modelling and simulation activities. Is there a description of how model analysis was used in this report to determine flow and management effects on oysters? Whatever the case, it should be clearly stated where the oyster effects fit into this report and whether or not model simulations were used to understand effects on oysters." • LSRWA Response: No specific modelling simulations were run to quantify oyster impacts. However this resource is of high interest so this qualitative language was added. This paragraph was deleted from this section since the context here is specific LSRWA simulation results (*i.e.* , quantified results). Section 2.7.4 discusses oysters and impacts from storm events summarizing a DNR report on effects from Tropical Storm Lee. **Comment I-7-17:** Were model runs conducted by DNR to determine impact on oysters or was it based on observations? If based on observation were sediment levels that blanketed the oysters considered as an impact?	Model runs were not conducted by MDNR, but the University of Maryland Center for Environmental Science did conduct an analysis of the sediment distribution from TS Lee in the upper Chesapeake Bay. This report indicated that the majority of the sediment deposition was in the upper Bay, directly below the Susquehanna Flats. In general, less than 1.5 cm of sediment was deposited downstream of this area. The UMCES report can be found at Palinkas, C.M., et al., Sediment deposition from tropical storms in the upper Chesapeake Bay: Field observations and model simulations. Continental Shelf Research (2013), http://dx.doi.org/10.1016/j.csr.2013.09.012i. The MDNR assessment was based on observations of live fouling organisms, including barnacles, mussels, and bryozoans, that were found attached to the oysters and shells on oyster bars in the northern Bay. Had the oysters been smothered by sediment, these organisms would not have been able to attach to the oyster shells and would not have survived.

Comment Code	Comment	Comment Response
I-7-18	• "As described in Section 5.2, "the LSRWA team relied heavily on the Bay TMDL work done by CBP and state partners to develop the watershed management strategies. As such, the LSRWA team adopted the CBP methodology and unit costs as the representative alternative for a watershed management strategy; additional cost and design analyses were not undertaken." Citations are included where appropriate (e.g. U.S. Environmental Protection Agency (U.S. EPA). 2010), however, personal communication by LSRWA was required to ensure that LSRWA interpretations of CBP work on watershed BMPs/strategies were accurate." (Pg. 35). **Comment I-7-18:** Throughout the report, statements are made that the Bay TMDL work needs to be reevaluated given that the Conowingo Dam no longer has the trapping capacity that was once considered. Given that the DLSRWA adopted the outdated CBP methodology, how could the team ignore additional cost and design alternatives?	The most recent information and cost estimates available at the time of report development were used in the analyses, with an understanding that these were just estimates. All estimates and methodologies can be updated after completion of the Chesapeake Bay TMDL 2017 midpoint assessment, providing more accurate evaluation of the most cost-effective and efficient management alternatives.
I-7-19	• Attachment I-7 includes a letter from Exelon to the Army Corps of Engineers (dated July 18, 2014) thanking the Corps of Engineers for the opportunity to review and comment on the Draft LSRWA Study. (No Page number provided). **Comment I-7-19:** Please explain why Exelon received the DLSRWA several months earlier to perform an extensive review of the main report and appendices. Why weren't other commenters, such as the Clean Chesapeake Coalition given that opportunity? Are we to expect that Exelon will assist the LSRWA study group in addressing our comments?	The purpose of the public review was to allow all interested parties to submit comments. This comment period ran from November 13, 2014 to January 9, 2015. Exelon and their contractors did not assist the assessment team in addressing the public comments, nor did they influence the findings of the report. Exelon's bathymetric data (collected in 2011 by Gomez and Sullivan Engineers) represented the most current condition of sediment within the reservoir. These data were used in the modeling efforts for this study; therefore, Exelon was able to review the report during the team review.

Comment Code	Comment	Comment Response
J-2	*It is quite evident that the data and studies used in the Watershed Strategy Section are outdated and incorrect. Appendix J relies on the following incorrect statements: • "Sediment deposition to Chesapeake Bay from the Susquehanna River is mitigated by the presence of three consecutive hydroelectric dams (Safe Harbor Dam, Holtwood Dam, and Conowingo Dam). These three dams form a reservoir system in the lower part of the River that These three dams form a reservoir system in the lower part of the River that has been trapping sediment behind the dams since they were constructed in 1910 (Holtwood Dam), 1928 (Conowingo Dam) and 1931 (Safe Harbor Dam). The uppermost two dams, Safe Harbor Dam and Holtwood Dam, have already reached their capacity to store sediment and sediment-related nutrients. Conowingo Reservoir, which is formed by Conowingo Dam, the lowermost and largest dam, has not reached storage capacity and is still capable of trapping." (Pgs. 1-2). **Comment J-2:** Appendix J begins with incorrect information by expressing the remaining storage capacity of the Conowingo Dam. (Pg. 2). Given that this Appendix is used to develop a watershed strategy, a major concern and comment is how could this be accomplished if the current status of the Conowingo Dam is not properly delineated or understood?	The watershed study evaluated the cost of the E3 scenario (Everything, Everywhere, by Everyone), which is a theoretical highest BMP implementation scenario that would largely be impossible to implement. Regardless of the storage capacity of the dams, the conclusion of the watershed study remains that implementing the E3 scenario would not be cost-effective and would not provide an adequate return on investment over implementing the watershed implementation plans (WIPs) in reducing sediment from the watershed, because the additional sediment removed in the E3 scenario is small relative to the total load. The watershed strategy has nothing to do with the sediment-trapping capacity in the lower Susquehanna River reservoir system. It evaluated the cost of implementing a theoretical scenario to achieve the maximum possible reduction of sediment. Appendix J did not evaluate the cost of implementing the WIPs as a sediment control strategy. The latest information from USGS indicates that there remains 8 percent of sediment storage capacity at Conowingo Dam, that 30 percent of sediment comes from scour and 70 percent comes from the watershed. Appendix J has been updated to reflect the latest information on storage and the high contribution of sediment from the watershed relative to scour from the dams. Note that even though the system has reached dynamic equilibrium, there will be years when sediment is stored followed by events that result in scour that in effect allow for new periods of storage.
J-3	*The Appendix discusses further the importance of the TMDLs and the CBP 5.3.2 Watershed model run established in 2010. • The Chesapeake Bay Program developed the E3 scenario from a list of approved agriculture and urban/suburban BMPs using output from the Phase 5.3.2 Watershed Model, which is also used for tracking towards the TMDL. "The BMPs that are fully implemented in the E3 scenario were estimated to produce greater reductions than alternative practices that could be applied to the same land base (Jeff Sweeney, personal communication)." **Comment J-3:** Is personal communication is now the new standard in determining scientific merit? What science is Jeff Sweeney using to make such an evaluation of BMPs and to make such a statement?	As described in Section 5.3, "the LSRWA team relied on the Bay TMDL work done by CBP and state partners to develop the watershed management strategies. As such, the LSRWA team adopted the CBP methodology…" Journal and report citations are included where appropriate; however, personal communication by the LSRWA team was required to ensure that LSRWA interpretations of the Chesapeake Bay Program work were accurate. C110

Comment Code	Comment	Comment Response
J-4	• The Chesapeake Bay Program also developed unit costs for the approved BMPs. Most, though not all, of the BMPs used in the E3 scenario have associated unit costs in either acres or feet. The primary source of the unit costs was the Bay Program approved list; however, in order to have as complete a cost estimate as possible, in the absence of unit costs from the Bay Program, costs from the Maryland Department of the Environment (MDE) (Greg Busch, MDE, personal communication), and costs from the Maryland Department of Agriculture (MDA) (John Rhoderick, MDA, personal communication) were used. (Pg. 5). **Comment J-4:** Is there a cost benefit analysis associated with these expected costs on local governments? If so, is it based on science and data or someone's personal communication?	As described in Section 5.3, "the LSRWA team relied on the Bay TMDL work done by CBP and state partners to develop the watershed management strategies. As such, the LSRWA team adopted the CBP methodology and unit costs as the representative alternative for a watershed management strategy; additional cost and design analyses were not undertaken." Citations are included where appropriate; however, personal communication by LSRWA team was required to ensure that LSRWA interpretations of the Chesapeake Bay Program work were accurate. The purpose of Appendix J was to develop a range in costs to implement the E3 scenario and achieve the theoretical maximum amount of sediment reduction in the watershed. The LSRWA team is not aware of a cost-benefit analysis that evaluates the costs to local governments of implementing the WIPs relative to the benefits associated with having the Bay and its tributaries meet their designated uses.
J-5	• Agriculture unit costs ranged from $2 per acre to develop conservation management plans to $1,948 per acre for "loafing lot management" (stabilizing areas frequently and intensively used by animals, people, or equipment). **Comment J-5:** Where is the source of this data? Is it from the unit cost estimates from the Bay Program and other sources used to develop a range in the cost of achieving the theoretical maximum amount of sediment reduction to the Conowingo Reservoir (discussed on Pg. 6)? If so, where is this data and what are the other sources?	The unit costs came from a series of spreadsheets that were prepared by the Chesapeake Bay Program and had references on which the costs were based. Please contact the Chesapeake Bay Program directly for the unit costs and the references.
J-6	• "The maximum available load of sediment per year that could be reduced by additional BMP implementation above and beyond the WIPs throughout the Susquehanna River watershed is approximately 95,000 tons (equivalent to 190,000,000 lbs of sediment per year; or 117,284 cubic yards per year) 2,000 lbs is equivalent to approximately 1 ton; 190,000,000 lbs divided by 2,000 equals 95,000 tons per year; approximately 81 tons are in 1 cubic yard; or 1600 kilograms/cubic meter; 95,000 divided by .81 equals 117,284 cubic yards per year) at a cost of 1.5 to 3.6 Billion dollars. The amount of 95,000 tons is an order of magnitude less of what is estimated to flow over Conowingo Dam into Chesapeake Bay on an average annual basis, which is approximately, 1.8 million tons (1993-2012 hydrology)." (Pgs. 5-6). **Comment J-6:** This no longer seems to be the case given that the Conowingo Reservoir was considered a trap and not a source of sediments and nutrients in these calculations.	Please see the response to Comment J-2.
J-7	**Comment J-7:** Attachments 2 and 3 (Pgs. 11-12) of Appendix J state the following: "Cost estimates are provided for planning purposes only, and are based on generalized costs of implementation. Project specific design and cost estimates would be required prior to actual implementation of any of these alternatives." What are the generalized costs of implementation? How do these attachments provide anyone with a true understanding of costs if design and cost estimates are not considered in the total cost analyses?	Cost estimates were identified for a number of in-reservoir sediment management alternatives as documented in Attachment J-2. These costs evaluated both one-time investment costs and yearly operation and maintenance costs. The cost components included real estate, specialty services, design, booster pump construction, permanent pipeline construction, transfer site and dike construction, dredging and dewatering plant, and reuse manufacturing plant. In addition, the operation costs evaluated tipping fees, dredging and transportation costs, manufacturing processing costs, and construction design and management.

Comment Code	Comment	Comment Response
J-8	• "EPA uses unit costs for agricultural sediment or nutrient controls identified in the WIPs from USDA's Environmental Quality Incentive Program (EQIP), where available, and WIPs and prior studies where EQIP estimates are not available. In selecting relevant studies, EPA excludes those prior to 2000, and relies on EQIP and WIP estimates where feasible because these costs likely represent the most recent and best estimates of actual implementation costs." **Comment J-8:** The U.S. Department of Agriculture's Environmental Quality Incentive Program (EQIP) is currently an interim rule open for comment. In addition, Executive Order 12866 and 13563 "Improving Regulation and Regulatory Review," directs agencies to assess all costs and benefits of available regulatory alternatives and, if regulation is necessary, to select regulatory approaches that maximize net benefits (including potential economic, environmental, public health and safety effects, distributive impacts, and equity). Executive Order 13563 emphasizes the importance of quantifying both costs and benefits, of reducing costs, of harmonizing rules, and of promoting flexibility. The Clean Chesapeake Coalition would appreciate an assessment of all costs and benefits of available regulatory alternatives, in particular analyses of how the unit costs were derived for the DLSRWA.	The two noted executive orders (12866 and 13563) are directed at the promulgation of regulations and regulatory actions. The Lower Susquehanna River Watershed Assessment was a science-based planning effort, not a regulatory action or review. No regulation actions are proposed for adoption or consideration. As such, executive orders 12866 and 13563 are not applicable to the LSRWA effort. The E3 maximum watershed action scenario, which is included in the LSRWA report as a potential sediment management strategy, was developed from a list of approved agriculture, urban, and suburban best management practices using output from the Phase 5.3.2 Chesapeake Bay Watershed Model. The E3 scenario and the development of its cost is summarized in Attachment J-1 (Appendix J) of the LSRWA report, but full documentation can be found in Appendix J of *Chesapeake Bay Total Maximum Daily Load for Nitrogen Phosphorus and Sediment: Technical Appendices* , published in 2010 by EPA's Chesapeake Bay Program Office. Any questions regarding the impacts of the noted executive orders on the sediment or nutrient controls identified in the E3 scenario or the WIPs should be addressed to EPA.
J-9	**Comment J-9:** Throughout the Document it is stated that: "EPA annualizes capital costs over the specified life of the BMP." How does EPA annualize capital costs?	The Chesapeake Bay Program annualized capital costs by dividing the capital costs over the useful life of the BMP. Please see Attachment 4 of Appendix J for the years over which capital costs were annualized for any specific project alternative.
J-10	• Forest buffers are linear wooded areas along rivers, stream, and shorelines. The recommended buffer width for riparian forest buffers (agriculture) is 100 feet, with a 35-foot minimum width required. Upfront installation costs associated with forest buffers typically include site preparation, tree planting and replacement planting, tree shelters, initial grass buffer for immediate soil protection, mowing (during the first 3 years), and herbicide application (during the first three years). **Comment J-10:** Forrest Buffers are listed as a BMP. Has anyone evaluated Sapropel concerns from decaying leaves and their ability to seriously decrease deep water oxygen and increase Hydrogen sulfide deposits?	The oxygen demand of tannins is negligible in the Susquehanna River at Conowingo, and in any case the organic nitrogen and phosphorus are calibrated state variables in the Watershed and Water Quality and Sediment Transport models.

Comment Code	Comment	Comment Response
J-11	• Estimates pertaining to unit cost in association with frequent maintenance and pumping of septic systems is expected to reduce nitrogen loadings. (Pg. 29). **Comment J-11:** What is the origin of these estimates? Where is the financial cost data associated with these estimates?	The focus of the BMP assessment was sediments, not nutrients. The discussion regarding septic systems was included in Appendix J by mistake and has been deleted.
Appendix J-2 J-12	• The Costs associated with the Charts presented in Attachment J2 are "concept-level costs for planning purposes only. Detailed design and cost estimate would be required for any future studies investigation implementation of any of these alternatives. All alternatives assume the dredging of a location in Conowingo Reservoir which currently has the highest amounts of deposition in the entire lower Susquehanna reservoir system; similar costs could be developed for the other lower Susquehanna reservoirs." **Comment J-12:** Given the assumption above, will the design and cost estimates be the same if the purpose of the DLSRWA were to comprehensively forecast and evaluate sediment and associated nutrient loads into and from the system of hydroelectric dams located on the Lower Susquehanna River above the Chesapeake Bay and consider structural and non-structural strategies to manage these loads to protect water quality and aquatic life in the Chesapeake Bay? (Pg. 4 – 08/16/2012, Attachment I- 6).	The elements within the design and cost estimates provided in Attachment J-2 would be the same; however, placement sites, movement of material, amount of material, etc. would all change with location and what is available at the other dam locations, thereby, changing specific cost.
J-13	**Comment J-13:** Screening level estimates are included in charts that evaluate available capacity. Does the available capacity evaluation consider that the Conowingo Reservoir is still trapping? In addition, estimates are based on assumptions in the screening level cost estimates. How are the financial benefit analyses achieved with assumptions being made for estimates? Is there a margin of error available for these estimates? What is the source for the cost estimates related to temporary dewatering sediment?	The table in Attachment J-2 refers to available capacity of the disposal site, not Conowingo Reservoir. As such, the trapping status of Conowingo Reservoir does not come into play. The cost estimates are presented in the format of low and high values to show the range of costs that would be expected. Information for the temporary dewatering plant costs for the innovative reuse alternative was provided by Jeff Otto of Harbor Rock.
J-14	• This analysis is based on planning level sediment management concepts. To fully understand and evaluate effects of any of these concepts detailed designs would be required. Fatal Flaw-Determined by team that strategy should be dropped from consideration. **Comment J-14:** What is the basis for these management concepts? What scientific studies and/or data were considered in developing such concepts? According to the summary "…because of amount of variables, representative alternatives were developed to cover ranges of costs each one of these variables could impact." What are those variables and alternatives developed?	The development of the sediment strategies and management concepts are detailed in Chapter 5 of the main report, beginning on page 100.

Comment Code	Comment	Comment Response
J-15	• Attachments 2 and 3 on Pgs. 12-13 in Appendix J show the costs by practice across the three states. However, the current information does not make it possible to assess the variation in cost effectiveness of the various urban and agricultural BMPs in meaningful terms, such as the dollars per cubic yard of sediment removal. Importantly, the cost effectiveness between practice types typically varies by one or two orders of magnitude. Hence, the current analysis aggregates all practices types and reports an overall cost estimate at $3.5 billion in Table 3 (or Table 6-3). Then the report provides an overall average cost effectiveness of $256-$597 per cubic yard in Table 6-6, and seems to imply that this watershed BMP approach is supposedly the most expensive. But this assessment that aggregates all practice types may overlook the high degree of heterogeneity in costs between practice types. (Pg. 35, Appendix 1-7). **Comment J-15:** Please explain how such an analysis is beneficial to the DLSRWA.	The intent of these analyses was to provide a concept level evaluation of a suite of alternatives for sediment management. See also response to referenced STAC comment in Appendix I-7.
J-16	• Attachment 4 of Appendix J on pp. 29-33 includes detailed information on "Septic Systems". However, septic systems are not discussed at all in the corresponding tables for the cost analysis in Attachments 2 and 3. **Comment J-16:** Please provide the cost analyses by different States.	The focus of the BMP assessment was sediments, not nutrients. The discussion regarding septic systems was included in Appendix J by mistake and has been deleted.
K-1	• Climate trends in the last two decades have shown wetter conditions on average, than in previous decades. Increased precipitation has produced higher annual minimum flows and slightly higher median flows during summer and fall (Najjar et al., 2010). (Pg. 5). **Comment K-1:** Why aren't climate change or climate trends considered in the draft model runs? If there were indeed considered why are the model runs capped at a flow rate slightly above 620,000 cfs.?	Specific climate-change flow scenarios were not considered in the LSRWA modeling analyses, due to the wide range of uncertainty associated with these forecasts. The LSRWA modeling runs focused on known historic flow events.
K-2	• As of 2003, 23 percent of the Chesapeake Bay watershed is used for agriculture and almost 12 percent has been developed. (Pg. 5). • Water circulation in the Bay is primarily driven by the downstream movement of fresh water in from rivers and upstream movement of salt water from the ocean. Less dense, fresher surface water layers are seasonally separated from saltier and denser water below by a zone of rapid vertical change in salinity known as the pycnocline (CBP, 2013). The pycnocline plays an important role in Bay water quality acting to prevent deeper water from being reoxygenated from above (Kemp et al., 1999). Pycnocline depth varies in the Bay as a function of several factors. It shows general long-term geographic patterns as summarized in Table K-4, but varies over shorter time periods as a function of precipitation and winds. (Page 8) During warm weather months it promotes stronger stratification that can last for extended periods during a year. Conversely, sustained winds in a single direction for several days can cause the pycnocline to tilt, bringing deeper water up into shallows on the margins of the Bay. **Comment K-2:** How do any of the models account for this water circulation or wave	The CH3D hydrodynamic model described in the LSRWA report accounts for estuarine circulation and waves with a time step of minutes.

Comment Code	Comment	Comment Response
	• Because of this partial seasonal separation into layers, or strata, the Bay is classified as a partially stratified estuary. Division of surface from deeper waters varies depending on the season, temperature, precipitation, and winds. In late winter and early spring, melting snow and high streamflow increase the amount of fresh water flowing into the Bay, initiating stratification for the calendar year. During spring and summer, the Bay's surface waters warm more quickly than deep waters, and a pronounced temperature difference forms between surface and bottom waters, strengthening stratification. In autumn, fresher surface waters cool faster than deeper waters and freshwater runoff is at its minimum. The cooler surface water layer sinks and the two layers mix rapidly, aided by winds. During the winter, relatively constant water temperature and salinity occurs from the surface to the bottom (CBP, 2013). (Pg. 9). • USACE and SRBC recognize the Susquehanna River basin as one of the most floodprone basins in the United States from a human impacts perspective. Flow conditions can vary substantially from month to month; floods and droughts sometimes occur in the same year. Floods can scour large volumes from the river bed and banks, and convey large quantities of nutrients and sediment downstream. (Pg. 11). • Salinity is an important factor controlling the distribution of Bay plants and animals. Salinity is the concentration of dissolved solids in water and is often discussed in terms of parts per thousand (ppt). In Maryland, Bay surface waters range from fresh in headwaters of large tidal tributaries to a maximum of about 18 parts per thousand (ppt) in the middle Bay along the Virginia border. Salinity varies during the year, with highest salinities occurring in summer and fall and lowest salinity in winter and spring. (Pg. 13). • The ETM zone is an area of high concentrations of suspended sediment and reduced light penetration into the water column. Each of the Bay's major tidal tributary systems has an ETM zone near the upstream limit of saltwater intrusion. The Susquehanna River ETM zone occurs in the upper Bay main stem. The position of the ETMs changes seasonally and with large freshwater flow events from storms. The ETMs extend further downstream into the Bay during times of year when lower salinities occur and following major storm events, and further upstream when seasonally higher salinities occur. The ETM zone is produced by a complex interaction of physical and biological processes, including freshwater inflow, tidal and wave-driven currents, gravitational circulation, particle flocculation, sediment deposition and resuspension, and biogeochemical reactions. (Pg. 13).	Both the Watershed Model (WSM) and the Water Quality and Sediment Transport Model (WQSTM) simulate phosphorus bound to sediment.

Comment Code	Comment	Comment Response
K-3	• Tidal resuspension and transport are primarily responsible for the maintenance of the ETM zone at approximately the limit of saltwater intrusion. Generally, fine-grained riverborne sediment in the ETM zones is exported further downstream into the main Bay only during extreme hydrologic events. The mainstem Bay ETM zone occurs in the upper Bay; in this region, most of the fine-grained particulate matter from the Susquehanna River is trapped, deposited, and sometimes resuspended and redeposited. • The mainstem ETM zone acts as a barrier under normal conditions for southward sediment transport of material introduced into the Bay from the Susquehanna River (USGS, 2003). Eutrophication • Anthropogenic nitrogen and phosphorus nutrient pollution delivered to the Bay exceeds the Bay ecosystem's capability to process it without ill effect. The Bay's physical character and circulation patterns tend to retain water-borne materials, thus exacerbating the effect of anthropogenic pollution. The Bay's natural capability to buffer the incoming nutrient loads are governed by seasonal stratification and limited tidal mixing rate (Bever et al., 2013). Anthropogenic nutrient pollution to the Bay derives from agricultural runoff and discharges, wastewater treatment plant discharges, urban and suburban runoff, septic tank discharges, and atmospheric deposition of exhaust (CBP, 2013). Water bodies possess a range of nutrient availability conditions. Water bodies possessing ample or excessive nutrients whether from natural or human sources are said to be eutrophic. The Bay became eutrophic because of inputs of large quantities of anthropogenic nutrients. Excess nutrients in the water column from human sources fuel the growth of excess phytoplankton. Zooplankton, oysters, menhaden, and other filter feeders eat a portion of the excess algae, but much of it does not end up being consumed by these organisms. The leftover algae die and sink to the Bay's bottom, where bacteria decompose it, releasing nutrients back into the water, fueling further algal growth. During this process in warm weather months, bacteria consume DO until there is little or none left in deeper bottom waters (CBP, 2013). Within the Bay, nitrogen is the principal limiting-nutrient regulating phytoplankton. The limiting nutrient is that nutrient available in lowest supply in proportion to biological demand. However, phosphorus is the limiting nutrient for phytoplankton growth in low salinity Bay waters in spring. Phosphorus is typically the limiting nutrient in freshwater ecosystems. (Pg. 16). • Nitrogen and phosphorus actually occur in a number of different forms in the environment that differ in their biological availability and effects on water quality. (Pg. 17). Total nitrogen (TN) includes nitrate, nitrite, ammonia, and organic nitrogen. (Pg. 17).	

Comment Code	Comment	Comment Response
	• Ammonia is the dominant dissolved nitrogen form in deeper waters during warm months. Nitrite is generally unstable in surface water and contributes little to TN for most times and places. Organic nitrogen (mostly from plant material, but also including organic contaminants) occurs in both particulate and dissolved forms, and can constitute a substantial portion of the TN in surface waters. However, it is typically of limited bioavailability, and often of minimal importance with regard to water quality. Conversely, nitrate and ammonia are biologically available and their concentration is very important. • Total phosphorus (TP) includes phosphates, organic phosphorus (mostly from plant material), and other phosphorus forms. Phosphates and organic phosphorus are the main components of TP. Phosphates tend to attach to soil and sediment where their bioavailability varies as a function of environmental conditions. Dissolved phosphate is readily bioavailable to aquatic plant life, and consequently promotes eutrophication (USGS, 1999). Phosphorus binds to river sediments and is delivered to the Bay with sediment. (Pg. 17). **Comment K-3:** What model is used to address how phosphorus is bound to sediments? How are phosphorus levels and its impact addressed in the DLSRWA?	
K-4	• Nutrient transport in rivers is usually considered in two fractions – that portion conveyed in dissolved form and that portion carried as particulates. Particulates include mineral sediments and plant debris. During downstream transport, bacteria and other stream organisms take up dissolved nutrients and convert them to organic form. When organisms containing these nutrients die, the nutrients return to the water in inorganic form, only to be taken up yet again by other organisms. This cycle is referred to as nutrient spiraling. • Nutrient pollutants delivered to the Bay vary year to year as a function of amount and timing of precipitation. Wet years deliver greater nutrient pollution to the Bay than dry years. For example, the amounts of nitrogen and phosphorus transported during Tropical Storm Lee (a September 2011 high-flow event) were very large compared to long-term averages for the Susquehanna River over the past 34 years. However, this difference is less pronounced for nitrogen than it is for phosphorus, because on average, a large part of the nitrogen flux is delivered in dissolved form. Specifically, the amounts transported during the Tropical Storm Lee event were estimated to be 42,000 tons of nitrogen and 10,600 tons of phosphorus. For comparison, the estimates of the averages for the entire period from 1978 to 2011 were 71,000 tons per year for nitrogen and 3,300 tons per year for phosphorus (Hirsch, 2012). (Pg. 17). **Comment K-4:** How were the phosphorus levels, namely 10,600 tons, generated for Tropical Storm Lee? Did the 10,600 tons number take into account phosphorus bound to sediments?	The phosphorus load from Tropical Storm Lee was calculated by Robert Hirsch of USGS. He used a method called "Weighted Regressions on Time, Discharge, and Season." Details of his methods are found in the publication referenced below and in citations therein. "Total Phosphorus" is reported; this parameter includes phosphorus bound to sediments. Text was added to Chapter 4.2.3 to discuss phosphorus bound to sediments. Hirsch, R. 2012. "Flux of nitrogen, phosphorus, and suspended sediment from the Susquehanna River basin to the Chesapeake Bay during Tropical Storm Lee, September 2011, as an indicator of the effects of reservoir sedimentation on water quality," Scientific Investigations Report 2012-5185, US Geological Survey, Reston VA.

Comment Code	Comment	Comment Response
K-5	• Phosphorus is conveyed in rivers as phosphate adsorbed to sediment particles. It is also conveyed bound to calcium, and as organic particles. The processes by which phosphorus is released from sediments is complicated and affected by biological as well as physical chemical processes. In oxygenated fresh water, phosphorus adsorbed to fine grained sediments remains bound and has limited bioavailability. Under anoxic or hypoxic freshwater conditions, phosphorus becomes more bioavailable, but phosphorus rebinds to sediments if oxygen is again present. In the Bay's saltwater environment, biogeochemical conditions change causing phosphorus bioavailability to differ from in freshwater. As salinities increase above about 3 to 4 ppt, phosphorus bound to sediments is increasingly released and becomes mobile and bioavailable to living resources (Jordan et al., 2008; Hartzell and Jordan, 2012). The uppermost Bay remains generally below salinities of 3 ppt all year, which tends to favor phosphorus immobilization in sediments, but otherwise the Bay is salty enough to allow phosphorus release from sediments (CBP, 2013). (Pg. 19). • Conowingo Reservoir water temperatures range from about 59°F to 91°F during the period of April through October. The reservoir remains relatively constant in temperature vertically for much of the year, but reservoir water can be up to several degrees cooler at the bottom than at the surface for brief periods. DO in Conowingo Reservoir becomes depleted in waters of the reservoir greater than 25-foot depth under conditions of low river inflow (less than 20,000 cfs.) and warm water temperatures (greater than 75°F). Reservoir DO levels occasionally drop below 2 mg/L (Normandeau Associates and GSE, 2011). USGS collected and analyzed water samples of Conowingo Reservoir outflow during high-flow events during water year 2011 (which ran from October 1, 2010 to September 30, 2011) for this assessment. (Pg. 22). **Comment K-5:** How did the models take into account reservoir water temperature? What type of model analysis was used to account for DO levels? • The Susquehanna River transports large volumes of sediment to the Chesapeake Bay. Two flood events, associated with Hurricanes Agnes (1972) and Eloise (1975), contributed approximately 44 million tons of sediment to the Bay. Recent estimates calculate that the Susquehanna River transports 3.1 million tons annually, depositing 1.9 million tons behind Conowingo Dam with the remaining 1.2 million tons deposited in the Chesapeake Bay (1996-2008 evaluation periods) (Langland, 2009). In the upper Bay, the Susquehanna River is the dominant source of sediment influx, supplying over 80 percent of the total sediment load in the area (SRBC Sediment Task Force, 2001). (Pg. 27).	The representation of Chesapeake Bay has its upstream limit at Conowingo Dam. The reservoir upstream of the dam is not represented. The temperature and dissolved oxygen concentration of water flowing over the dam are based on the observational record. The AdH model did not model water temperature or dissolved oxygen.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
Mtg-1	**Comment Public Meeting:** The three individuals at the December 9, 2014 meeting at Harford Community College that presented the DLSRWA (Messrs. Bierly, Michael and Bier) suggested that the report will be used to determine who should have responsibility for addressing harm to the Bay caused by sediment scour. The discussion overlooked the decades of harm from scour that already has occurred and the fundamental evolution of the surface solids that now settle in the reservoirs. When the dams were new and the reservoirs behind the dams were deep, clays and silts in addition to the larger grained sands settled in the reservoirs behind the dams. The clays are the easiest sediments to scour as they are the finest grained and lightest solids to settle out of suspension and become more easily resuspended. The clays also probably bond the most phosphorus and other pollutants and nutrients. Silts lie somewhere in the middle and the sands are the heaviest and probably bond the least amount of sediments and nutrients. For decades, the dams have deprived the upper Bay of sands and have allowed the less desirable and more harmful clays and silts to be scoured and flushed into the Bay in deathly quantities during storm events. Such clays and silts also are more likely to become resuspended during turbulent weather in the Bay than the sands. Now, much of the material remaining on the floor of the reservoirs consists of sand, as the clays and silts have been flushed into the Bay for the last 80 years, while the sand, due to particle size and weight, has settled to the bottom and has less frequently been scoured into the Bay. There are studies that confirm these phenomena. Any consideration of responsibility for scour should take into account how the dams already have materially altered and damaged the Bay estuary by depriving it of the more beneficial sand while flushing in the more harmful clays and silts, until the present, when most of what remains to be scoured consists primarily of sand.	Comment noted.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
Mtg-2	**Comment Public Meeting:** The three individuals at the December 9, 2014 meeting at Harford Community College that presented the DLSRWA (Messrs. Bierly, Michael and Bier) suggested that the report had received favorable peer review. Peer review can take on several formats but it most commonly is understood as review by qualified scientists of written scientific reports to test and to assess the methodology used to reach findings and conclusions and to access the confidence level in/validity of the findings made and the conclusions drawn in the report. It is hard to imagine that the DLSRWA was peer reviewed because the report does not begin to explain the methodology used to derive any findings or conclusions. Only upon reading thousands of pages of appendices can one begin to assess what work was performed, and even then only in the most cursory of manners. For example, the flow chart used to diagram the models used to generate data is cursory. Nowhere is the raw data underpinning different modelling efforts set forth, let alone being adequately explained. If there was any meaningful peer review of the DLSRWA, any report or appendix attached to the report, or any of the findings and conclusions in the report, please identify by name and qualifications the each person who conducted any peer review and attach any written findings conclusions, and input made by each such individual or group of individuals. There should be a peer review document. Please identify and provide a link to such document.	The document review process included many different reviews from within the team member's respective agencies and from outside organizations. Of significance, the Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) sponsored an independent review. The STAC review committee consisted of 11 professionals in the fields of economics, and watershed, riverine, and estuarine processes. Chapter 6 of the report describes stakeholder involvement and the review process. Appendix I-7 describes STAC and identifies the committee and their affiliations. All peer review comments are included in Appendix I-7. Additional clarification regarding the inputs and links between model is included in the revised report as Figure 1-5 and Attachment J-5.
Ex-1 General	Regarding citation of Study 3.17 – currently the LSRWA report cites the 2011 Initial report. The Final report should be cited as: URS Corporation and Gomez and Sullivan Engineers (GSE). 2012c. Downstream EAV/SAV study. (RSP 3.17). Kennett Square, PA: Exelon Generation, LLC.	The citation was changed in the list of references; no references to a 2011 URS/GSE report were found in the main report.
Ex-3 General	<u>**Original Comment:**</u> The "full" condition estimation should be more clearly explained. Pieces of the explanation are given throughout the report (Page 112, Appendix A-3), but there is not enough detail given in any one location (or even collectively throughout the report and appendices) to understand or follow how the estimation was derived. <u>**Additional Comment:**</u> Exelon is trying to more thoroughly understand what specific methods were used to estimate the 'full' bathymetry. It is not clear how this was done, or how the assumptions made as part of this process may ultimately influence the ADH model results.	<u>**Original Response:**</u> The full condition is a term used to describe the storage capacity of a given reservoir. A reservoir is full when it can no longer effectively trap sediments and associated nutrients in the long term (decades). This language added to page 112. "Full" is better described as dynamic equilibrium which is described in detail on pages 109-110.) More detailed language has been added to Appendix A, Attachment A-3. <u>**Additional Response:**</u> A reference and some text regarding the estimation of the "full condition" has been added to Appendix A, page 52, in step 2 of the procedure; see response for Ex-C-3.

Comment Code	Comment	Comment Response
Ex-6 ES-2/ paragraph 3	**Original Comment:** Examples given are for sediment only. No information is given to determine if differences in flows are the cause of differences in sediment loads (W = Q C so if Q ↑, W ↑). No information is given to support the statement that reservoirs are trapping a smaller amount of nutrient loads from the upstream watersheds. No quantification of incoming or outgoing nutrient load. **Additional Comment:** The revised text states that bathymetric data were the basis for estimates of changing sediment loads; there is no quantification of incoming or outgoing nutrient loads. For example, if nutrients are preferentially present on the finest fraction of sediment particles (e.g., clays), then the relative change in trapping may be small (i.e., trapping of clays may never have been high). Thus, there is still a disconnect between trapping of sediment in general and trapping of sediment fractions that carry the most nutrients.	**Original Response:** Text altered to indicate that this conclusion is from a comparison of 1996 to 2011 bathymetry. Nutrients are discussed on ES-3. Also better quantification and reactivity of nutrients is identified as a recommendation of the study. **Additional Response:** The data to perform a nutrient budget for the reservoir based on nutrients associated with sediment size fractions does not exist. Certainly, the reservoir traps nutrients, as evidenced by the observations of nutrients attached to bottom sediments. Two scientific studies have determined that nutrient trapping is declining in concert with declining sediment trapping. Hirsch (2012) reported a 55-percent increase in total phosphorus and a 97-percent increase in suspended sediment in the Susquehanna River at Conowingo during 1996--2011. Zhang et al. (2013) reported “upward trends of SS and particulate-associated N and P were generally observed below the Conowingo Reservoir since the mid-1990s. The reservoir’s capacity to trap these materials has been diminishing over the past two or three decades.” See comment-response for K-4 for the full Hirsch reference. The Zhang et al. (2013) reference is Zhang, Q., Brady, D., and Ball, W. 2013. “Long-term seasonal trends of nitrogen, phosphorus, and suspended sediment load from the non-tidal Susquehanna River to Chesapeake Bay,” Science of the total Environment 452-453: 208-221.
Ex-8 ES-3/ paragraph 2 (full)	**Original Comment:** Use of phrase “Conowingo Reservoir material” implies that the reservoir is the source of material rather than the reservoirs being a site where transient storage appears. **Additional Comment:** The phrases “Conowingo Reservoir material” to “bed sediment stored behind Conowingo Dam” mean the same thing. The point of the comment is that the assessment is predisposed to assume that all “excess” sediment generated during high flow is coming from Conowingo Pond. However, the uncertainties involved preclude such a definitive statement.	**Original Response:** Text altered to indicate bed sediment stored behind Conowingo. **Additional Response:** The noted statement is based on the findings of the modeling analyses; that is, approximately 20 to 30 percent of the sediment flowing in during a major storm event comes from the Conowingo Reservoir sediments. The report does not refer to this as "excess" sediment. No changes to the report are required.
Ex-10 Chapter 1 – page 8 – 1st paragraph	The 2nd sentence is new and the reference cited, Pazzaglia and Gardner 1993, is inappropriate. This reference examines the state of the lower Susquehanna River in recent geologic time (≈ 10,000 – 20 million years ago), not historic time. This new sentence seems to refer to historic time prior to construction of the dams. If referring to historic time, a different citation should be used. If Pazzaglia and Gardner 1993 reference meant to be cited, add that this publication explores geologic conditions, not historic.	Concur. The referenced has been removed and text has been changed to include an appropriately referenced statement.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
Ex-11 Page 10 - para. 2	Is the reference given as Gomez & Sullivan (2012) (RSP 3.11) [twice in this paragraph] really meant to be URS and Gomez & Sullivan (2012b)?	Yes, the references have been changed on page 10.
Ex-12 CH. 1/P.11/Paragraph last(Sec 1.9) and Table	**Original Comment:** Assessment products include many overlapping, and not necessarily parsimonious, study elements. For example, the table states that HEC-RAS was used to compute sediment loads into Conowingo Pond. The Chesapeake Bay Watershed Model (CBWSM) also computes sediment loads to/though Conowingo Pond. How do they compare? SEDFLUME data were collected to determine erosion rates and erosion thresholds for sediment in Conowingo Pond. HEC-RAS, which was also used to calculate sediment transport, uses transport capacity relationships. How do the rates determined by the SEDFLUME work (and used in AdH) compared to calculations using HEC-RAS? Do they agree? The CBWSM also computes transport (because the reservoir is a node in the stream network) and uses an entirely different approach. How were differences handled? Which sediment load estimates were used to feed the CB water quality model (CE-QUAL-ICM) (Carl Cerco model)? **Additional Comment:** This comment is not meaningfully addressed without a change to the report to include this information and discuss the uncertainty. There are three different load estimates at Conowingo and each implies a different balance of transport processes: (1) Bay watershed model, (2) HEC-RAS, and (3) AdH. An attempt to identify or reconcile these differences in a quantitative way or recognize uncertainties does not appear to be made in the report. If AdH results differ from HEC-RAS results for Conowingo, is it appropriate to consider HEC-RAS results for upstream reservoirs to be reasonable?	**Original Response:** HEC -RAS inputs of watershed loads compare well to CBWSM. USGS (HEC-RAS) annual average load for 1993 – 2012 is 1.5 million English tons/annum. This converts to 3.74 million kg/d. The WSM daily average load for 1991 – 2000 under 2010 Progress Run conditions is 3.06 million kg/d. The differences between the two estimates can be attributed to numerous factors including different summary intervals – 1993 – 2012 for USGS/HECRAS vs. 1991 – 2000 for the WSM. HECRAS also used some of the SEDflume data for estimation of several sediment model parameters. **Additional Response:** First, the HEC-RAS data was only from 2008 to 2011, not 1993-2011. Neither the daily loads from HEC-RAS (underestimated) nor AdH were used; the WSM daily inputs were used because the data was available for the time period for simulating effects on water quality in the Chesapeake Bay. Its use allowed comparisons to the TMDL evaluations and water quality attainment criteria. A longer time period than provided by HEC-RAS and AdH was needed.
Ex-14 CH. 1/ P.18/ Figure 1-6	**Original Comment:** Figure does not clarify which model feeds sediment estimates to CE-QUAL-ICM and how differences between estimates from models in the suite (CBWSM, HEC-RAS, and AdH) are handled. **Additional Comment:** No further comment at this time. Please see comments in cover letter regarding Exelon's proposed Attachment 1 and 2.	**Original Response:** The information on CE-QUAL-ICM loading is provided in Figure 1-5. The differences in the model suite are not the subject of these flow charts. This flow chart is meant to provide a simplified, broad picture of the analytical approach of the study tailored for a wide-audience. **Additional Response:** Attachments 1 and 2 have been reviewed, and incorporated into the document within Figure 1-5 and Attachment J-5, with some changes for accuracy and clarity.

Comment Code	Comment	Comment Response
Ex-15 CH.2/P.26/ Paragraph 1	**Original Comment:** Table 5-6 of the main report is consistent with TMDL Appendix T in stating that the reservoir trapping capacity of Conowingo has been 55-60% from 1993-2012. Please elaborate on what trapping capacities were used in the various WSM model runs. **Additional Comment:** We disagree that Appendix D adequately describes the input parameters for each run. It is important to understand the conditions of the scenario runs within the context of trapping capacity/efficiency as discussed in TMDL Appendix T.	**Original Response:** The LSRWA scenarios are fully described and characterized in Appendix D along with the estimated Conowingo bathymetries used in each scenario. That is the correct place for the scenario information and not page 75. Changes are unwarranted. **Additional Response:** There will be a refined assessment of Conowingo infill and its influence on Chesapeake water quality done in 2017 based on extensive research and monitoring supported by Exelon and appropriate changes made to the Watershed Model (WSM) and the Water Quality Sediment Transport Model (WQSTM). This assessment will better reflect the improved understanding of sediment and associated nutrient scour and mobilization from the Conowingo. The refined assessment of the Conowingo based on the best monitoring, research, and modeling available will allow a better understanding of the Conowingo trapping capacity/efficiency as it relates to the Chesapeake TMDL.
Ex-18	A good test of the AdH model would have been to start with the 2008 bathy and perform a continuous run of the model thru the date of the 2011 bathy and see how well the model reproduces the observed 2011 bathy	This was done, and is reported in the validation section. But it was only compared in a bulk sense (i.e., in terms of a total volume change); it was not compared spatially.
Ex-25 CH. 3/P.45/ Paragraph last (onto P.46)	**Original Comment:** Were these nutrient contents compared to Marietta samples to get an idea of what the 'watershed' makeup may have looked like? **Additional Comment:** Relevant data may be available from the Susquehanna River Basin Commission's Nutrient Assessment Program (SNAP)	**Original Response:** We did not find Marietta samples that provided relevant information for comparison with observations at Conowingo. **Additional Response:** SRBC's Sediment and Nutrient Assessment Program (SNAP) provides relevant data as it utilizes equivalent sampling and analysis methodology as compared to the USGS sampling effort at Conowingo, Md. The existing dataset extends from 1987 to the present with sampling occurring twice per month (roughly every two weeks) and during storm events for total nitrogen, total nitrate/nitrite, total ammonia, dissolved nitrogen, dissolved nitrate/nitrite, dissolved ammonia, total phosphorus, dissolved phosphorus, dissolved inorganic phosphorus, total organic carbon, total suspended solids (Aug 2000-present), and suspended sediment concentration. Samples were collected during both referenced high flow events, 1996 (including SSC) and 2011 (including TSS and SSC). Additionally, the dataset was used to compute nutrient and sediment loads at Marietta using the USGS estimator model.

Comment Code	Comment	Comment Response
Ex-26 CH. 3/P. 49-50	**Original Comment:** Based on the estimates of bioavailable nitrogen and phosphorus quoted here, which could potentially be resuspended and transported into Chesapeake Bay, there is a serious mismatch between the bioavailable fractions of TN and TP contained in the Conowingo Pond sediments and how they are incorporated in the CBEMP model wherein they are assumed to be approximately 85% bioavailable. Given this, it is likely that the CBEMP is over-estimating the release of Conowingo Pond nutrients from the sediment bed once they are deposited into the Bay sediments and therefore the model is over- estimating the change in non-attainment of the DO water quality standard. **Additional Comment:** The comment was not meant to describe the G2 and G3 fractions in the SFM bed, but rather to point out that the current particulate organic matter coming in from the boundary is assumed to be all refractory. However, it may be possible that during a large scour event a major portion of the scoured particulate organic matter may be largely G3 and therefore putting this into the refractory pool (G2) may over-estimate the bioavailability of the combined watershed and scoured POM pool coming into the Bay. However, we acknowledge that a proposed study effort will be undertaken to address this issue.	**Original Response:** The fractions assigned to G2 (slowly reactive) and G3 (inert) are based on long experience with the Bay model, as applied over the period 1985 – 2005. This interval includes multiple scour events so the assigned fractions are considered representative. Nevertheless, we acknowledge the reactivity of organic matter scoured from the reservoir bottom is an area of uncertainty. There are efforts underway to address this issue and this is a recommendation of the study. **Additional Response:** The comment expresses some misunderstanding about the nature of refractory matter in the water quality model (WQM) and how material deposited on the bottom is mapped to variables in the sediment model (SFM). The misunderstanding originates in a "disconnect" between the variable suite in the water quality and sediment models. As noted in the comment, "all particulate organic matter coming in from the boundary is assumed to be refractory." The refractory variables in the WQM combine the G2 and G3 fractions represented in the sediment model. When refractory organic material settles from the water column into the sediments, it is split into G2 and G3 fractions for subsequent treatment in the sediment model. At present, refractory material settling from the water column is assumed to be 80% G2 and 20% G3. So the transport of G3 material across the boundary is not ignored.
Ex-27 CH. 4/ P.59 60/ Paragraph 3-4 (Sec. 4.2.1)	**Original Comment:** There is a shift in focus from transport in general for all three reservoirs (paragraph 3) to just transport within Conowingo Reservoir (paragraph 4). The same condition would be expected in all three reservoirs, not just Conowingo Pond. **Additional Comment:** True, but still an important issue that warrants a statement in the report that is similar, if not the same, as Scott's response.	**Original Response:** There most certainly is scour in the upper two reservoirs that supply Conowingo. However, without field data to quantify it, it is very uncertain how much of the scour enters Conowingo. More field data measurements are needed below the dams. **Additional Response:** The following paragraph was added after the first partial paragraph on page 61 (October 2014 version, now page 63): "While the focus for many of the LSRWA analyses is the Conowingo Reservoir, there most certainly is scour in the upper two reservoirs that supply Conowingo. However, without field data to quantify this scour, it is very uncertain how much of the scour enters Conowingo. More field data measurements would be needed below the two dams (Safe Harbor and Holtwood Dams) for this level of detail."

Comment Code	Comment	Comment Response
Ex-28 CH. 4/P.106/ Paragraph 4 (full paragraphs) (term appears on pg. 60)	**Original Comment:** What does "trace" erosion mean? Is it resuspended sediment that is moved within the pond and does not pass the dam? Is it erosion of the thin unconsolidated layer? **Additional Comment:** The qualitative term "trace erosion" is used several times in text. Since this response indicates it refers to a quantitative condition, the use of this term should be defined when used in the text. Ditto for the term "mass erosion."	**Original Response:** Erosion of the mixing layer in the reservoir. Very unconsolidated that mobilizes at low shear rates (.004 psf) **Additional Response:** Term occurs on pg. 60. Definition for "trace erosion" has been added to text on page 60 (October 2014 version, now page 63) and to the glossary as: "Erosion of the unconsolidated material of the mixing layer in the reservoir, which occurs at low shear rates"; also, the mass erosion definition has been added on page 43 and in the glossary: "Scour which penetrates the deeper layers and occurs at higher flows with higher bed shear stresses (greater than 0.02 pounds per square inch). "
Ex-30 CH. 4/P.65/ Paragraph	**Original Comment:** This paragraph cites an 'active layer' depth of 2-3 feet. Specific study results that prove this statement should be provided or referenced. Appendix A of the LSRWA does not mention any 'thin unconsolidated mixing layer' as cited, and there is only a single reference to this in Appendix B which states that "[t]he top layer of Conowingo Reservoir sediments consists of a low density unconsolidated layer that may mobilize at lower flows." **Additional Comment:** We were not clear in our first comment – our primary concern was the evidence behind the statement of a 'thin unconsolidated mixing layer', which we cannot find a satisfactory description of within the main report. Our concern is that the main report appears to step beyond what is stated in Appendix B.	**Original Response:** The depth of sediments available for scour was assumed to be 2 - 3 feet in the model. Bed properties were measured in the SEDflume up to one foot of depth. The remaining 2 feet were estimated. Appendix B is the source of this info. Sentence in main report was changed from "The active layer has a depth …" to "For modeling purposes, the active layer is estimated to have a depth…" **Additional Response:** This mixing layer is a real phenomenon, but is modeled as an "active layer" -- a very thin layer at the surface where sediment sorting takes place. The text at the top of page 68 was changed to include this new language: "....; this very thin layer at the surface where sediment sorting takes place was modeled as part of the active layer." This definition of the mixing layer has been added to the glossary.
Ex-32 Page 66, end of last paragraph	Two new sentences were added to the bottom of Bathymetry Comparisons section explaining what "full" condition means – unfortunately they do not clarify the definition of dynamic equilibrium given elsewhere.	The last sentence of that section (page 69, para 3) was changed to: "In this state, the reservoir will experience a periodic "cycle" with an increase in sediment and associated nutrient loads to the Bay from scour also resulting in an increase in storage volume (capacity) behind the dam, followed by reduced sediment and associated nutrient loads transported to the Chesapeake Bay due to reservoir deposition within that increased capacity."
Ex-33 Page 69, end of last paragraph	The phrase "Hurricane Agnes in 1972" appears to have been inadvertently deleted from the last sentence after the word "excluding."	"Excluding" was removed from the text. The value presented in this sentence is for the past 30 years which does not include the Hurricane Agnes event.

Comment Code	Comment	Comment Response
Ex-34 CH.4/P.73/ Figure 4-5	**Original Comment:** The second panel in this figure indicates that silt deposition buried oyster beds. It's not clear if this is a proven impact, as earlier in the report (page 57), evidence was cited that disproved the 'sediment burial theory' following Tropical Storm Lee and indicated that oyster mortality was likely due to excessive fresh water and low salinities for an extended duration. This is reiterated again on page 138. **Additional Comment:** Response appears to reference the second figure not the second panel (Tropical Storm Agnes June, 1972 – "silt deposition buried oyster beds.")	**Original Response:** Second figure shows extent of sediment plume, not extent of substantial sediment deposition. Change sentence "As a result, sediment runoff from Tropical Storm Lee was quite extensive compared to that of Hurricane Sandy, as depicted in Figure 5-6. " to "As a result, sediment runoff from Tropical Storm Lee was quite extensive compared to that of Hurricane Sandy and produced a large sediment plume in Bay waters, as depicted in Figure 5-6. Where sediment transported into the Bay would be deposited is controlled by waves and currents, thus mainstem Bay deep waters and protected headwater tributary settings would likely retain sediment from this storm, whereas higher energy shallow waters of the mainstem Bay would be expected to show negligible deposition (see Section 2.6.1)." **Additional Response:** Additional text covering SAV and oyster impact concerns has been added to Section 4.2.3.
Ex-35 Chapter 4 (pp. 74-75)	Langland's response to the Riverkeeper comment (# 41) in Appendix I (page 7) indicates both the average peak flow for the Jan 1996 storm (630,000 cfs) and the instantaneous peak flow (908,000 cfs) are to be added to the text to match what is now figure 4-7. However, the text only mentions the 908,000 cfs value and the figure illustrates a 630,000 cfs value (but it shows up more as a transposed 603,000 cfs). The mean daily flow for the 24-hr period centered on the 908,000 cfs peak is reported in Langland and Hainly (1997) as 530,000 cfs. These discrepancies should be resolved.	The instantaneous peak flow for the January 1996 "Big Melt" event was 908,000 cfs. The peak mean daily flow value was 622,000 cfs which is what is plotted in Figure 4-7. Figure 4-7 has been revised to indicate daily peak flow values for the Y-axis. Text has been added to page 75, last para, to show that 622,000 cfs was the daily peak flow value for the Big Melt. The 1997 Langland and Hainly report value of 530,000 cfs was as noted in the comment, a calculated 24-hour value centered on the instantaneous peak. As such, it is not the instantaneous peak nor the peak daily value which were 908,000 cfs and 622,000 cfs, respectively. It has no meaning or use in the context of the LSRWA.
Ex-36 CH.4/P.74/ Paragraph 1	**Original Comment:** It's not clear what "Average peak flow" means – is that the peak daily average flow (and if so at what location), or the average of the peak flows measured along the river? Also, the event says there was an ice dam breached "within the reservoir itself" but the specific reservoir (Clarke, Aldred, or Conowingo) was not described. It is our understanding that the ice jam breached in the Safe Harbor impoundment. **Additional Comment:** The first portion of this comment was adequately addressed, however, clarification was not provided in regard to the specific reservoir where the ice jam breached.	**Original Response:** Correct, there is no average peak flow. Replaced "Average" with "The"; peak flow value changed to 908,000 cfs. **Additional Response:** The peak flow is for Susquehanna River at Conowingo, MD; the ice dam breach was in the uppermost reservoir behind Safe Harbor Dam. The first paragraph on page 74 (October 2014 version, now page 75, last paragraph) has been changed to read "The event was further exacerbated by the breaching of an ice dam in Lake Clarke behind Safe Harbor Dam ..."

Comment Code	Comment	Comment Response
Ex-37 CH.4/ P.75/ Paragraph last (onto P. 76)	**Original Comment:** Again Conowingo is specifically called out separately, while loads from Safe Harbor and Holtwood are just considered part of the "watershed" loads. **Additional Comment:** We would like to see a breakdown of the model results for each reservoir similar to what is shown for Conowingo Pond, recognizing that there are little to no measured data available to assess accuracy. Additional information should be added to the report.	**Original Response:** The design of the study was to model Conowingo since it was believed it had remaining capacity, was largest reservoir, and may have the greatest impact on the upper Bay **Additional Response:** A breakdown of the model results for each reservoir cannot be done because there is no monitoring data between the upstream dams. However, scour estimates include all three reservoirs.
Ex-38 CH.4/P.76/ Table 4-7	**Original Comment:** Is there a reason that the AdH results were not used here instead? **Additional Comment:** It is unclear why the AdH model could not be used to estimate scour loads at various sized flood events.	**Original Response:** The AdH model could not generate all the data included in Table 5-7. **Additional Response:** The model is likely not validated sufficiently to predict absolute values of scour loads. It is better served to examine model-to-model comparisons, i.e., if something is changed in the model (such as bathymetry) what is the relative change in the modeled result.
Ex-39 Page 78 (Nov), 5th Paragraph	In the first sentence, recommend changing "versus scour from the Conowingo Reservoir" to "versus scour of watershed sediments stored in the Conowingo Reservoir"	Text has been changed as noted.
Ex-40 CH.4/ P.80/ Table 4-9	**Original Comment:** It would be more useful to the reader to list the absolute amount of nonattainment for each scenario, rather than a differential from other scenarios. It is difficult to 'back-calculate' the absolute nonattainment numbers from the differentials presented because of a lack of significant figures and because the 'baseline' scenario is different for several of the scenarios. **Additional Comment:** Our original comment still stands. We disagree that this would not be a worthwhile exercise.	**Original Response:** The critical period of the Chesapeake TMDL is 1993-95, but the year of the Big Melt high flow event on the Susquehanna was 1996, so a 1996-98 3-year period was used to capture the main scour event simulated in the LSRWA report. With the new 1996-98 period, the high flow event is simulated, but the scenario findings of the 1993-95 period are now lost. It is not a worthwhile exercise to compare the TMDL WIP or the 2010 scenarios on the 1996-98 period that is now disconnected to the 1993-95 hydrology and loads that the Chesapeake TMDL was based on. For this reason differential results are used. **Additional Response:** Appendix J4 already has the relevant information. A typical excerpt is as follows, "Generally, a June high flow storm event has the most detrimental influence on Deep Channel DO followed by a storm of the same magnitude in January and then October. A 'no large storm" condition has the highest level of Deep Channel DO attainment. The June high flow event scenario (LSRWA -24) had an estimated increase in Deep –Channel nonattainment of 1%, 4%, 8% and 3% in segments CB3MH, CB4MH, CHSMH and EASMH when compared to the No Storm Scenario." Note the values are given for each of the CB segments as requested. The reason the individual absolute values for each CB segment for each scenario are not given is because the relevant information only comes from the scenario comes from the difference with a base scenario. The absolute scenario values are meaningless in and of themselves.

Comment Code	Comment	Comment Response
Ex-42 CH.4/P.97/ Paragraph 3 (full paragraphs)	**Original Comment:** Paragraph focuses on AdH results for Conowingo Pond and purported loss of storage despite prior (and subsequent) text suggesting that changes in sediment transport are not expected to have a big impact on Bay water quality. **Additional Comment:** Given uncertainties in upstream loads to Conowingo reservoir and loads passing the Dam, what is the uncertainty associated with the mass estimates ascribed to erosion and deposition within Conowingo Pond?	**Original Response:** The reservoir is currently in a dynamic equilibrium for which deposition and scour continually occurs without a net change in storage. Sediments will deposit during low flows and scour during periodic storms. The loads from TS Lee did not demonstrate a long-term adverse impact to water quality. There was a short-term impact as would be expected. **Additional Response:** The uncertainties are difficult to quantify, but they are on the order of the uncertainties associated with the incoming load. The most significant point, however, is that the reservoir is effectively at dynamic equilibrium, which means that future loads, whatever they may be, are unlikely to exhibit an increasing trend attributable to additional losses of capacity in the reservoir.
Ex-43 CH. 5/P.100/ Paragraph 2	**Original Comment:** Goal of management not clearly stated. Stopping all sediment entering Bay is not possible or desirable. **Additional Comment:** The nature of our comment is that the goal appears to be to reduce sediment loading to the Bay; however, this is not stated clearly in the report.	**Original Response:** Comment is vague. The referenced paragraph doesn't mention the word management or goal. There is no place the report that suggests stopping all sediment from entering the Bay. Goal/focus of the management strategies are adequately discussed in paragraphs 1 and 2. **Additional Response:** The previous paragraph (first) on page 100 clearly states that the strategies were "to address the additional loads to Chesapeake Bay from the reservoirs' bed sediment scour." No change to the report is required.
Ex-44 CH.5/P.102)Figure 5-2	Morris (1998) is not in the list references. This figure is not from Morris & Fan (1998). Believe the correct citation should be: Morris, G.L., (2014). Sediment management and sustainable use of reservoirs. In: Modern Water Resources Engineering (L.K. Wang and C.T. Yang, eds.). Humana Press. NY. Chapter 5. Pp. 279-338.	Reference has been corrected to Morris, 2014, both in the text and the list of references.
Ex-46 General	**Original Comment:** Pertaining to all alternatives – not addressed are the potential environmental impacts as related to: aesthetics, air quality and greenhouse gases, soils, water quality, wetlands, groundwater, surface water, wetlands, floodplains, biological resources, cultural resources, land use, socioeconomic resources, recreation and tourism, utility and transportation infrastructure, public health and safety, and noise. In many cases the environmental impacts associated with a specific alternative may cause more harm than good. **Additional Comment:** While a NEPA level review of potential environmental impacts is well beyond the scope of such as assessment, it is not unreasonable for a watershed assessment to discuss the relative environmental impact of alternatives and to list specific resources to be considered for future analysis.	**Original Response:** This paragraph was inserted after last paragraph on page E-4 (before section titled "Future Needs of the Watershed") and after first paragraph on page 182 (before paragraph starting "Table 6-10 is a matrix....). "It should be noted that the LSRWA effort was a watershed assessment and not a detailed investigation of a specific project alternative(s) proposed for implementation. That latter would likely require preparation of a NEPA document. The evaluation of sediment management strategies in the assessment focused on water quality impacts, with some consideration of impacts to SAV. Other environmental and social impacts were only minimally evaluated or not evaluated at all. A full investigation of environmental impacts would be performed in any future, project-specific NEPA effort." **Additional Response:** Disagree. The environmental impacts are identified to the degree needed for the purposes of the assessment, including as pro/cons in Table 5-5. Additional environmental information has also been added in response to internal comments.

Comment Code	Comment	Comment Response
Ex-50 CH. 8/ P.150-151/ Finding #1	**Original Comment:** The important point is to know if the trapping capacity assumed in the TMDL is the same as considered now. Based on reading Langland trapping efficiency data in Appendix T and this LSRWA report they are the same. **Additional Comment:** To clarify the original comment, is the trapping capacity assumed in the TMDL the same as is considered now? It appears based on this report and Langland trapping efficiency data in TMDL Appendix T that they are. Please confirm.	**Original Response:** Good news. Thanks **Additional Response:** The 2010 TMDL documentation of Appendix T clearly stated that the Conowingo was assumed to be effectively trapping particles. The LSRWA report clearly states that the Conowingo is in dynamic equilibrium and is no longer effectively trapping particles.
Ex-52 CH. 8/P.152/ Paragraph 2	**Original Comment:** Couldn't the amount of time for sediments to settle out increase if there is an increase in velocity due to decrease in depth? The statement may be too strong a statement since the time to settle is a unique combination of gravitational and fluid forces." **Additional Comment:** Based on the response of this comment, recommend revising the paragraph in question as shown below in red: "As the lower Susquehanna River reservoirs have filled, water depths have decreased and water velocity has increased. This has led to increasing the bed shear (which can result in more scour) and to decreasing the amount of time ~~for~~ sediments spend in the reservoir ~~to settle out of the water column~~, which thereby, reduces sediment deposition within the reservoir (Appendix A)."	**Original Response:** No, because water is traveling faster, therefore, potentially, less time spent in reservoir. **Additional Response:** Text has been changed as suggested.
Ex-54 CH. 8/ P.154/2nd Full Paragraph	Recommended revision to wording at the end of Finding #2: "To achieve the required water quality conditions under the Chesapeake Bay TDML, full attainment of the states' Chesapeake Bay water quality standards, the extra nutrient loads associated with sediment scoured from the three reservoirs ~~Conowingo Reservoir~~ must be offset by equivalent nutrient load reductions."	Yes, the 2010 Bay TMDL was based on the understanding and the supporting monitoring data that the upper two dam/reservoir systems were in long-term equilibrium. Text has been changed from "Conowingo Reservoir" to "the three lower Susquehanna reservoirs"

Comment Code	Comment	Comment Response
	Original Comment:	**Original Response:**
	The model depends on how upstream boundary conditions (BCs), sediment bed properties, and transport processes are represented in order to "calibrate" the model to reproduce measured downstream BCs.	Suspended-sediment concentration (SSC) was used, not TSS; there is a bias difference in lab methods that generate an error when sand is present. The TSS method by using an aliquot taken at the middle of the sample potentially does not capture the heavier sands that have already settled.
	With respect to the sediment BC, USGS used a function where upstream TSS = 0.007 $Q^{0.9996}$. For all practical purposes, this is a linear relationship between TSS and Q. Although there is a lot of spread in the data, the maximum concentration reported at any Q is 700 mg/L (with a more general trend around 300 mg/L). Extrapolating the upstream BC function to the high flow of interest leads to TSS = 835 mg/L when Q = 1.2e6 cfs. This extrapolated TSS concentration is just ~15% more than the maximum reported value (and less than 3x more than the general trend value of ~300 mg/L).	There are a lot of great discussion points here, linear vs. quadratic relations, BC in and out of the reservoirs, maximum "measured" sediment concentrations, sediment recession, etc.
	[If the upstream reservoirs are believed to in dynamic equilibrium (and Holtwood reservoir is very shallow), the increase in TSS concentration is modest given the factor of 2 extrapolation of flow beyond the limit of measurements.] In contrast, the downstream BC was represented using a parabolic function where downstream TSS = 4e-09 Q^2 – 0.0007 Q + 34.313. As before, there is a lot of scatter in the data but it is harder to see on the graph because the y-axis goes to such a high limit that typical values appear compressed. Nevertheless, typical values are on the order of 300 mg/L to ~1000 mg/L (at 600,000 cfs) with a maximum value of 3,000 mg/L (at 600,000 cfs). This may not be a reasonable representation of the downstream BC. Further, the form of this relationship presents a curious situation for several reasons:	It is important to note that the sediment concentrations shown in the sediment rating curves may NOT be the maximum concentrations. This is most likely the case at Marietta when the first (and highest at ~700 mg/L) measurement for the T.S. Lee event was 3 days after the peak. Most likely this was well after the sediment peak and on the recession side of the sediment hydrograph. This monitoring location is just upstream of the reservoirs. The downstream site reflects the cumulative effect of the Susquehanna River and 3 reservoirs and therefore the sediment rating curve might be expected to be different than a rating curve outside of a reservoir system.
	• the linear term, TSS = -0.0007 Q, is nearly identical in magnitude but opposite in direction to the upstream BC function • the quadratic term, TSS = 4e-09 Q^2, implies that concentration increase geometrically for a linear increase in flow	The quadratic form of the equation suggests a different source of sediment than the linear upstream. as you mention, scoured bed sediments. This is reflected in the" measured" data at the Conowingo site.
	• because the linear term is essentially equal to the upstream load (and opposite in sign), the mass represented quadratic term must be transported off the bed in the model in order for simulated TSS concentrations at the downstream boundary to equal measured values. When extrapolated, the relationship implies that TSS = ~5,000 mg/L when Q = 1.2e6 cfs. Not only is this concentration very high, it is 40% more than the maximum reported concentration of 3,000 mg/L (assuming that this 3,000 mg/L value is representative and not impacted by a sampling or measurement error), ~5x greater than other values measured at 600,000 cfs and ~10x higher than more typical values. There is no basis to determine if this downstream BC TSS relationship is reasonable or appropriate, particularly when extrapolated to 1.2e6 cfs.	I'm not sure how you define "massive bed erosion". The conclusion of the model simulation was the model "UNDER ESTIMATED" the amount of sediment when compared to "measured data" at Conowingo.

Comment Code	Comment	Comment Response
Ex-A-1 Appendix A, General	This situation is further exaggerated because the exponents in the sediment transport capacity/erosion relationships selected for HEC-RAS (1 for Parthenadies, 6/7 for Laursen) are much less than the value of 2 in the downstream BC relationship. This means that the model is forced to scour tremendous amounts of sediment from the reservoir bed to match downstream TSS levels. In short, with this downstream boundary, the model can only compute massive bed erosion and must be set-up so that erodible limits are sufficient to allow massive bed erosion.	
	Additional Comment: No revisions in the report appear to relate to this comment. Uncertainty bounds for both the upstream and downstream load estimates from measurements should be evaluated. There are no means to determine how much overlap may exist in these estimates. Understanding overlap in estimates is important because the difference between the downstream load and the sum of the upstream loads and tributary inputs empirically defines the amount of bed scour. All load estimates are extrapolated to high flow to represent high flow events. The functional form of load estimation equations can have a pronounced impact on inferences of bed scour.	**Additional Response:** Additional efforts were completed for just this reason. Error bounds were estimated and presented for regression scour estimates and the sediment flux estimates at Marietta and Conowingo. It is important to note that the sediment concentrations shown in the sediment rating curves may NOT be the maximum concentrations that occurred because only a small percentage of a storm event is sampled. This is most likely the case at Marietta when the first (and highest at ~700 mg/L) measurement for the T.S. Lee event was 3 days after the peak. Most likely this was well after the sediment peak and on the recession side of the sediment hydrograph. This monitoring location is just upstream of the reservoirs. The downstream site reflects the cumulative effect of the Susquehanna River and three reservoirs, and therefore, the sediment rating curve might be expected to be different than a rating curve outside of a reservoir system.
	If 2 points in the downstream load estimate data set were treated as outliers (TSS = ~1,200 mg/L at Q = ~390,000 cfs; and TSS = ~3,000 mg/L at Q = 610,000 cfs), the implied curvature where TSS rapidly increases with Q at high flow in the downstream boundary load estimate would be reduced (or eliminated).	Suspended-sediment concentration (SSC) were used not TSS, since there is a bias difference in lab methods that generate an error when sand is present. The TSS method uses an aliquot taken at the middle of the sample that potentially does not capture the heavier sands that have already settled. SSC used the entire sample and captures all the sediment. Concur with your point, but excluding data and treating as outliers would also bias the curvature, perhaps in the opposite way. The USGS has deployed continuous monitoring sondes for turbidity to help with improving the Q-C relation at high flows. The "outliers" were removed to determine the effect on the regression equations. For Marietta, the linear change was from 0.0007 to 0.0008 with exponent change from 0.9996 to 0.9957. For Conowingo, the change was 4e09 to 3e09 in the quadratic and from (-0.0007) to (-0.0003) in the linear. The curvature for the Conowingo Q-C is still very evident but obviously dampened a little.
	Thus the quadratic term speaks more to a likely error in model boundary conditions rather than a different source of sediment. Moreover, correlation does not imply causation; cause cannot be inferred; particularly because the USGS analysis appears that it does not account for the time of travel between Marietta and Conowingo.	The quadratic form of the equation suggests a different source of sediment than the linear upstream. And, as you mention below, scoured bed sediments. This is also reflected in the" measured" data at the Conowingo site.
	The fact that the model was judged to underestimate the empirical TSS load passing Conowingo Dam speaks to errors in representing erosion and deposition processes in the reservoir.	This is likely so. The underestimation was related to lack of scour due to the model algorithms, not misspecification of the sediment rating curve.
	Table 2 (p. 12) of the revised report indicates a high clay fraction in the sediment bed. The inference is that the sediment is substantially cohesive. The transport formulations selected are not applicable to such sediment.	Concur, and that is one of the limitations of HEC-RAS in a reservoir simulation. Once in suspension, the model parameters settings control cohesive transport.

Comment Code	Comment	Comment Response
	The model is largely set to operate on a transport capacity limited basis (with infinite supply down to erodible limits). In contrast, reality may be more of a case where, due to sediment cohesion, the system is supply limited. Ultimately, the USGS' assessment that the model underestimates the TSS load leaving Conowingo is more a reflection of the method used to estimate upstream and downstream loads rather than an assessment of the model. Underestimation of loads at Conowingo could be the result of errors or uncertainties in any of the following: (1) (overestimating) the empirical load at Conowingo, (2) the upstream load, (3) watershed loads, and (4) scour from the bed. The report does not adequately deal with these issues and instead advances a priori conclusion that scour within Conowingo reservoir is the source of sediments.	Concur, this is most likely the case, but not for sediment cohesion but for sediment compaction. Errors contribute to the estimation of sediment loads entering and leaving the system. However, other issues with the model were determined to have a greater effect on underestimation. These are presented in the report in Appendix A. Based upon the HEC-RAS model, there was difficulty simulating to the calibration data. This was related to model, not data, limitations. There are other lines of evidence that scour does occur. Bathymetric surveys provided a good indication of bottom change. Increasing loads using a mass balance approach combined with a color change in the sediments also provide evidence of scour.
Ex-A-2 Appendix A, General	**Original Comment:** At a minimum, confidence intervals should be established for the upstream and downstream boundary conditions and alternative formulations should be explored for the functional relationships used for both BCs. **Additional Comment:** Use of alternative sediment transport functions (which are themselves not applicable to the types of sediment being modeled) does not establish confidence intervals. This is a question of statistics; given the TSS and flow values used in the regressions shown in Figures 6 and 7, what are the confidence limits? Do the confidence limits of the upstream and downstream load estimates overlap? This is unrelated to sediment transport functions.	**Original Response:** Selecting 2 different sediment transport functions for the model was the attempt to place some confidence interval in overall sediment transport from Conowingo. **Additional Response:** The transport function selected was chosen because it performs best with the dominant bed material and suspended material transport in and through the reservoirs (silt). Use of the transport function does allow for a range of simulations under two different conditions. Nowhere in the report is it stated that these were "confidence limits." The original response was in error. Computing the confidence limits for Figures 6 and 7 would be misleading due to the water regulation of dams and the trapping of sediment. For flows up about 400.000 cfs, the concentrations are nearly always greater at Marietta than Conowingo. There is overlap in the concentration data, but loads are more important when evaluating reservoir dynamics because the loads can be related to flow. In Table A3 in Appendix A, error (confidence) ranges are presented.

Comment Code	Comment	Comment Response
Ex-A-3 Appendix A, General	**Original Comment:** There is a link with the SEDFLUME data too (and the AdH report) for cohesive transport. As noted in the AdH report (Section 6.1 of Appendix B), the sampling tube could not penetrate the substrate indicating highly consolidated sediments. The AdH report notes that most of the cores were less than 1 foot in length. However, erodible depths in the HEC-RAS model ranged from 0 feet just downstream of each dam where the bed is composed of gravels, boulders, and bed rock to 20 feet in the deepest sediment accumulation areas. This seems a bit inconsistent. **Additional Comment:** Did the HEC-RAS model show erosion depths greater than the depths to successful SEDflume collection? The maximum depth of erosion in the HEC-RAS model should be compared to the physical information implied by difficulty collecting SEDflume core deeper than 1 ft.	**Original Response:** I did not collect the SEDFLUME data, but I am aware of some of the difficulties in the collection. Previous cores collected by USGS in 2000 and analyzed by University of Maryland, go down much deeper (average of 5 feet, deepest one 11.5 feet) and contain particle size information at incremental levels. In general, particle size becomes courser with depth, but there are many areas with erodible fines at depths greater than 5 feet. Just because the erodible depth is set to 20 feet, that does not mean the model is going to erode down that deep. Just because the erodible depth is set to 20 feet, that does not mean the model is going to erode down that deep. **Additional Response:** No, it did not, but the model did erode in areas were the critical shear stress was higher than the bed shear, again pointing to issues with the HEC-RAS model. In addition, SEDflume results were not the only means used to estimate potential for "erosion." SEDflume erosion data indicated an eight-fold "erosion" variability in Conowingo Reservoir. HEC-RAS only has the ability to enter one non-changing set of erosion parameters.
Ex-A-4 Appendix A, General	Starting with the second sentence on page 4, in the citation for the URS and Gomez & Sullivan publication, "USR" is used in multiple locations.	Typographical errors have been corrected.
Ex-A-5 Appendix A, P. 4, middle paragraph	**Original Comment:** Fall velocities do not change with water velocity, transport capacities and shear. Statement is incorrect. **Additional Comment:** The response to the original comment is satisfactory; however, the last two sentences of this paragraph are somewhat unclear: "The report implies increasing concentrations and loads are due to the loss of storage capacity from a decrease in the scour threshold. Reasons for this increase are not certain but likely involve changes in particle fall velocities, increased water velocity, transport capacities, and bed shear." Please provide further clarification.	**Original Response:** Agree removed "due to" **Additional Response:** See response to comment Ex-A-20; also added "and from a possible decrease" in paragraph 2, penultimate sentence, page 4.
Ex-A-6 Appendix A, P. 5, Figure	This figure indicates that sediment transport by means of density currents is an important process in reservoirs. What evidence is there that this is occurring in Conowingo Pond?	This is an "idealized" schematic, not necessary representative of Conowingo. The figure was not meant to imply that this is exactly what happens in Conowingo but is representative of reservoirs in general. The fact that the particle size is sandier at the top of the reservoir and finer near the dam combined with changes in bed-surface elevations, indicate the bottom sediments are mobile.

Comment Code	Comment	Comment Response
Ex-A-7 Appendix A, P. 11, Figure 6	**Original Comment:** Here and elsewhere (USGS regression equation) sediment transport curves are developed based on suspended sediment samples. Suspended samples do not capture bed load which is not estimated in the report. In addition there is always part of the water column on the bottom (usually with the highest concentrations) where the sampling device cannot collect data. I did not see any explanation of how the bed load or unmeasured loads were considered, if at all, in the analyses. **Additional Comment:** Other than "initial conditions or boundary conditions in a model may not be well known" (page 22) there appeared to be no discussion about the uncertainty in the inflowing load based on our review of the cited section. Not including bedload or unmeasured load at the upstream boundary does not appear to be addressed.	**Original Response:** On page 24, under model limitations and uncertainty, this issue is addressed. **Additional Response:** Correct, bedload is separate from "wash" or suspended load. Data analysis indicates that sand (primarily deprived from bedload) is less than 10 percent of the total washload. Bedload movement and resuspension could account for large quantities of sediment transport, but this study was focused on what was in the suspended load, and therefore available for transport over the dam and into the Bay.
Ex-A-8 Appendix A, P. 18, top of page	**Original Comment:** Only flows from two tributaries were included – any estimate of flow percentage missing from ungaged tributaries? Should be able to estimate by comparing outflow from Conowingo with sum of inflows from Marietta and gaged tributaries. **Additional Comment:** Is the reference to Attachment A-1 of the report or to a different one? Did not see anything about this in A-1.	**Original Response:** This was an additional exercise completed and included in attachment 1 **Additional Response:** No, there is not a long enough streamflow record at the gaged sites to do this type of analysis.
Ex-A-9 Appendix A, P. 24, para 4	**Original Comment:** Lots of problems were encountered with appropriate fall velocities for cohesive sediment. As recommended by HEC, the grain size distribution should reflect the flocs rather than discrete grains. **Additional Comment:** This should be identified as a limitation or uncertainty.	**Original Response:** We did not have information about the floc size. **Additional Response:** Agree. Text in Appendix A has been updated to include limitations; change can be found on page 24, first line, in limitation #4.
Ex-A-10 Appendix A, P. 24, para 7	**Original Comment:** Statement is not exactly true. HEC-RAS solves sediment transport by size class. **Additional Comment:** Original comment still stands. Item #7 is still incorrect in that sediment load is determined by size class using whatever transport formula was chosen (some are bed load only, some are total load) and the capacity limiters mentioned in the response.	**Original Response:** With limited capacity **Additional Response:** Concur, HEC-RAS does determine sediment load by size class. But the issue is that the HEC-RAS model, while partitioning the sediment load and transport by particle size, has limited capacity to simulate the suspended load, which is critical in reservoir transport.

Comment Code	Comment	Comment Response
Ex-A-11 Appendix A, P. 24	**Original Comment:** Missing a paragraph #9 which would point out that the hydrograph is being simulated by a series of steady flow pulses, and sediment transport is assumed at equilibrium for each flow pulse. This is different from true unsteady flow (non-equilibrium transport) models. **Additional Comment:** Should be listed as a limitation. Can put something simple without further explanation required, e.g., "the model simulates flow hydrographs via a series of steady flow pulses."	**Original Response:** May be a little too technical to explain without adding more information on the difference (advantage, disadvantage) between steady and unsteady models **Additional Response:** This is presented on page 7 of Appendix A.
Ex-A-12 Appendix A, P. 25, para 1	**Original Comment:** Why is there poor agreement with bathymetry? **Additional Comment:** The report should have an explanation for the poor agreement.	**Original Response:** Model performance and added "the estimated change" **Additional Response:** Text has been revised to include "due to model limitations" on page 25 of Appendix A.
Ex-A-13 Appendix A, P. 25, last para	The Duan et al. reference is not very pertinent as her work on the Rillito Wash was for an ephemeral sand bed riverine system as opposed to a perennial silt dominated reservoir environment.	This suggests the model should have been better at predicting the transport, because many of the transport functions are for sand. While not in the identical situational use, it is interesting that the results are similar.
Ex-A-15 Appendix A, P. 29, para 1	The first sentence that models were calibrated to samples is misleading in that there was no comparison of computed versus measured (based on concentration) sediment load but rather of percentages of sand/silt/clay	Agree; text has been modified on page 29, including Table 7, to indicate that the particle size data was compared to the model output.
Ex-A-16 Appendix A, P. 35, Table A1	**Original Comment:** It appears that the results were computed with Log-Pearson Type III distribution. The Appendix should note that this distribution is not always applicable for controlled systems. **Additional Comment:** Noting that the difference between the in and out curves may be due to flow regulation is not the same as recognizing that the assumed distribution itself may not be appropriate for regulated systems.	**Original Response:** I noted the difference might be due to flow regulation. **Additional Response:** According to "Water Committee on Water Information" http://acwi.gov/hydrology/Frequency/B17bFAQ.html, the issue with regulated flows is the effect on natural peaks. If the reservoir is effective at regulating floods, then the difference will be noticeable in the upper middle range with the regulated flow <u>below</u> the natural river flow, then converging again near the upper end. This is not the case when comparing the two stream gages. At the higher ends, the reservoirs do not have the ability to "hold" much water (i.e., the reservoirs are overwhelmed by higher flows) helping to negate this effect. This does not mean that there is zero effect, and it is noted that flow regulation may have some effect.

Comment Code	Comment	Comment Response
Ex-A-18 Appendix A, P. 38-39, Figure A4	**Original Comment:** Not clear how scour loads were computed and curve developed, important as used for model calibration. Also based on suspended load measurements only (no bedload). **Additional Comment:** The original question remains. How were scour loads computed and curves developed? Also, it appears the regression equation in the Figure has changed since the last draft even though the data appears to be the same. Not sure what happened here?	**Original Response:** Scour loads are defined as sediment capable of being lifted from the bed become "SUSPENDED" and transported through the dam. The bed is always moving to some degree, however, this study (and most of Chesapeake Bay Program is concerned with what exits the dam, not necessary how movable is the bed. **Additional Response:** The estimated loads from upstream of the reservoirs plus the tributary input is subtracted from the estimated loads from Conowingo. The scour estimates are used in a total mass balance approach and checked against estimated changes in bathymetry. Estimated data may change depending on the load model and time period chosen. In general, the closer the data is to the center of an estimation time period, the more accurate the estimate becomes. Newer estimates (results) are reflected in regression equations.
Ex-A-20 Appendix A, P. 42, para 1	**Original Comment:** As velocity increases and bed shear increase, wouldn't the time for sediments to settle out also increase, not decrease? **Additional Comment:** It seems the authors are referring to the <u>time available to settle out in the reservoir</u> and not the time it takes to settle. The text and author's response here are not clear. The sentence in question is: "As the reservoir fills with sediment, the velocity increases, perhaps increasing the bed shear (can result in more scour) and decreasing the amount of time for sediments to settle out of the water column thereby reducing deposition." Under the scenario of increased flow velocity and bottom shear, a particle in suspension will remain in suspension longer. That is, it will take longer to settle out of the water column. If the author means to communicate that there is less time available for the particle to settle out of the water column in the reservoir because it is being transported out of that system faster, this should be clearly stated.	**Original Response:** NO, velocity increases, lessening the amount of time for sediment to settle out. **Additional Response:** The word "residence" is added in front of time in the noted sentence (line 7, para 1, page 42).
Ex-B-1 Appendix B, General	**Original Comment:** Lots of discussion about erosion threshold and SEDflume data but not much about deposition shear stress threshold. Are these set equal in the model? **Additional Comment:** Floccing is given importance and described on page 13, it is identified as one of three most critical model uncertainties on page 14, it is presented as a needed improvement to the AdH model on page 60, and it is identified as a source of uncertainty in the main report (2nd paragraph of page 38 in November version). However, I did not see this uncertainty described in Attachment B-1.	**Original Response:** Because of uncertainty in flocculation dynamics, there was no minimum depositional shear stress (based on particle fall velocity of individual particles **Additional Response:** The title of Attachment B-1 has been changed to reflect the fact that it is really a discussion of AdH model simplifications, not uncertainties. The uncertainty discussions are located in Chapter 4 of Appendix B.

Comment Code	Comment	Comment Response
Ex-B-2 Appendix B, General	**Original Comment:** The AdH model TSS upstream boundary condition is directly from the USGS HEC-RAS application. As noted in comments on Appendix A, USGS used a function where upstream TSS = 0.007 $Q^{0.9996}$. For all practical purposes, this is a linear relationship between TSS and Q. Although there is a lot of spread in the data, the maximum concentration reported at any Q is 700 mg/L (with a more general trend around 300 mg/L). It would be worth reviewing the basis and functional form for this upstream TSS BC. Uncertainty bounds and confidence limits for this relationship should also be established. **Additional Comment:** This comment does not appear to have been addressed by a revision to the report.	**Original Response:** Agree. Perhaps the field data collection effort by Exelon and USGS can provide more data for such as effort. **Additional Response:** Please see response to comment Ex-A-1. No changes to the report are warranted. Please note that a linear TSS relationship represents a quadratic load relationship, since the load is TSS times Q.
Ex-B-3 Appendix B, General	**Original Comment:** The AdH model TSS downstream boundary condition differs from the USGS HEC-RAS application. Whereas the USGS TSS downstream BC fit a parabolic function to the data and did not force the relationship to pass through the maximum point (TSS = 3,000 mg/L at Q = 600,000 cfs), the relationship used for AdH is forced through this maximum value. Consequently, at a flow of 600,000 cfs, AdH is calibrated to yield even more erosion than the USGS model. It would be worth reviewing the basis and functional form for this upstream TSS BC. Uncertainty bounds and confidence limits for this relationship should also be established. **Additional Comment:** AdH simulations attempt to approximate the load implied by the product of flow and concentration (Q times C) at Conowingo Dam. The load implied by the data reflects uncertainties in measurements and the timing of those measurements relative to flow conditions (i.e., rising limb, versus falling limb, etc.). The issue is whether the handful of high concentrations measured at Conowingo Dam, or not measured upstream, are accurate and reflective of the true load. The original comment was intended to express these concerns rather than to imply that AdH was curve fit. What effort was put into screening and evaluating the data?	**Original Response:** The USGS did not use this linear function. They used actual data. The maximum value of their actual data set was more like 2700 mg/l. The AdH downstream output of TSS was based on both pass through sediment and bed scour contribution. The output of AdH was not forced through any curve fit. The actual measured values of concentration discharged through Conowingo were plotted as an exponential function that did pass through the maximum value. **Additional Response:** The paucity of available data, especially at high flows, make quantitative assessments of these uncertainties difficult. This is one reason why the AdH model is validated by comparison to several bulk-measured properties, the load being just one. It is true that these unquantified uncertainties render such comparisons somewhat subjective, and could even result in an overly pessimistic perception of the model (if the model is validated to within the known uncertainty of the data, that is as good as it is possible to know). But there is just not enough data to do this analysis.
Ex-B-4 Appendix B, General	**Original Comment:** Boundary conditions should be reviewed to establish defensible ranges/relationships and quantify uncertainties. **Additional Comment:** It is unclear if any action was taken based on this comment.	**Original Response:** Agree. **Additional Response:** The reliance on model-to-model comparisons makes the uncertainties in boundary conditions far less significant with respect to model results, as the impacts of boundary condition uncertainties largely subtract out of the results for model-to-model comparisons. Also, it is not clear that sufficient data exist to perform meaningful uncertainty analyses on boundary conditions. No further action is warranted.

Comment Code	Comment	Comment Response
Ex-B-5 Appendix B, General	**Original Comment:** SEDFLUME cores only penetrated to ~1 ft or less. In some cases the depth of scour identified in Figure 5 often exceeds 1 ft and can exceed 5-8 ft in several locations. Such model results are extrapolations beyond the range of measurements. Cores for the SEDFLUME could not penetrate sediment so it is likely that the erosion resistance of sediment at depth could be much more than at 1 ft below grade. **Additional Comment:** This comment does not appear to have been addressed by a revision to the report.	**Original Response:** I agree. I increased the erosion threshold considerably for these deeper depths (greater than 1 ft) up to 5 – 6 pascals **Additional Response:** Table 1 of Appendix B is correct. For simulation #3, 1 lb/foot^2 is equal to 5 Pascals which is what the modeler used in the run.
Ex-B-6 Appendix B, General	Appendix B-1 mentions transport by density currents several times as a process of sediment transport in reservoirs. What evidence is there that this is occurring in Conowingo Pond?	It typically occurs in reservoirs during low flow, or perhaps with sediment-laden water. But it is not generally of great significance during high flow events.
Ex-B-7 Appendix B, P. ii, para 1	Recommend deleting the 1st paragraph of abstract. As currently written, it comes off largely as the opinion of others (i.e. USGS). Besides, it is not needed given content of rest of abstract.	The paragraph provides historical context for the problem, and is of use to anyone reading the abstract without knowledge of the system. Therefore, the abstract will not be changed.
Ex-B-8 App. B, P. 1-2, para 3/1	How is enforcement of a TMDL standard related to perception of steady-state sedimentation in a reservoir?	It addresses the question of whether the TMDL is likely to increase over time or not.
Ex-B-9 Appendix B, P. 2, para 1	Statement that "[i]n the absence of large flow events, the majority of sediments that enter the two upstream reservoirs transport to the lowermost Conowingo Reservoir" has no clear basis. The AdH report only covers the Conowingo Reservoir; it does not extend to consider reservoirs upstream. This statement should either have a citation, reflecting the work/opinion of others, or it should be deleted.	This statement is based on the discussion of studies of the other reservoirs (referenced in the report), indicating that these reservoirs are in a state of dynamic equilibrium.
Ex-B-10 Appendix B, P. 4-5, entire sect.	This section seems as if it is a summary of work by others; however, there are relatively few direct citations. Recommend updating to include the appropriate citations.	This section is based on a general discussion of studies of the other reservoirs (already referenced in the report), indicating that these reservoirs are in a state of dynamic equilibrium. All citations are present, but a repeat of the USGS citation in the next paragraph has been added, to make it clear that these data being cited are also from that report.
Ex-B-11 Appendix B, P. 5, bottom of page	**Original Comment:** "HEC-6 model did better when included coarser sediments." By using only suspended samples you are missing out on coarser particles that might transport as bedload **Additional Comment:** To state this as a question, is the potential lack of coarser material at the upstream boundary considered in the uncertainty analysis?	**Original Response:** Agree. **Additional Response:** The potential lack of coarser material is not specifically considered in the uncertainty analysis; concur that it is a potential source of error.

Comment Code	Comment	Comment Response
Ex-B-12 Appendix B, P. 8-9	**Original Comment:** Goals stated more clearly here than in main report. This description should be incorporated into the main report. **Additional Comment:** This comment does not appear to have been addressed by a revision to the report.	**Original Response:** Main report will be updated. **Additional Response:** The Appendix B study goals for the AdH model have been added into the main report in Section 3.2. It should be noted that the AdH study goals should not be confused with the overall goals of the LSRWA study.
Ex-B-13 Appendix B, Chapter 4	**Original Comment:** This section does a much better job of describing the uncertainties associated with the AdH results than the main report does. Specifically page 14, paragraph 2 which states that "Because of these uncertainties the AdH model may potentially over-predict to some degree transport of bed sediment through the dam." These points, for all models, need to be more clearly made and emphasized in the main report. **Additional Comment:** This comment does not appear to have been addressed by a revision to the report.	**Original Response:** Main report will be updated. **Additional Response:** The suggested text was previously added to Chapter 3.2, page 39. Text on uncertainty was also added as suggested by comment Ex-C-11.
Ex-B-15 Appendix B, P. 16, para 1	**Original Comment:** USGS model input taken from inflowing suspended load not considering bedload – missing coarser materials? **Additional Comment:** See response 4 rows up. [EX-B-11] To state this as a question, is the potential lack of coarser material at the upstream boundary considered in the uncertainty analysis?	**Original Response:** Agree. Bedload not sampled **Additional Response:** The potential lack of coarser material is not specifically considered in the uncertainty analysis; concur that it is a potential source of error.
Ex-B-17 Appendix B, P. 17, para 1	**Original Comment:** Conservatively high inflowing sediment load assumed and used for all other simulations. This does not appear to have been stressed or explained well in the main report. **Additional Comment:** To confirm, we understand that the HEC-RAS sediment load was increased by 10% to account for the under prediction of sediment loads.	**Original Response:** The USGS used measured suspended sediment concentration data to create a sediment rating curve into the uppermost reservoir. The output to the AdH model was based on HECRAS output to Conowingo. **Additional Response:** Yes, it was increased by 10 percent to account for the under-prediction of sediment loads and to err on the side of conservatism with respect to estimating scour potential in the Conowingo Reservoir -- the more sand that enters the reservoir during lower flows, the more potential for erosion of material from the sediment bed during high flow events.

Comment Code	Comment	Comment Response
Ex-B-19 Appendix B, P. 22-32, entire section	In the absence of data that were considered sufficient for calibration, please explain how parameterizing AdH to reproduce results from USGS studies independently validates AdH results: 1. If USGS results are driven by empirical load estimates (or regression equations) that assume different functional relationships for upstream and downstream locations, and scour is imputed by the difference between downstream and upstream estimates, do AdH simulations parameterized to reproduce USGS results provide an independent confirmation of those results? 2. If AdH is constrained by SEDflume core measurements, what are upper and lower bound limits of AdH solids concentrations given upper and lower bound parameterizations based on SEDflume core data (without limiting the erodible depth of sediment as described to 1 ft)?	In the absence of sufficient data for calibration, boundary conditions, and model parameterization, AdH was subjected to a "validation exercise." The results were compared against several bulk parameters: the USGS scour load estimates, the grain size distribution of the outflow, and the net change in volume of the reservoir, computed from bathymetric differences. Since the model compared well to these three semi-independent sources of data, it was determined that the model was representing the basic sediment dynamics of the reservoir with sufficient fidelity to conduct model-to-model comparisons and observe modeled trends.
Ex-B-21 Appendix B, P. 23, para 3	**Original Comment:** "The properties of the lower two feet were either approximated from the SEDflume results or determined from literature values." It would be useful to have a table of these properties. **Additional Comment:** This comment does not appear to have been addressed by a revision to the report.	**Original Response:** I estimated increases in shear stress from literature. **Additional Response:** Concur. Noted sentence has been revised to reflect source of shear stress values from literature only.
Ex-B-22 Appendix B, P. 34, para 1	**Original Comment:** Middle of paragraph, sentence starting with "This channel was not included…" and next sentence should include a citation. **Additional Comment:** This comment does not appear to have been addressed by a revision to the report.	**Original Response:** Agree. **Additional Response:** Concur. The noted paragraph in Appendix B has been revised to include references to the USGS and Exelon surveys. The source of the bathymetric data that described the general channel shape and slope is believed to be LIDAR data from USGS. However, this cannot be confirmed since the original AdH modeler has retired from federal service.
Ex-B-24 Appendix B, P. 46, para 2	**Original Comment:** Last sentence of paragraph is speculative and goes to the uncertainty of using the HEC-RAS model as the input to the AdH model **Additional Comment:** This comment does not appear to have been addressed by a revision to the report.	**Original Response:** Agree. **Additional Response:** This comment was addressed by the inclusion of the word "potentially" in the noted paragraph. No further text change is warranted.

Comment Code	Comment	Comment Response
Ex-B-25 Appendix B, P. 52+, General	**Original Comment:** The description of this downstream model has much less detail and is shorter than the sections dealing with the upstream model. **Additional Comment:** This comment does not appear to have been addressed by a revision to the report.	**Original Response:** Agree. **Additional Response:** While the description is shorter, it contains sufficient information to characterize the modeling effort.
Ex-B-26 Appendix B, P. 53-54, para 1, Figure 34	**Original Comment:** What is the reference for the ratio of roughness with SAV? **Additional Comment:** Add reference to Berger et al. to text and/or figure.	**Original Response:** The AdH user's manual **Additional Response:** Change has been made to Appendix B.
Ex-B-27 Appendix B, P. 55, para 1	**Original Comment:** No description is given of the upstream or downstream boundary conditions. Assuming that the U/S BC is the outflow from the U/S AdH model, but which run? Or were measured SSCs used? **Additional Comment:** Does not answer the question of what was used in the modeling exercise that produced the figures and led to conclusions.	**Original Response:** The upstream boundary was an arbitrary flow, not Specific Conowingo outflow. **Additional Response:** The text in Appendix B has been altered to reflect that this is a synthetic event that is simulated, not actual observed or modeled boundary conditions.
Ex-B-30 Appendix B, P. B-1	**Original Comment:** Using the provided graphs, the 86,000 cfs limit where all flows pass through the powerhouse accounts for about 30% of the annual sediment load. This should be mentioned. **Additional Comment:** Original comment was based on Figure 5. Maybe the ordinate (y-axis) should be labeled average annual load? It is notable that 70% of the average annual load does NOT go through the powerhouse (usually due to larger events).	**Original Response:** Doesn't that depend on storm frequency? Not sure about that. Maybe "average" annual sediment load. **Additional Response:** This cannot be meaningfully quantified without some integration of storm frequency into the calculations.
Ex-C-1 Appendix C, General	The use of metric units when everything else is in English unnecessarily confuses the issue.	The investigation reported in Appendix C was conducted using SI units. These are the international standard in science and engineering. Unfortunately, federal planning studies meant for public consumption in the United States report English (non-metric) units, so as to not confuse non-scientist Americans.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
Ex-C-2 Appendix C, P. 18, para 3	**Original Comment:** Although period examined has a range of flows, how representative is the flood frequency during this period with the long-term flood frequency? **Additional Comment:** Does the use of the 1996 storm event combined with the high nutrients observed in 2011 make for either a worst case, or at least very conservative, estimate of Bay impacts?	**Original Response:** The report indicates two erosion events (flow > 11,000 m3 s-1) occurred during the ten-year simulation period. These events were in April 1993 and January 1996. Langland's report indicates flows in excess of 400,000 ft3 s-1 (11,000 m3 s-1) have a recurrence interval of five years. Two events in ten years correspond well with the expected recurrence. **Additional Response:** The model application did not combine the 1996 storm event with high nutrients observed in 2011. The model characterized the nutrient composition of scoured material based on multiple surveys of bottom sediments in Conowingo Reservoir. The characteristic nutrient concentrations were combined with estimates of the mass of sediment scoured during the 1996 storm. The characteristic bottom sediment nutrient content exceeded the observed nutrient content of material flowing over the dam in January 1996. Consequently, model results tend towards the "worst case." They are not the absolute worst case but the effects on the Bay are more severe than if the nutrient fractions observed in 1996 were employed.
Ex-C-3 Appendix C, P. 19, para 3	**Original Comment:** How was the Conowingo Pond equilibrium condition determined? **Additional Comment:** Original comment still stands. Please address as appropriate following the next round of LSRWA comment review.	**Original Response:** The equilibrium bathymetry was determined by the team that modeled Conowingo Reservoir (Mike Langland, Steve Scott, and associates). This question must be answered by that team. **Additional Response:** The sediment storage capacity (i.e., equilibrium) was determined by USGS in Reed and Hoffman, 1996, based on conveyance equations.
Ex-C-4 Appendix C, P. 23, entire chapter 4	**Original Comment:** How are the scoured sediment and nutrient loads from Lake Clarke and Lake Aldred accounted for? Is it similar to the process for which Conowingo-scoured sediments (and thus nutrients) are superimposed on the WSM nutrient loads input to the WQM as described in Chapter 4 of Appendix C? **Additional Comment:** While author's response is correct, it still does not address the upper reservoir issue directly.	**Original Response:** Sediment loads from Lake Clarke and Aldred are not specifically identified in the Chesapeake Bay loads. The Chesapeake Bay model only "sees" loads at the Conowingo outfall. Loads from Clarke and Aldred are combined with other loading sources at this outfall. The only material superimposed on the WSM loads is scour calculated in Conowingo Reservoir. **Additional Response:** These are considered lumped into the sediment inflow into Conowingo Reservoir, as they are taken from HEC-RAS models of the upper reservoirs, which would include these scour loads.
Ex-C-5 Appendix C, P. 23, para 1	**Original Comment:** "The loads at the head of the reservoir system are supplemented by inputs from the local watersheds immediately adjacent to the reservoirs." It would be useful if there were a figure depicting this either in the main report of this Appendix (or both). **Additional Comment:** It would be useful to the reader to have such a figure.	**Original Response:** A figure such as this one might be included in the main report. This doesn't appear to be a critical deficiency. **Additional Response:** Comment noted. The addition of the figure is not considered critical to the reader's understanding of the modeling effort.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
Ex-C-6 Appendix C, P. 26, para 3	**Original Comment:** Bullet 5 – "For key scenarios, an alternate set of nutrient loads was constructed based on 1996 observed nutrient fraction." These should be included and discussed in the main report. **Additional Comment:** Given the uncertainty of the exact composition of the nutrients, the main report should include discussion about the results from the scenarios which used the alternate nutrient loads.	**Original Response:** The results from these scenarios are reported in the appendix to this report. **Additional Response:** Basic time-series plots were produced for the scenario conducted with loads based on the 1996 sediment nutrient fraction. As noted previously, these are available from the Baltimore District Corps of Engineers. Since this scenario was based on anomalous conditions and was not employed in the study, no further analysis was conducted on this scenario.
Ex-C-10 Appendix C, P. 53, last para	Last paragraph at bottom of page 53 in public draft report, makes a strong case that the Conowingo Dam is still providing WQ benefits. Similar argument at bottom of page 55 in public draft report.	At times, the dam in its present state provides water quality benefits to the bay. In basic terms, the reservoir slowly accumulates organic matter and nutrients that come down the Susquehanna River. The accumulated material is suddenly released during scour events. During intervals of accumulation, the Chesapeake Bay benefits because organic matter and nutrients are retained in the reservoir rather than pouring into the Bay. The benefits are "repaid" however, when the accumulated material is scoured and deposited in the Bay.
Ex-C-11 Appendix C, P. 119, para 1	**Original Comment:** "Model results can be reported with extensive precision, consistent with the precision of the computers on which the models are executed. Despite the precision, model results are inherently uncertain for a host of reasons including uncertain inputs, variance in model parameters, and approximations in model representations of prototype processes." This statement and the rest of this section do a much better job of clearly stating the uncertainties associated with models and model results than the main report does. While the main report does generally acknowledge some model limitations/uncertainties it does not do as good of a job as the Appendices in stating how uncertain some of these results may be. **Additional Comment:** The main report should state as clearly as the Appendix does how uncertain some of these results may be.	**Original Response:** The potential to alter the main report to reflect this section of Appendix C is left to the authors of the main report. **Additional Response:** In the draft report for public review, the suggested text change had been made to Chapter 3, paragraph 2., prior to being released for public review.
Ex-C-13 Appendix C, P. 119-120	The new report should acknowledge that another area of uncertainty is how much of the nutrient load coming from the three reservoir system is due to the Conowingo Pond alone versus a combination of all three reservoirs, since they are all likely to be in some form of dynamic equilibrium. Needs to be addressed with a more refined model of the three reservoirs.	Our study emphasizes the effect of additional material released to the Bay due to the gradual filling of Conowingo Reservoir. Evidence suggests that the reservoir has arrived at or is approaching dynamic equilibrium, and that material that previously accumulated on the bottom is now released to the Bay. In addition, less sediment is able to deposit due to increased velocities resulting from reduced storage capacity. The study also examines potential remediation measures in Conowingo Reservoir. In the long-term, no additional material enters the Bay from the two upper reservoirs. They arrived at dynamic equilibrium decades ago and the influence of these reservoirs is already incorporated into monitoring, modeling and management actions. No remediation measures been proposed or examined for the two upper reservoirs. Consequently, the loads from these reservoirs do not require mention as a source of model uncertainty in Appendix C.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
Ex-D-1 Appendix D, P. 3, paragraph 3	**Original Comment:** The last portion of this paragraph starting with "During the 2017 Midpoint Assessment…" discusses decisions being made regarding any necessary adjustments to the CB TMDL. It should be clearly noted here that Appendix T of the TMDL discusses actions that will be taken in the event that the status of Conowingo Pond changes from previously understood conditions. The language used should be that contained in TMDL Appendix T. **Additional Comment:** To clarify, Appendix T of the TMDL already takes into consideration actions that should be taken if it is found that Conowingo Pond has reached dynamic equilibrium. The TMDL specifically states, "…if future monitoring shows the trapping capacity of the dam is reduced, then EPA would consider adjusting Pennsylvania, Maryland, and New York 2-year milestones loads based on the new delivered loads."	**Original Response:** Appendix T is correctly cited, referenced, and characterized in Appendix D. It's clear from the text what's directly quoted and what's paraphrased. The citation and attribution is entirely correct and changes are unwarranted. **Additional Response:** Appendix T outlines some strategies that could be taken to address sediment build up behind the dam. The referenced text in the comment from Appendix T of the 2010 TMDL documentation is correctly quoted and cited in Appendix D and further text will not be added.
Ex-D-2 Appendix D, P. 21, Figure 5	**Original Comment:** While the differential values are useful, it is helpful for the reader to also list absolute nonattainment values rather than just relative values. **Additional Comment:** We disagree; having absolute nonattainment values is the only way to compare various loading scenarios and time periods. We understand the goal of reducing confusion and improving clarity, but we feel these data need to be provided somewhere for the public to digest. We cannot fully evaluate the modeling scenarios without this critical piece.	**Original Response:** Listing the absolute values for Scenario LSRWA-21 and LSRWA-3 (and explaining why the 1996-1998 period is different from the 1993-1995 period and the reason they're different , etc., etc. would add confusion, not clarity. Adding absolute nonattainment values is unwarranted. **Additional Response:** See response to comment Ex-40.
Ex-D-5 Appendix D, P. 25, Table 3	**Original Comment:** 1) It would be useful to add a row for each of these columns specifically indicating which years are being analyzed for WQ attainment. 2) The nonattainment's should be listed with more significant figures (e.g., 1.4% nonattainment instead of 1% nonattainment) 3) The absolute nonattainment values (e.g., LSRWA-21 had 19% deep channel DO nonattainment in segment CBMH4) should be listed in addition to the relative nonattainment numbers (e.g., an increase of 1% nonattainment over the Base TMDL Scenario (LSRWA-3)) **Additional Comment:** Please see our previous comment (2nd comment, page D-1) [EX-D-2]. We believe it is crucial that absolute nonattainment values are provided somewhere in order for the reader to comprehensively evaluate the model results.	**Original Response:** 1) The text on (example page 18 paragraphs 2 and 3) provides sufficient information on when the 1996-1998 simulation period is used in order to simulate the January 1996 storm. 2) A single significant figure is sufficient and is consistent with the level of significance typically reported in the Chesapeake TMDL. 3) Listing both the absolute value and the base value along with the difference between the base scenario is from the base as suggested would be redundant, confusing, and unwieldy. **Additional Response:** See response to comment Ex-40.

Comment Code	Comment	Comment Response
Ex-D-6 Appendix D, P. 25-26, Tables 3-5	**Original Comment:** Why aren't LSRWA-22, 26, 27 discussed in these tables? **Additional Comment:** Important to note that only the worst case scenarios are presented in the tables.	**Original Response:** LSRWA-22, 26, and 27 are discussed in the text. **Additional Response:** All relevant findings were presented in the reports text, tables, and figures.
Ex-D-8 Appendix D, P. 31, para 1	**Original Comment:** "During episodic high flow scour events, large nutrient loads are delivered to Chesapeake Bay." The term "scour events" lead the reader to believe that the scour is responsible for all nutrient loads going to the Bay when in fact the vast majority of the loads originate from watershed sources upstream of Conowingo Pond and the Lower Susquehanna Reservoirs. This comment is true of any reference to "scour events" throughout the main report and appendices. **Additional Comment:** As stated in the updated text and pointed out by STAC in their review, DO water quality standards are greatly affected by seasonality; that is, the summer hypoxic period is the season of concern and "a small difference in DO during this period makes a big difference to living resources…" As stated in the Appendix, deep-water and deep-channel DO water quality standards are on a "knife-edge of attainment". STAC went on to say that, "it strikes the reviewers that changes in chlorophyll and dissolved oxygen associated with "normal" inter-annual variability in climate and nutrient loading are much higher than those associated with additional Conowingo Dam-derived nutrients as simulated here."	**Original Response:** The scenarios referred to in the conclusion section separated the loads from the watershed and the scoured loads from the Conowingo by the difference between scenarios as described in the results section. The increase in nonattainment in Deep Water and Deep Channel DO (described in the results and discussed in the conclusions) were specifically because of the scoured nutrients from the Conowingo Reservoir. **Additional Response:** As described previously, the relevant scenario of the watershed implementation plans (WIPs) that are applied to attain Chesapeake water quality standards is done by a difference of the same WIP scenario with Conowingo scour of sediments and nutrients simulated, and the same scenario with Conowingo scour of sediments and nutrients not simulated. The difference between the two scenarios is the estimated water quality nonattainment that is solely attributed to the Conowingo scour.
Ex-D-9 Appendix D, P. 31, para 3	**Original Comment:** The last sentence of this paragraph discusses how the TMDL will account for changes in the trapping capacity of Conowingo Pond as per TMDL Appendix T. When discussing the TMDL and changes in Conowingo Pond trapping capacity throughout this Appendix, and the main report, it is important to always use consistent language from Appendix T in regard to how this will be handled. **Additional Comment:** See first response at beginning of table --- [To clarify, Appendix T of the TMDL already takes into consideration actions that should be taken if it is found that Conowingo Pond has reached dynamic equilibrium. The TMDL specifically states, "…if future monitoring shows the trapping capacity of the dam is reduced, then EPA would consider adjusting Pennsylvania, Maryland, and New York 2-year milestones loads based on the new delivered loads."]	**Original Response:** Appendix T is correctly cited, referenced, and characterized in Appendix D. It's clear from the text what's directly quoted and what's paraphrased. The citation and attribution is entirely correct and changes are unwarranted. **Additional Response:** Text in this paragraph has been changed to exactly quote Appendix T of the TMDL, specifically text in Appendix D, para 3, on p. 31 now reads: ..."then the Chesapeake Bay Program partners will need to consider adjusting the Pennsylvania, Maryland, and New York 2-year milestone loads based on the new delivered loads to ensure that all are meeting their target load obligations."
Ex-E-1 Appendix E, General	**Original Comment:** The bathymetric map does not indicate the elevation datum for the contours. **Additional Comment:** The location map of the first draft (Figure 1) has been replaced with a NOAA bathymetric map. Contours, however, are not legible.	**Original Response:** Contour info added. **Additional Response:** The bathymetric contours are not critical for showing the location of the sample sites. For depth information at the specific sample sites, please consult Table 3, page 8, in Appendix E.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
Ex-E-2 Appendix E, P.2, para 1	The Susquehanna River drainage does not include six states; it includes three states.	In this context, the reference is to the drainage of the Chesapeake Bay which includes six states. No report change is required.
Ex-E-3 Appendix E, P.2, para 1	What is meant by 'increasing' in the sentence: "In addition to an increasing amount of sediments being deposited behind Conowingo Dam in the Conowingo Reservoir, there is an increasing quantity of sediment that is delivered to the Chesapeake Bay by bypassing the dam."? Increasing relative to what?	Replaced 2nd and 3rd sentences in paragraph with "Historically, these dams functioned as sediment traps, reducing the amount of sediments and associated nutrients reaching the Chesapeake Bay. Over time, the trapping efficiency of these dams has diminished as the volume of sediment trapped behind the dams approached storage capacity. As a result, increasingly more sediments bypass the dams and enter into the Chesapeake Bay. There is growing concern that, if not properly managed, the increase in sediment delivery to the Chesapeake Bay will have deleterious effects on the Bay's ecosystem."
Ex-E-4 Appendix E, P.2, para 4	Where were samples #1 and #2 to be located in the Susquehanna River?	Samples 1 and 2 were located in the lower Susquehanna River proper where hard rock was exposed along the river channel. A note indicating that these locations were not actually sampled was added to the Figure 1 caption.
Ex-E-5 Appendix E, P.4, para 3	Please indicate that the Bennett and Lambert method provides wet bulk density values.	"Wet" has been inserted before "Bulk" in first sentence of noted paragraph.
Ex-E-6 Appendix E, P.4, para 4	Remove comma after Kerhin and others.	Comma has been removed from noted location.
Ex-E-7 Appendix E, P.5, para 1, Figures 2-3	Correct citations are Shepard (1954) and Folk (1974), not Shepard's (1954) or Folk's (1974). Remove apostrophe.	Text has been corrected.
Ex-E-8 Appendix E, P.6,last para	Insert period at end of sentence.	Text has been corrected.
Ex-E-9 Appendix E, P. 7,Figure 2	Caption should indicate that the classification is based on percent of sediment size classes in sample. Otherwise the numbers on the tertiary diagram are not explained.	"Sediment type classification is based on relative percentages of each size component (sand, silt and clay)." has been added to Figure 2 caption.
Ex-E-10 Appendix E, P. 7,Figure 3	The sediment type codes in the tertiary diagram should be explained, as per Table 7.	"Sediment type classification is based on relative percentages of each size component (gravel, sand, and mud (i.e., silt plus clay)." has been added to the Figure 3 caption.
Ex-E-11 Appendix E, P. 8, Table 3	The columns labeled #alive and #dead appear to refer to clams. Please note this on table. The footers (#6, #12, #17) are not lined up nor are they clear as to meaning. Please clarify.	Text has been corrected.
Ex-E-12 Appendix E, P. 8, Table 4	Please note that color notations (e.g., 5 YR 3/4) are in accordance with the Munsell color system. "Asian" for sample 7 should be capitalized	"Colors and color codes (e.g. 5 YR 3/4) from the Rock-Color Chart (Rock-Color Chart Committee, 1984)." has been added to the Table 4 caption.

Comment Code	Comment	Comment Response
Ex-E-13 Appendix E, P. 11, Fig. 4	This is a very important graph. It may show up better if printed in landscape view. To help the reader understand this graph, interpretive footnotes may be useful, e.g., the steeper the slope the better the sorting; the 50% mark is the median grain size; etc.	This graph was presented in landscape view in the original file submitted. Minor explanations have been added. Depending on the audience's experience with this type of data, further detailed explanations could be rather lengthy.
Ex-E-14 Appendix E, P. 14, Tab. 7	Please note that bulk density is wet bulk density.	Text has been corrected.
Ex-F-1 Appendix F, General	**Original Comment:** Cover letter states "samples were collected along a representative cross-section from the catwalk on Conowingo Dam…" Conowingo Dam catwalk sampling is not representative of the channel cross-section at the dam. **Additional Comment:** The reader of this letter may take the originally commented upon statement as meaning the data collected are representative of the river at the dam. In a published document prepared by USGS it is noted these data are only representative of the river in front of the turbines. That is, in the USGS Quality-Assurance Project Plan (QAPP) for the Maryland River Input Monitoring Program and Nontidal Network Stations for the period July 1, 2013 to June 30, 2014 (Updated July 2013) available at: http://www.chesapeakebay.net/documents/MD_RIM_QAPP_2013_2014.pdf it is written: "Previous testing at Conowingo Dam has shown that this approach provides a representative sample for flows confined to the turbines. However, sampling from the turbines can be unrepresentative of spillway discharges since the flows originate from different locations in the reservoir's vertical profile." The Introduction of this Appendix should include the same language.	**Original Response:** The data transmittal letter dated February 10, 2012, represents an accurate assessment of the relation between catwalk and cross- sectional variability, given the analysis of available historical USGS quality control **Additional Response:** The sample-collection methods are an assessment of representativeness based on historical analyses. The QAPP notes that the turbines can be unrepresentative. However, these differences were not observed in a previous study comparing catwalk and spillway samples.
Ex-F-2 Appendix F, General	**Original Comment:** A brief report to accompany the data would be useful (in addition to the cover letter provided). The report could highlight the sampling methods used, field conditions, hydrograph, sampling comments/notes, etc. In its current form, the Appendix does not provide the reader with very many details about the sampling event(s). **Additional Comment:** While it is understood that a brief report goes beyond the time and funding constraints of this effort, a more detailed Introduction providing a general overview of the sampling methods, field conditions, hydrograph, sampling notes/comments, etc. would be helpful to the reader to put the data collected into context.	**Original Response:** The data were collected using standard methods for the site as outlined in the QAPP on file with EPA CBPO. Streamflow records for the periods represented by these samples as well as the analytical results themselves are publically available at http://waterdata.usgs.gov. Limited time and funds availability precluded the preparation of a separate report detailing these data. **Additional Response:** The most important piece of information for context of the sediment data provided is Instantaneous discharge presented in Table 6. In 2010 and 2011, these analyses were performed on samples collected at streamflows ranging from 233,000 to 617,000 cubic feet per second.
Ex-F-3 Appendix F, General	The sampling does not appear to take into account the travel time of the water and sediment through the reservoir system during a storm event. It would be useful if the author could provide comment on what effects this may have on the use of the data and any subsequent results/conclusions.	The sampling was conducted to measure the Susquehanna River at the Conowingo Dam. No consideration was given to reservoir travel time in determining when to sample.

Comment Code	Comment	Comment Response
Ex-I-1 Appendix I-7, General	In response to STAC comments pertaining to the AdH model, there are multiple references to "Response under development by ERDC AdH modeler" yet no response is actually provided. Please provide a response for each of these instances.	Responses have now been finalized and will be included in the final document.
Ex-I-2 Appendix I-7, P. 17	The graph in Appendix A (Figure 7) does not appear to have been updated as indicated.	Figure 7 is the sediment-transport curve for Conowingo, no "updates" were ever needed on this graph.
Ex-I-3 Appendix I-7, P. 28	The notes to Figure 1-6 (Main Report) do not appear to have been changed as indicated.	In the October 2014 public draft report (Figure 1-6, page 18), the third note which contained the commented language was removed from the text.
Ex-I-4 Appendix I-7, P. 29	The definition of saprolite does not appear to have been added as indicated.	In the October 2014 public draft report (Appendix K, page 11), a definition of saprolite was provided in parentheses at the appropriate location in Appendix K. The term "saprolite" does not appear in the October 2014 main report. Definition of saprolite has been changed slightly. Parenthetical expression on page 12, paragraph 2, 1st sentence (May 2015 version), was changed to "(decomposed rock that has weathered in place)".
Ex-I-5 Appendix I-7, P. 29	The deletion of 'river' does not appear to have been made as indicated (now in Appendix K).	The commenter is correct. Change was made to Appendix K on page 11, line 5 ("natural variations ....").
Ex-J-1 Appendix J, Attachment J-1, Page 2, para 2	**Original Comment:** The implication that sediment plumes as represented by TS Lee in Figure 3 are due to scour from Conowingo Reservoir is incorrect. As noted in the main report, these plumes are predominantly comprised of sediment from the watershed upstream of Conowingo Reservoir. **Additional Comment:** Please make "dam" plural. That is, change to: "...from scour behind the dams."	**Original Response:** Page 2, paragraph 2 – change the last sentence to "The massive plume of sediment that occurred following Tropical Storm Lee extended from the Conowingo Dam past the mouth of the Patuxent River (Figure 3) and originated both from the watershed and from scour behind the dam.", with the majority of the sediment coming from the watershed. **Additional Response:** Text has been changed as noted.
Ex-J-3 Appendix J, Attachment J-4, Page 1, Table	**Original Comment:** It is not clear what reservoir bathymetry/trapping efficiency means. If it is simply referring to trapping efficiency, then it should be stated as such. The actual trapping efficiencies should be listed as well (e.g., 55%) rather than just a level associated with a time period. **Additional Comment:** It would be useful to the reader to have the trapping efficiency explicitly listed for each scenario. Please see our example matrix provided as an attachment to our cover letter.	**Original Response:** For scenarios 2-6 the input parameter is actual reservoir bathymetry per AdH. The exception is Scenario 1, which did not use AdH but was the TMDL/WSM only run which considered trapping rates/efficiency of the 1990s (which was around 55%). What is most important is what era is represented in the simulation which is depicted. **Additional Response:** Comment noted; however, we believe the information is available in the main document (e.g. Table 4-6) and the appendices, so no change will be made to the text.

Public Review Comments and Response – October 2014 Draft
Review Period: November 13, 2014 – January 9, 2015

Comment Code	Comment	Comment Response
Ex-J-5 Appendix J, Attachment J-4, P. 1/7/8, Table	**Original Comment:** The DO nonattainment's should be listed by segment (similar to pieces from the stoplight plots), and must be listed as absolute numbers as opposed to differentials from other runs, as it becomes confusing for the reader to follow which runs are being compared to other runs. Also, the nonattainment's should carry an additional significant figure (e.g., 1.4% instead of 1%). **Additional Comment:** As noted in some Appendix D comments, we believe listing absolute nonattainment values by segment would be useful. We also understand that providing the data in this report may be difficult. We are interested in the absolute nonattainment values if there is another way for them to be provided.	**Original Response:** Organizing nonattainment by segment does not work in the format of the table. As comment states Appendix D stoplight plots organizes by segment if reader wants to view it this way. Listing the absolute nonattainment values is unwarranted. Significant figures will remain as we received comments earlier on that that amount of precision was not conducive. **Additional Response:** See response to comment Ex-40.
Ex-K-1 Appendix K, P. 1, para 1	**Original Comment:** While the last portion of this paragraph describes why the discussion is focused on Conowingo it does not explain why there is no focus on the two upstream reservoirs. Why are these reservoirs not discussed at the same level of detail as Conowingo? **Additional Comment:** To be consistent, the report should acknowledge that Holtwood and Safe Harbor are in "dynamic equilibrium" The revised text still does not quantify or adequately describe how much more important Conowingo Pond loads are to Susquehanna River sediment loads versus loads from Lake Clarke or Lake Aldred. In general, throughout the report and appendices a satisfactory reason has not been given as to why so much more importance has been placed on Conowingo Pond scour as opposed to scour from Lake Clarke and Lake Aldred.	**Original Response:** Modify sentence "As such, it has potentially a large influence on the Chesapeake Bay during storm events due to scouring of nutrients and sediments stored behind this dam." to "Holtwood and Safe Harbor Dams were known to be at equilibrium at the start of this assessment. Because Conowingo was not believed to be in dynamic equilibrium and it reaching that condition could have a potentially large effect on the Bay, more attention is focused on Conowingo Dam than Holtwood or Safe Harbor Dams in this section." **Additional Response:** Concur with consistently using term "dynamic equilibrium." Noted sentence in the original response has been revised with the insertion of the word "dynamic" before "equilibrium". While it would ideally have been useful in retrospect to have also included detailed consideration of processes occurring in dynamic state in upper reservoirs, that was not the context of concern that propelled study and was effectively beyond study scope. It is likely that having done so would not change findings of the study, although it could provide additional detailed consideration of processes occurring within those reservoirs while in dynamic equilibrium condition.
Ex-K-2 Appendix K, P. 1, para 1	**Original Comment:** This paragraph, and the third paragraph in particular, attempt to explain why Conowingo Pond is of particular importance; however, they do not quantify or adequately describe how much more important it is to Susquehanna River sediment loads versus Lake Clarke and Lake Aldred. **Additional Comment:** It is hard to follow why believing Lake Clarke and Lake Aldred are in dynamic equilibrium means that they are not capable of having an equally important impact on Bay health. We understand that the initial focus was on Conowingo because it appeared to be fundamentally different (larger in size, trapping more) than the other two reservoirs, but now that we understand that all three reservoirs have reached dynamic equilibrium, we feel that future efforts should be more evenhanded between all three impoundments.	**Original Response:** Dealt with by response to #35. **Additional Response:** The LSRWA report has no recommendations for any management measures in Conowingo Reservoir. Because dynamic equilibrium processes would presumably be comparable in upstream reservoirs, it is unlikely that any management measures would have been recommended for implementation had they been studied.

Comment Code	Comment	Comment Response
Ex-K-3 Appendix K, P. 5, para 4	**Original Comment:** The report identifies that climate change has resulted in recent years being wetter. In general, wetter years would mean increased watershed sediment delivery and transport through the reservoirs. This potentially conflicts with the conclusion that loads are increasing as a consequence of reduced trapping/dynamic equilibrium. It is unclear how earlier statements regarding decreases in trapping can be evaluated without first establishing how hydrologic (and land use) changes impact the watershed the river system. **Additional Comment:** The original comment is still valid. The revision does not address the fact that conclusions are made that focus on sediment transport within Conowingo Reservoir without also noting that watershed changes and responses to climate also contribute to changes in sediment and nutrient delivery to the Bay.	**Original Response:** Added sentence to paragraph 2 on page 97, before "All of the Table 4-1 scenarios…" "However, there were no modeling runs formulated for forecasted climate change conditions; a general discussion of global climate change impacts can be found in Section 5.1.4." **Additional Response:** Text has been changed in Section 4.1.4 of the main report and now addresses implications for changes in sediment and nutrient transport. No change has been made to Appendix K as the paragraph in Appendix K references Chapter 4.1.4 of the main report.
Ex-K-4 Appendix K, P. 11, para 3	**Original Comment:** The Exelon study cited (RSP 3.12) does not mention contributions to vertical circulation in the reservoir. **Additional Comment:** The corrected citation should be for the final report which is 2012, not 2011. A similar citation change was made at the end of the 2nd preceding paragraph (page 11). That change was incorrect. At the end of the first paragraph on page 11 of Appendix K the citation should be URS and Gomez & Sullivan (2012a).	**Original Response:** Citation corrected to "(Normandeau Associates and GSE, 2011)" -- see comment response #48 for citation details. **Additional Response:** Citations have been corrected.
Ex-K-5 Appendix K, P. 16, para 4	**Original Comment:** Statement that nutrients released from bottom sediments provide a substantial portion of the nutrients required by phytoplankton is perhaps a little simplified. First, as noted, vertical stratification limits the vertical exchange of dissolved oxygen between the surface and bottom waters (as pointed out on page 34 paragraph 4) and, therefore, the vertical exchange of bottom water nutrients to surface waters is also limited. In addition, as pointed out in paragraph 3 of page 33, nutrients are recycled and reused many times over as they move downstream in rivers towards the Bay. They are also recycled and re-used in the Bay as well. Bottom nutrients are likely to contribute to the production of surface phytoplankton, but it is not clear what the balance between surface recycling of nutrients and bottom release of nutrients is in determining algal productivity. **Additional Comment:** Suggest adding “could” as shown in red “ Nutrients contained in Bay bottom sediments are re-released into the water column seasonally, and these regenerated nutrients could provide a substantial portion of the nutrients required by phytoplankton, particularly in the middle Bay. "	**Original Response:** Concur that complicated topic, so will further simplify/generalize. Change "Nutrients contained in Bay bottom sediments are re-released into the water column seasonally, and these regenerated nutrients provide a substantial portion of the nutrients required by phytoplankton in summer, particularly in the middle Bay. " to "Nutrients contained in Bay bottom sediments are re-released into the water column seasonally, and these regenerated nutrients provide a substantial portion of the nutrients required by phytoplankton, particularly in the middle Bay. " **Additional Response:** Text has been changed as suggested, with the addition of "could."

Comment Code	Comment	Comment Response
Ex-K-6 Appendix K, P. 18, para 3	**Original Comment:** "Monitoring of nutrients in the Susquehanna River has shown that the flow-adjusted annual concentrations of total nitrogen, total phosphorus, and suspended sediment delivered to the dams have been generally decreasing since the mid-1980s." It is unclear how much of any trends are due to increasing data density over time and reduced uncertainty. There may be some apples and oranges comparisons beneath everything. As stated in the Zhang et al. (2013) paper, there is interpolation and extrapolation in load estimates. The next statements that "This decrease is attributed to the success of environmental management measures. However, total nitrogen, total phosphorus, and suspended sediment loads from Conowingo Reservoir itself to the Chesapeake Bay have shown an increasing trend since the mid-1990s, indicating decreasing reservoir trapping capacity (Zhang et al., 2013)" need further evaluation. Changes in sediment export from the River could also include changing sediment delivery from the watershed. It is unclear how the data analysis on which these statements rely was performed **Additional Comment:** Original comment is still valid.	**Original Response:** Change middle sentence from "This decrease is attributed to the success of environmental management measures." to "Environmental management measures in the watershed contributed to this decrease." to be less precise over relative importance of management measures versus other causes. **Additional Response:** Original sentence stating that monitoring has shown decreases includes word "generally" to imply that there are bumps/uncertainties. While nutrient and sediment loads from the river channels versus the watershed should be elucidated to determine appropriate BMPs, that difference is subtle compared to the overarching concern that incentivized the study, that is, the Conowingo Reservoir filling to capacity and potential management measures in the reservoir itself.
Ex-K-7 Appendix K, P. 18, para 3	**Original Comment:** Zhang et al (2013) refers specifically to the reservoir system (reservoirs plural) and loads from the Conowingo Dam outlet. To quote from their conclusions: "Flow-normalized loads of SS, PP, and PN at the outlet of the Conowingo Reservoir have been generally rising since the mid-1990s. The reservoirs' capacity to trap these materials has been diminishing, and the Conowingo Reservoir has neared its sediment storage capacity." **Additional Comment:** The revised statement still does not reflect the cited Zhang et al 2013 appropriately. Suggested edits are shown in red (page 18 of Appendix K): "One study has indicated that loads of total particulate nitrogen, total particulate phosphorus, and suspended sediment from the reservoir system of the lower dams to the Chesapeake Bay are increasing and attributes this, in part, to decreasing trapping capacity of Conowingo Reservoir (Zhang et al., 2013)." Furthermore, the actual statement from Zhang is "Flow-normalized loads of SS, PP, and PN at the outlet of the Conowingo Reservoir have been generally rising since the mid-1990s. The reservoirs' capacity to trap these materials has been diminishing, and the Conowingo Reservoir has neared its sediment storage capacity." Zhang says reservoirs (plural).	**Original Response:** Change last sentence in paragraph (already recently revised as per above) from "One study has indicated that loads of total nitrogen, total phosphorus, and suspended sediment from Conowingo Reservoir to the Chesapeake Bay are increasing and attributes this to decreasing reservoir trapping capacity (Zhang et al., 2013)." to "One study has indicated that loads of total nitrogen, total phosphorus, and suspended sediment from the reservoir system of the lower dams to the Chesapeake Bay are increasing and attributes this to decreasing trapping capacity of Conowingo Reservoir (Zhang et al., 2013)." **Additional Response:** While Zhang may state plural reservoirs at the end of the sentence, the paradigm in place at the start of the study was that upper reservoirs were in dynamic equilibrium for decades, thus they are part of the trend condition already in place. Conversely, changes in Conowingo Reservoir are recent/ongoing and are of concern as they could produce greatest changes in Bay. The study findings from Zhang and others' (2013) are not universally accepted yet. The text in Appendix K has been revised to: "One study has indicated that loads of total particulate nitrogen, total particulate phosphorus, and suspended sediment from the reservoir system of the lower dams to the Chesapeake Bay are increasing and attributes this, in part, to decreasing trapping capacity of Conowingo Reservoir (Zhang et al., 2013)."

Comment Code	Comment	Comment Response
Ex-K-8 Appendix K, P. 22, para 4	**Original Comment:** The citation to Exelon (2011) regarding DO in the reservoir is not the 2011 report in the References section. The 2011 Exelon study RSP 3.1 should be cited for this statement. **Additional Comment:** Please cite the final report which is 2012, not 2011.	**Original Response:** Changed citation to (Normandeau Associates and GSE, 2011). Added reference but used the format that Exelon requested in comment #1. New reference = Normandeau Associates, Inc., and Gomez and Sullivan Engineers. 2011. *Seasonal and Diurnal Water Quality in Conowingo Pond and below Conowingo Dam* (RSP 3.1). Kennett Square, PA: Exelon Generation, LLC. **Additional Response:** Citation has been changed as noted.
Ex-K-9 Appendix K, P. 26, para 1	**Original Comment:** The report cites Hartwell and Hameedi (2007) for the proposition that "[t]idal portions of the Anacostia River, Baltimore Harbor, and the Elizabeth River are hotspot areas of contaminants." However, Hartwell and Hameedi (2007) does not mention the Anacostia River, and the figure with the sites of greatest contamination does not include the Anacostia. **Additional Comment:** Hartwell and Hameedi (2007) needs to be removed from the reference section in the main report.	**Original Response:** Change reference to instead be "CBP, 2013" (That these are the three "hottest" contaminated regions of Bay is widely reported and not dependent upon an individual report.) **Additional Response:** The Hartwell and Hameedi (2007) reference has been removed from the list of references in the main report.
Ex-K-13 Appendix K, P. 29, para 7	**Original Comment:** The report does not appear to discuss the potential impacts that the particulate coal may have on collected data or model predictions, nor whether it is uncommon to have an 11-percent coal content. **Additional Comment:** The importance of coal content is not the effect of future transport to the Bay, but how its presence may influence chemical measurements of sediments.	**Original Response:** Unlikely that additional future coal to be transported into Bay from sediment behind the dams would have much effect on the Bay. The upper Bay already contains substantial coal as was stated in Section 2.6, and has for probably more than a century. Evaluating effects of additional coal input is one of many specific topics that were not evaluated in this assessment. An environmental impact statement covering any proposed project would be the appropriate place to specifically address this. However, we should change existing sentence on p. 38, 2nd paragraph in "Bay Bottom Materials and Processes" subsection from "Abundant coal occurs in Susquehanna Flats sediments (Robertson, 1998)." To "Abundant coal occurs in Susquehanna Flats sediments transported into the Bay from coal mining in the Susquehanna Basin (Robertson, 1998)." This would better clarify source and timing of coal deliveries to the Bay (coal mining having begun in earnest in Basin by early 1800s). (On side note, I skimmed MGS [1988] and Robertson [1998], but neither of these provides specific information on how much coal occurs in Bay's flats sediments, other than to state that it's abundant in certain strata near the surface.) **Additional Response:** The presence of coal and its impact on chemical analyses of the sediment are unimportant in light of the report's no recommended action. In the future, if dredging or other action is recommended, further investigation of coal in sediment may be appropriate.
Ex-K-14 Appendix K, P. 29/30, para 7/1	**Original Comment:** Focus is only on Conowingo: what about the other reservoirs? **Additional Comment:** See Exelon comment to first two rows of this table on page 1 [Ex-K-1 and Ex-K-2]	**Original Response:** See Comment #35. **Additional Response:** Some limited attention to sediment behind upper two reservoirs is provided on p. 28. In the context of this assessment, it was appropriate to focus more attention on Conowingo Reservoir than the upper two reservoirs.

Comment Code	Comment	Comment Response
Ex-K-16 Appendix K, P. 38, para 1	**Original Comment:** The first sentence states that "no SAV beds were mapped immediately below Conowingo Dam in the non-tidal and tidal Susquehanna River over the period 1997-2012." Exelon RSP 3.17 mapped SAV at the mouth of Octoraro Creek and at the island complex at near the mouth of Deer Creek (Robert, Wood, and Spencer Islands) and at Steel Island along the opposite bank in 2010 surveys. **Additional Comment:** SAV was found to occur in 2010 downstream of Conowingo Dam at creek mouths and islands between the dam and Port Deposit in shallow areas with coarser-grained sediment (sand and cobble) near sources of sediment supply and reduced flow velocities (tributary mouths and a protected island complex) (URS and GSE , 2012c). Study 3.17 should be cited with the final report year (2012). Thus, in the references section it should become 2012c.	**Original Response:** Change paragraph "No SAV beds were mapped immediately below the Conowingo Dam in the non-tidal and tidal Susquehanna River over the period 1997-2012. However, SAV was frequently mapped in the non-tidal and tidal river downstream to the river mouth from the 1990s through 2010 (VIMS, 2013)." to "VIMS mapped no SAV beds immediately below the Conowingo Dam in the non- tidal and tidal Susquehanna River over the period 1997-2012. However, VIMS frequently mapped SAV in the non-tidal and tidal river downstream to the river mouth from the 1990s through 2010 (VIMS, 2013). SAV was found to occur in 2010 downstream of Conowingo Dam at creek mouths and islands between the dam and Port Deposit in shallow areas with fine-grained sediment and low water velocities (URS and GSE , 2011). **Additional Response:** Last sentence of paragraph 1, page 38 (October 2014 version, now page K-34, 4th paragraph), has been revised as suggested. Reference was changed as noted in the response to comment Ex-1.

Lower Susquehanna River Watershed Assessment
Public Meeting * December 9, 2014
Questions/Comments

Questions received via Webcast:

1. I believe the concern regarding the Conowingo Dam is whether or not the loss of sediment storage capacity will contribute to the recurrence of Hurricane Agnes type ecological impacts on the Lower Susquehanna Watershed. The base weather period you used in your study did not include years and time periods of extreme weather, such as Hurricane Agnes. The TMDL and the model that is used to develop the TMDL, looks at broad average, longer-term impacts, not those from very short-term extreme events. So the question remains: Is a Hurricane Agnes, with excessive delivery of sediment that essentially buries subaquatic vegetation, now more likely to occur or not and, if so, what are we going to do about it, if anything?

2. Isn't the lower Chesapeake Bay starved for coarse grain sediment as a consequence in part of the dams on the rivers? If so, isn't there a benefit that should be considered of transporting some of this coarse grain sediment to where it is needed for ecological restoration or rehabilitation?

3. Will in-situ technology for denitrification be evaluated for managing the increases in nitrogen loadings to the Bay?

4. If the runoff from my driveway makes a big difference, what plans are in effect to control runoff from business lots and our highways?

5. Did the cost analysis for sediment removal consider the ongoing cost for sediment removal in the navigation channels downstream?

6. Will the economic benefit to the use of dredged sediments to replace wetlands being lost as a result of sea level rise?

7. What specifically is the reason for not granting the license to Exelon today? I understood their license ended in September.

8. Someone stated that whether or not sediment from scour is good or bad depends upon when the scoring event occurs. Lee was late in the year. Agnes early. Have you examined the possibility of controlled, intentional scours at times of the year when adverse impacts are less likely to occur?

9. When Exelon was initially granted the original license were they required to do silt removal? If not, what changed to even discuss the issue with them rather than requiring those up river to be responsible parties and leave Exelon to generate power.

Questions received in-person:

1. The report asserts the nutrients associated with sediments have more of an adverse impact than the sediments themselves and that there may be more cost effective means than restoring the Conowingo storage volume to prevent these nutrients from reaching the Bay. Did the study quantify the nutrient offsets required and identify options and costs for achieving these offsets?

2. Once the WIPs are in place and fully effective, now many tons per year of nitrogen and phosphorus associated with the sediments are needed to offset the dynamic equilibrium state?

3. Besides evaluating the impact of sedimentation on the indicators of dissolved oxygen, light attenuation and chlorophyll concentrations, did the study identify the environmental and cost benefits that a reduced sedimentation rate would have on other parameters such as dredging the shipping channels, restoring the oyster population, and sustaining recreational activities?

4. What are the panel's thoughts that the draft report is already influencing some Maryland politicians and policy makes to make the case of why should their jurisdictions be required to control nonpoint source sediments and nutrients since they won't be controlled beyond the WIPs in place form the very large areas of New York and Pennsylvania?

5. The Susquehanna River Basin Commission has studied the sediments from the floor of the Conowingo Pond and reported to MDE (the Maryland Department of the Environment) that such sediments contain PCBs (polychlorinated biphenlys), pesticides and herbicides, phosphorus and nitrogen, and acid mine drainage (AMD) that contained sulfides. Does the Draft LSRWA take into account the impact of such components of scored sediments on the aquatic life in the Bay? If so, how does the report account for the impact of such components on the aquatic life in the Bay? If not, why were such impacts not considered? Does the Draft LKSRWA take into account the impact of such components of scored sediments on the SAV (submerged aquatic vegetation) in the Bay? If so, how does the report account for the impact of such components on the SAV in the Bay? If not, why were such impacts not considered?

6. USGS reports that a flow event greater than or equal to 800 cfs (cubic feet per second) will occur once every 25 years and the last time such a flow event occurred was in 2011 (Tropical Storm Lee). Appendix A at page 41; Draft LSRWA Report page 71. USGS estimates that the scour from the floor of the Conowingo Pond during such a flow event is between 4 and 20 million tons of sediment. Exelon has requested a 46 year permit from FERC (the Federal Energy Regulatory Commission), so such a storm event is predicted to occur twice during the life of the renewal period. Why does the Draft LSRWA not take into account the scour that will occur during such a storm event? What accounts for the large range or predicted scour? What impact will such a scour event have on fisheries habitat and which fisheries would be impacted? What impact will such a scour event have on SAV habitat and how was such impact determined?

7. USGS reports that a flow event greater than or equal to 1 million cfs (cubic feet per second) will occur once every 60 years and the last time such a flow event occurred was in 1972 (Hurricane Agnes). Appendix A at page 41. USGS estimates that the scour from the floor of the Conowingo Pond during such a flow event is between 10 and 31 million tons of sediment. Exelon has requested a 46 year permit from FERC (the Federal Energy Regulatory Commission), so such a storm event is predicted to occur during the life of the renewal period. Why does the Draft

LSRWA not take into account the scour that will occur during such a storm event? What accounts for the large range or predicted scour? What impact will such a scour event have on fisheries habitat and which fisheries would be impacted? What impact will such a scour event have on SAV habitat and how was such impact determined?

8. Does the Draft LSRWA account for sediments that are scoured from the floor of Lake Aldred and Lake Clark during storm events and already are in suspension in the river when it flows into the Conowingo Pond? If so, how does the Draft LSRWA account for such scoured sediments and what appendix references the data used to determine the quantity of such scour and how such scour varies with the rate of flow across those lakes during storm events?

9. How if at all do the models used in the Draft LSRWA predict scour from the floors of the Conowingo Pond, Lake Aldred, and Lake Clark and account for scour that occurs from the circular flow and agitation that occurs when storm surges hit the Conowingo, Holtwood and Safe Harbor Dams and are turned back. How many cfs (cubic feet per second) can flow through the sluiceway at each dam? How many cfs can flow through each gate at each dam? How many gates are at each dam? During what storm events has water flowed over each dam?

10. EPA studies show that phosphorus that is bound to sediments in a fresh water river estuary and is therefore not available to spawn algae blooms is released into the water and is available to spawn algae blooms when such sediments are transported into a slightly saline, warmer and more acidic bay or delta estuary. Does the LSRWA account for the impact of the release of phosphorus bound to sediments that are scoured from the floor of the Conowingo Pond and if so what percentage or quantity of phosphorus is attributed to phosphorus bound to sediments prior to passing through or over the Conowingo Dam and being release in the Bay estuary.

11. Is a Hurricane Agnes (with excessive delivery of sediment that buries subaquatic vegetation) now more likely to occur or not? And if so what are we going to do about it, if anything?

12. A lifetime ago, when the dam was built, what historically, if indeed anything, was said about sediment or other environmental impacts, their costs, how they would be dealt with or the like? Is this the missing discussion we now need to have?

13. If one percent of the value of the electricity produced by the dam since it was built was spent on preventing sediment scouring or fish kills, what would that number of dollars be? How much to date for that sort of thing has been spent?

14. If Conowingo Dam was not there would it make a difference in the amount of sediment in the Bay? Has an extensive study been done assessing the storms that pass down from NY and PA? How much sediment?

15. All of the discussion has focused on Conowingo Dam. What about Holtwood Dam and Safe Harbor Dam? It seems that the study recommendations are equally applicable to those dams as well.

16. What are the costs for achieving/implementing enough BMPs in the watershed to make a difference? Is this even feasible?

17. How does this report impact the dam relicensing?

18. Is non-renewal of operating license being considered as a possible measure to be taken?

19. I am an avid fisherman, boater and wildlife photographer. I fully support relicensing the Conowingo Dam and its form of renewable green energy. (The dam is not a source.) What can I do as a Maryland resident to support the restriction on sources of nutrient and sediment into the Chesapeake Bay watershed?

20. Do we know what sources of nutrients are largest contributors?

21. We seem to have a handle on the nutrient load that is impacting the Chesapeake. Given the reforestation recommendation in particular as it contributes to best practices, do we have an estimate for the approximate acreage that would need to be reforested? How achievable would that be?

22. Recommendation: In the Executive summary (page ES-4) sediment is quantified as cubic yards. Elsewhere in the report, those sections describing TMDL, sediment is quantified as tons. Recommend that any cubic yard figures be also shown as tons.

23. Has there been any analysis or data collection into the impact of the Vulcan Materials Quarry in Harve de Grace on upper Bay water quality?

24. All dams have a lifespan, what happens to the sediment behind the dam when the dam reaches the end of its useful life? Who pays for it?

25. The Assessment concludes that it is not cost effective to dredge the sediment. It shifts the solution and the costs upstream. In doing so, it shifts the burden from a few big players, Feds, States, etc. to small jurisdictions. Will sufficient funding be made available to the townships in PA and similar jurisdictions in NY to get the job done?

26. How are TMDLs enforced? What will it take to strengthen them - i.e. what is the approval process?

27. There's a great deal of talk about sediment with Conowingo Dam. Are there other ecological impacts associated with the dam that we should be concerned about? If so, what can be done to reduce those impacts?

28. Bruce Michael (DNR) stated that Appendix T of the 2010 TMDLs in the 2010 TMDL anticipated the source trapped behind the Dam. Isn't it true that Appendix T actually showed a sink or trapping of TMDLs? And not a source?

29. For Mike Langland (USGS) – The HEC-RAS model is one dimensional. How is this model different from the HEC-6 model, also one dimensional? How is scour accounted for in these one dimensional models? Do you feel comfortable with the scour estimates from those models?

30. What would conditions be like if the Dam had never been built? How would impacts change if the Dam were removed?

31. A recent scientific editorial in *NY Times* advocated for removing Conowingo Dam and replacing it with smaller hydroelectric and other green energy systems. Dam removal is gaining ground in the US. The ecological benefits to the Susquehanna River and especially Chesapeake Bay would be transformative. Thoughts?

32. Is the 2 year period of enhanced monitoring of sufficient duration to provide meaningful input to the 2017 model adjustment?

33. In the Executive Summary it seems that "management strategies for reducing sediment from the Susquehanna watershed beyond the WIPs" are not given much consideration, but in the analysis of sources of sediment, the watershed contributions are assessed to be the source of the majority of the sediment load. Doesn't it make sense to target reductions to the main source, rather than secondary sources?

34. We have been doing BMP's "at the source" for decades, yet your graph shows phosphorus levels continue to rise. What makes you think additional BMPs will help cut down that 87% sediment load?

35. We are increasing TMDLs based on information found in this study and the volume of sediments found behind the Dam. Will we increase TMDLs in other systems with large dams or series of smaller dams?

36. I'm wondering if you can help put the slide on "estimated sediment load" (the pie chart with 87% - 13% split between Susquehanna watershed and Conowingo reservoir) into perspective. Am I correct that Conowingo's 13% contribution is 13% of Susquehanna load, not 13% of total load flowing into the Bay from all sources? How significant is Conowingo's sediment/nutrient contributing seen from the perspective of total loads into the Bay?

37. To what extent has Maryland reached its goals for TMDL? Is there anything we citizens can do politically to help move us toward our goals?

38. Is sediment the only carrier of nutrients? If not, why is sediment only mentioned in the report?

Comments: General Public (5 Individuals, Received via email)

==

Commenter Code E.4

Thank you for providing an opportunity to comment on this important report. I attended the December 9 public meeting and have reviewed the LSRWA Draft Report. I believe that the relicensing of the Conowingo Dam Hydroelectric Generating Station presents a unique opportunity to improve the health of Chesapeake Bay.

The legacy sediments behind Conowingo Dam contain nutrients and toxins that otherwise would have entered Chesapeake Bay. What needs to happen now is to remove them. This will reduce scour of the legacy sediments into the Bay during storm events and restore capacity to trap new sediments behind the dam.

Removal of legacy sediments upstream is an important strategy for protecting and improving the water quality of Chesapeake Bay. This effort should be undertaken not solely by the state of Maryland but with support from all of the states in the Susquehanna River watershed. Maryland governor-elect Larry Hogan explained the importance of this approach during his campaign and I believe this strategy should be incorporated into the relicensing of Conowingo Dam.

==

Commenter Code E.2

One of the main findings of the report was that the nutrients associated with the sediments were more harmful to the Bay than the sediment itself. However, the report is unclear as to the effectiveness of dredging on reducing the sediment load to the Bay.

There are numerous locations that discuss returning the bathymetry to 1996 levels etc. (for example Table 4-4) but it is not made clear just exactly how much sediment is estimated to be prevented from entering the Bay for each ton of sediment removed from the reservoir. This analysis should include taking the levels back to 1996 and beyond. It should also incorporate the value of strategic dredging to address high deposition areas and targeting removal of the fines (more likely transported).

My company, HarborRock, is able to use the fines to make its product and leave the sand fraction in place – a benefit to lowering the scour rate. Reuse is the only option that is sustainable but the report does not clearly articulate or evaluate the long-term value of long-term dredging. We believe the information is within the various appendices etc. but is not being presented with enough transparency to make an informed decision on the value (nutrient reduction) obtained by dredging.

==

Commenter Code E.1

Is it true that most of the sediment behind the Dam has already blown through the Shoot-Gates every time they are OPENED during Flooding??? Is there not very much Sediment in BACK of the DAM now?? ? How about behind the other UPSTREAM Dams??? Do we need another DAM built down-stream of Conowingo...prior to the BAY??? HELP Save the BAY.

==

Commenter Code E.5.1 to E.5.3

Comment #1

The report asserts the nutrients associated with sediments have more of an adverse impact than the sediments themselves and that there may be more cost effective means than restoring the Conowingo storage volume to prevent these nutrients from reaching the Bay. It is suggested that in updating the draft study that it be made clear that the study did not quantify the nutrient offsets required nor recommend options and costs for achieving the offsets. It is also suggested that it be made clear that the study does not rule out dredging from behind the dam as an option in future studies.

The draft study indicates with the WIPs in full effect (Table 4-9, page 82, Scenario 2) the nutrient load associated with the sediments will be 50.8 tons per day of nitrogen and 4.2 tons per day of phosphorus. These are very large loads. To put them in perspective, if we looked to the 173 wastewater treatment plants in Pennsylvania that are in the watershed to contribute to the nitrogen offset, the most they could provide would be 5 million pounds per year, or 6.85 tons per day. The Phase II WIP already counts on these treatment plants removing nitrogen to achieve effluent concentrations of 6 mg/L to achieve their annual nitrogen wasteload allocation of approximately 10 million pounds. Upgrading these wastewater treatment plants to the limit of technology to achieve 3 mg/L will provide 5 million pounds per year offset. Treating to the limit of technology is a strategy being employed at Maryland's major wastewater treatment plants to achieve a comparable amount of nitrogen removal and the capital costs are in excess of $1 billion. Thus, a very considerable expenditure would be required to remove only 6.85 tons per day using this strategy. It may be that increasing the storage volume is found to be the most cost effective option after all.

Comment #2

In evaluating the impact of sedimentation on the indicators of dissolved oxygen, light attenuation and chlorophyll concentration, the study did not identify the environmental and cost benefits that a reduced sedimentation rate would have on other parameters such as dredging the shipping channels, restoring the oyster population and recreational activities.

While the Chesapeake is a national resource, we as Marylanders at the downstream end of the watershed have the most at stake in having a healthy Bay, because it largely defines who we are. It's not the correct question to ask: Is it cost effective to remove the sediment from behind the Conowingo dam? The correct question to ask is: Do we want to restore the Conowingo dam to beneficially serve as a sediment trap as it had for the past 70 to 80 years, or do we want to give up that benefit and essentially allow all sediment to pass through it? It would be a big mistake to accept a well publicized interpretation of the draft Study's findings that there is little benefit to dredging. For example, see Karl Blankensip's *Bay Journal* article dated November 13, 2014 which stated in part:

“The $1.4 million study, released by the Army Corps of Engineers and the Maryland Department of the Environment, also concluded that dredging built-up sediment from behind the 100-foot-high Susquehanna River dam would have huge costs and provide little benefit.”

We shouldn't be satisfied to have a sediment-laden, degraded, unhealthy Bay define us. Instead we need to focus our efforts on restoring the dam as a sediment trap. We need to determine the most cost-effective and environmentally responsible means of removing the sediments and to identify the most beneficial re-use for them.

<u>Comment #3</u>

It appears that the draft report is already influencing some Maryland politicians and policy-makers to make the case of why should their jurisdictions be required to control non-point source sediments and nutrients since they won't be further controlled from the very large areas of New York and Pennsylvania?

Regardless of what is done to control sediments and nutrients from the Susquehanna, we should not reduce our own activities in Maryland to control non-point source sediments and nutrients, nor reduce our efforts to improve nutrient removal at our wastewater treatment plants. My main concern with draft Study is it may influence policy makers to do nothing about sediments from the Susquehanna and it also may be influencing policy makers to cut back on environmental measures that are already being implemented in Maryland.

We must reduce the sediments and nutrients from the Susquehanna in addition to what we are already doing and for funds to be available for each initiative. The Chesapeake is a national resource influenced by several states. As such, it is very reasonable to expect funding to be fairly shared among the federal government, New York, Pennsylvania and Maryland to mitigate the Susquehanna's impacts on the Bay.

For this to happen, consideration needs to be given as to what New York and Pennsylvania will receive in return.

==

Commenter Code E.7

As you know, an interesting project is evolving as to the Conowingo Dam and the release of sediment laden contaminants (primarily Phosphorous and Nitrogen), from the Susquehanna River into the Chesapeake Bay. Of particular interest to various parties invested in this project, is the approximately 200m cubic yards of sediment behind the dam and the reduced "trapping" capacity of the dam itself.

While there are conflicting tactics as to the sort of solution to the sediment/nutrient discharge, The Chesapeake remains in limbo regarding the "best of solutions". This is a seminal project requiring a provocative technological approach tied to cost effective disposal solutions.

I am here to report that the dewatering component of the project can be done at a small fraction of traditional costs. Production of tens of thousands of cubic yards per day is achievable. Return water is clean and clear (<20 mg. per ltr.,t.s.s.), with virtually all phosphorous (99%), and most nitrogen removed. Obviously, all organics and clay are captured and dewatered. I have a "dog in this hunt". I am the founder of a company that holds recent patents on very high-speed dewatering capabilities. Any eutrophic waterway can be restored as quickly as the dredge can pump. I hope we have the opportunity to discuss the core issues of this unusual project.

January 9, 2015

U.S. Army Corps of Engineers, Baltimore District
Attn: Anna Compton
P.O. Box 1715
Baltimore, MD 21203

Via Email: LSRWAcomments@usace.army.mil

The Chesapeake Bay Foundation has reviewed the October 2014 draft of the Lower Susquehanna River Watershed Assessment (LSRWA), Maryland and Pennsylvania Phase I report. The following comments are provided for your consideration.

The Chesapeake Bay Foundation (CBF) is a non-profit environmental education and advocacy organization dedicated to the restoration and protection of the Chesapeake Bay. With over 200,000 members, CBF works to ensure that changes in policy, regulation, and legislation are protective of the water quality of the Chesapeake Bay and its watershed. In this regard, we have a keen interest in the results of the LSRWA study as it pertains to the achievement of the Chesapeake Bay's water quality goals and the Total Maximum Daily Loads for nitrogen, phosphorus, and sediment (TMDLs) established to achieve those goals.[1]

First, we would like to sincerely commend and thank the staff at the Army Corps of Engineers and the other participating agencies and organizations for their efforts. This study addressed a number of extremely challenging scientific issues, requiring the integration of complex models, observational data, and the coordination of multiple participants. In the end, the study has dramatically increased and changed our collective understanding of the processes and impacts of the Susquehanna River and scouring from behind the Conowingo Dam on downstream habitats and water quality.

Overall, CBF believes the report's conclusions and recommendations are well supported and grounded in the best available science. The results clearly show that nutrients scoured from the behind the Conowingo Dam during high flow events are contributing to the violation of downstream water quality standards for dissolved oxygen. Results also suggest, however, that implementation of the state Watershed Implementation Plans (WIPs) which complement the Chesapeake Bay TMDL, have a far larger influence on the health of Chesapeake Bay in comparison to scouring of the lower Susquehanna River reservoirs. In addition, results also show that while impacts to the Chesapeake Bay ecosystem from all three dams and reservoirs are important, the majority of the sediment load from the lower Susquehanna River entering Chesapeake Bay during storm events, originates from the watershed rather than from scour from behind the Conowingo reservoir.

[1] 76 Fed. Reg. 419, 549 (Jan. 5, 2011)

The study also makes recommendations for future research and monitoring needed to address key data gaps. We firmly support these recommendations, particularly those related to enhancing the understanding of the nature, availability, and fate of nutrients scoured from the Conowingo Reservoir. These findings and the additional research are critical to the development of the Section 401 Water Quality Certification by the state of Maryland during the relicensing process and will also serve to inform the 2017 Midpoint Evaluation for the Chesapeake Bay TMDL.

We do, however, believe the report would benefit by bolstering the qualitative discussion regarding potential impacts of storms and scouring on submerged aquatic vegetation (SAV) and oysters. We recognize that all LSRWA modeling scenarios listed in Table 4-9 resulted in estimates of full attainment of the SAV and water clarity water quality standards for all Chesapeake Bay segments. And furthermore, that the SAV and water clarity water quality standards were not the drivers behind the TMDL allocations like the DO deep-channel and deep-water water quality standards were. That said, we also know that big storms like Tropical Storms Agnes and Lee do affect underwater grasses. In addition, when the January 1996 "Big Melt" event storm was moved to the June time period, light attenuation was estimated to be greater than 2/m for 10 days, a level of light attenuation that does not support long-term SAV growth and survival (1.5/m is required).

On page 71 there is a brief discussion about effects of storm events on underwater grasses and then the statement that "Appendix K provides further discussion on SAV trends and impacts from storms in Chesapeake Bay." Appendix K, though containing a section on underwater grasses, is more devoted to general background information on the Bay and associated habitats. We suggest this Appendix include more discussion of the findings of Gurbisz and Kemp (2013), Wang and Linker (2005) and any more recent work on this topic including, if possible, a consideration of the relative effects of scouring versus watershed loads, if only in a qualitative sense.

Similarly, we suggest a more in depth discussion on oyster impacts. Currently, the report references a post Tropical Storm Lee study indicating the oyster mortality in the northern Bay was due to salinity decreases, not to sedimentation. We are not disputing this finding, but would encourage the study authors to include additional studies and information that support this contention. In addition, we also recommend including a discussion of why some oyster bars are susceptible to sedimentation that may not be, in any way, related to storm events. Questions about effects of scouring from behind Conowingo Dam on SAV and oysters continue to be raised in the public domain. To the extent that they can be addressed more comprehensively in the report, may help to assuage some lingering concerns.

Thank you for the opportunity to provide comments and once again for your collective efforts on drafting this report.

Sincerely,

Beth L. McGee, Ph.D.
Senior Water Quality Scientist

cc: Jon Mueller, CBF
Alison Prost, CBF
Doug Myers, CBF

Comments of the Soil and Water Conservation Society, National Capital Chapter

Andrew Manale, President

The National Capital Chapter appreciates this opportunity to comment on a report on a scientific and policy subject which has received insufficient attention—management of a legacy dam and its associated accumulated sediments and nutrients at critical node in the water-land ecosystem. The Soil and Water Conservation Society (SWCS) is a nonprofit scientific and educational organization -- founded in 1943 -- that serves as an advocate for conservation professionals and for science-based conservation practice, programs, and policy. SWCS has over 4,000 members around the world. They include researchers, administrators, planners, policymakers, technical advisors, teachers, students, farmers, and ranchers. Our members come from nearly every academic discipline and many different public, private, and nonprofit institutions. The National Capital Chapter represents members who live and work in the greater Washington, DC area.

General comments

We find that the report, though it summarizes well the science related to issue of management of the Conowingo Dam reservoir for the protection of the water quality of Chesapeake Bay, fails in its argument that the loss of sediment storage capacity in the dam reservoir lacks critical importance to the health of the Bay ecosystem. The critical findings of the studies that underlie the report suggest the opposite. Also not convincing is its assertion that the current approach to water resource management through the Chesapeake Bay Total Maximum Daily Load (TMDL) water quality management process <u>alone</u> will adequately safeguard the resilience of the Bay ecosystem from the impacts of extreme weather events. Though a policy and its implementation process—the TMDL--is conceived and designed to achieve a longer term goal of water quality, this does not in itself argue that the individual steps and components in this highly complicated venture will necessarily succeed. There is uncertainty in any approach and consideration of this uncertainty should be apparent in the study. As the report states--though this admission is buried deep in the body of the report--, the nature of the problem of legacy nutrients in the hydrologic system makes verification of effectiveness of measures implemented as part of the TMDL implementation plans nearly impossible in the short while. The report also fails to identify and examine what the unique opportunities are for changing the management of a key component of the water system presented by this once-in-a-lifetime relicensing of the operation of the dam. This latter should be the focus of this study and should be answered in the report.

We suggest strongly that a revised report discuss measures to reduce the volume of water, and hence the nutrients and sediment contained within, associated with the kind of extreme weather events that normally occur within the timeframe of the dam electrical plant operating permit and those that become more likely to occur as a consequence of a rapidly changing climate. As the report states, though this too is hidden deep in the body, a Conowingo dam at dynamic equilibrium leads to faster flowing water that carries with it more sediment and nutrients. Hence, expanding the amount of stormwater that can be temporarily stored on the land adjacent or immediately connected to the Susquehanna and its tributaries and otherwise slowing the runoff from these lands should be a major focus of the options for addressing the consequence of Conowingo dynamic equilibrium. Instead the reader is presented with the tautological argument that a policy designed to achieve a policy goal will by definition do so. It does not reconcile this assertion with the admission that the current TMDL and its measures are already out of date and must be revised as a consequence of increasing nutrient and sediment loads from a Conowingo dam that is already at dynamic equilibrium.

The finding of a current TMDL already out of date belies the conclusion of the report that the dam and its accumulated sediments are inconsequential to the health of the Bay and the implicit suggestion that a change in the conditions for relicensing of the operation of the dam—whether or not the onus is placed directly on the operator of the dam--are not necessary. Rather than a "[f]uture needs and opportunities in the watershed," as the report suggests, development of management options that offset impacts to the upper Chesapeake should instead be examined in this report in order to take advantage of the relicensing opportunity that is available for only a short period of time.

Management of water volume, particularly as it relates to agricultural land, is not specifically covered by TMDL measures. The Soil and Water Conservation Society National Capital Chapter is eager to demonstrate how, for its part, agricultural land can be managed for temporary water storage and for retarding the rate of flow of water into the river system and thus effectively reduce water volume to reduce scour. Moreover we can also help identify and explain the policies that can feasibly and cost-effectively be implemented, taking advantage of this once-in-a-lifetime relicensing opportunity.

Specific comments

The relicensing of Conowingo Dam for hydropower generation presents a unique opportunity for the Federal Government to ensure that the operation of the dam minimizes unintended environmental consequences and supports the provision of the suite of ecosystem services that benefit everyone who lives, works, and recreates in the Chesapeake Bay watershed. Under the new Federal Principles, Requirements, and Guidelines[1], the relicensing of the Conowingo Dam represents a project that falls under the provisions of the new rules, i.e. " 3. [e]xisting assets that may not result in a change in water quality or quantity by themselves, but without which unintended changes to water resources may occur. These situations may occur when an existing infrastructure may fail or degrade in the absence of additional Federal investment, resulting in a change in quality or quantity of the water resources, or the level of service provided. and 4. Activities where the Federal government is responsible for implementation of an action, or when another party is responsible for implementation using Federal funds." As a consequence of the applicability of Conowingo to these new rules, we expect that the analytical studies that support the relicensing decisions meet the new principles, in particular, the use of healthy and resilient ecosystems as a measure of performance.

According to the Executive Summary of the LSRWA report, " [t]he purpose of this assessment was to analyze the movement of sediment and associated nutrient loads within the lower Susquehanna watershed through the series of hydroelectric dams (SafeH arbor, Holtwood, and Conowingo) located on the lower Susquehanna River to the upper Chesapeake Bay. This included analyzing hydrodynamic and

[1] http://www.whitehouse.gov/sites/default/files/docs/prg_interagency_guidelines_12_2014.pdf

sedimentation processes and interactions within the lower Susquehanna River watershed, considering strategies for sediment management, and assessing cumulative impacts of future conditions and sediment management strategies on the upper Chesapeake Bay. The need for this assessment is to understand how to better protect water quality, habitat and aquatic life in the lower Susquehanna River and Chesapeake Bay. "

An assessment was indeed conducted as part of the study but the act of assessing is itself NOT a clear articulation of what the assessment is conducted for. The Executive Summary nor the introductory chapters to the report makes clear what the core questions were that the assessment was to provide information to answer. These should be stated at the outset so that the reader can better evaluate the science and the arguments that underlie the conclusions relating to key public policy choices that pertain to the relicensing decision. Our examination of the body of the report suggests that the major conclusions as stated in the Executive Summary are not well supported by the methods and results. The reader has literally to dig deep into the report to identify the scientific questions that were posed and to discover the scientific findings. Often one set of findings, such as related to extreme weather events, i.e. greater than five years recurrence intervals, and reservoir bed scouring were not sufficiently incorporated into the analyses in another section.

What was the perceived problem for which the study was to provide the information to answer? It appears that an answer to this question is provided only later in the press release, not in the introduction or body of the report—what is the importance of loss of sediment storage capacity in the dam reservoir relative to implementation of the Chesapeake Bay TMDL and the environmental problem that it—the TMDL-- is designed to address. It is unclear how the findings and conclusions of the LSRWA will or can be used in the relicensing decision. We hope that the final report will contain a serious examination of conditions and options that should be considered in the relicensing decision.

We learn elsewhere in the body of the report that the loss of sediment storage capacity behind the dam in the next few years will increase the threat to the ecosystem health from extreme weather events (ever more likely with a rapidly changing climate, such as occurred with Hurricane Agnes just some forty years ago). Also, inconsistent with the conclusions that are presented in the Executive Summary, we learn that the dam and its reservoir are already at dynamic equilibrium and that the TMDL, which the report argues is the answer to water quality concerns, will no longer achieve its intended goals as a consequence of the dam at dynamic equilibrium. Nor do we have an answer as to how at this juncture with the pending relicensing of the Conowingo Dam for electric power use, the management of the dam and its reservoir could or should be changed to ensure that the ecologic damage from a future Hurricane Agnes does not recur. Also disturbing is the absence of a discussion of the value of the sediment that increasingly fills up the reservoir to the ecosystem health of the larger Bay system, particularly in lower sections of the Bay. Here the problem is land disappearing in part because of sediment starvation. Sediment that restores and enriches the land-water interface is instead captured behind the dam. The answer at the public hearing by representatives of the study that "we all agree that we should study the issue more" is, to be blunt, an acknowledgement that this report does not address the prevailing public policy concerns. Calling for another study to do what this study should do does not instill confidence in how this larger issue of protection of ecosystem resilience, as we have articulated it here, will ever be addressed.

We are not persuaded by the report's statement that a Conowingo Dam reservoir at dynamic equilibrium with regard to sediment matters little to ecosystem health. There is no discussion in the analytical section of the report of how the dam at dynamic equilibrium may adversely affect ecosystem resilience and the ability of the ecosystem to withstand infrequent, but highly severe insults, such as 40 year or more recurrent interval storms. Should we not be managing components of the system, such as the dam and its reservoir, for resilience? If so, then the study should have examined the ability of the system, with the reservoir at dynamic equilibrium, to withstand infrequent recurrence interval storm events and used these results as the measure against which to compare alternative management strategies. Since the Conowingo Dam license renewal is for some fifty years, fifty years, at least, would seem to be the proper recurrent interval number to be used, not five or ten-year storms.

The study appears designed to give the answer that implementing regulatory requirements under the Clean Water Act for the Chesapeake Bay to meet the Total Maximum Daily Load (TMDL) goal will address any current and future problem of sediments and nutrients. The implementation plan under the Chesapeake Bay TMDL may or may not eventually result in significant improvements in the ecosystem health of the Bay and its environs. Time will tell. However, choosing to examine only that period of time in the analytical part of the report that compares options that coincides with the current phase of the TMDL and that incorporates only relatively minor storm events of low recurrence intervals that are not of the kind that can be expected to occur during the much longer time period (some fifty years) of the Conowingo Dam relicensing period leads not surprisingly to results supportive of the major conclusions regarding importance of storm-related scour events. Certainly the inclusion of forty or fifty year recurrence interval storm scour events would have been called for and may have likely led to different conclusions regarding the appropriateness of management strategies.

The assumption in this study that the TMDL implementation occurs flawlessly and on time despite the thousands of required practices conducted by different public and private entities necessary to achieve predicted levels of performance defies logic and almost fifty years of Clean Water Act experience. That this assumption regarding success on the agricultural portion of the TMDL is highly questionable and that it should be bracketed within a large uncertainty range is supported by hundreds of studies conducted under the auspices of the United States Department of Agriculture's Conservation Effects Assessment Project (CEAP)[2].

Over more than ten years, the top government and academic researchers under the auspices of CEAP examined the effectiveness of agricultural nutrient reduction practices and strategies in watersheds throughout the country and over many decades. The conclusions are that most nutrient reduction practices on agricultural lands, for a variety of reasons that are often location-specific, have not been successful. More effective interventions needed to be implemented as part of a comprehensive management system that is tailored to site-specific conditions with constant

[2] See CEAP, http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap/.

reassessment regarding the effectiveness. How this must occur is still the subject of scientific and policy debate. The reason stems in part from the fact that no farm or section of land is the same, nor is any the management of any two farms or sections of land likely to be the same. The problem is one for which there are no certain answers at the moment and that requires more research to resolve. Compounding the problem is the legacy of how the land was managed in previous decades and its impact on nutrient loss from these lands. This is an issue of cutting edge science and policy that has been reduced to almost cartoon simplicity in this report.

In any case, the uncertainty regarding TMDL implementation success and effectiveness should be factored into any comparison of <u>alternative options for managing sediment and nutrients to and from the Conowingo Dam</u>. We suggest only that alternative and parallel strategies of managing sediment, such as through dredging or controlled flushing, and actions to expand temporary stormwater storage upland from the dam can potentially be far more certain since sediment management at the dam can be relatively easily implemented and monitored and increased upland water storage quantified using today's new technologies. And, of course, there is a significant cost for all strategies.

For unknown reasons, only the cost of dredging was estimated in detail. The cost of implementing the TMDL was assumed to be a one-time cost that appears lower than the ongoing Net Present Value (NPV) of a stream of costs associated with dredging. How farm management practices to reduce nutrients and sediment can be assumed to be one-time costs is not credible and runs counter to hundreds of economic studies and case studies that argue significant ongoing costs. Moreover, unpublished data generated as part of US Environmental Protection Agency's Chesapeake Bay TMDL cost-benefit analysis suggest that TMDL implementation, if and when fully implemented in the upper sections of the Chesapeake Bay watershed, will also likely cost billions of dollars per year. Clearly, a large range of benefits can be expected to accrue from successful implementation of the TMDL which can justify this costs. But the public policy issue is not either the TMDL or another intervention at the locus of the dam, but rather whether or not an action linked to the dam relicensing and operation can be justified by its costs and benefits.

The question that should have been the driver for the analysis is instead the caboose in this report in that it finally appears in the "Future Needs and Opportunities.." section of the Executive Summary. The recommendation, i.e. "[d]evelop and implement management options that offset impacts to the upper Chesapeake," should actually be restated as the core question that the study should address. What do you do with the loss of sediment capturing capacity over time since the implication is that the currently required practices under the TMDL are or will no longer be enough to reduce significant increases in nutrient and sediment loads to the Bay? Can there be beneficial uses to the sediment, if dredged or otherwise removed from the reservoir? The town hall meeting that occurred in December 2014, acknowledged these questions. One-time costs assumed by this study become ongoing costs as new requirements on urban communities and on farmers get imposed to offset this loss.

It appears that alternative strategies to or along with the TMDL to address the consequence of rising nutrient and sediment loads as a result of the loss of storage capacity behind the dam are treated in a biased manner. The discussion of intentional scouring, for example, was given short shrift and deserves a more unbiased and serious examination. The issue of timing and its relationship to unintended downstream consequences was totally neglected. That these other options are not viable has not been well demonstrated by the analyses presented in this report.

The sediment management options were limited to engineering and technological options. Why were no economic options examined? Options for addressing the problem of stormwater flow volume and rate of through the system at times of extreme weather events were not examined. Doing so would consider means for expanding floodwater storage on lands adjacent to the river, such as on agricultural lands. There are likely to be options on temporarily storing water on non-agricultural lands, such as through the management of road culverts, rehabilitation of wetland and of wet lands and forested lands, as well New digital elevation map data could be extremely helpful in identifying these lands for increased storage. Contingent contracting would serve to make these lands available when needed [See the references below.] Another example of an economic approaches is a policy to convert negative economic value of "pollutants" (i.e., sediment and nutrients) to tradeable commodities with positive economic value. This is can be done through labeling and a combination of regulatory and economic measures.

No economic cost was assigned to the uncertainty regarding the implementation and effectiveness of TMDL measures as opposed to measures, such as dredging for which the effectiveness and be more quantitatively ascertained. For example, the cost estimates for TMDL measures lack credibility. The report should have made clear that then values were largely drawn from scattered studies of unclear relevance to where they could be implemented in the watershed, along with no credible assessment of the variability of their effectiveness given the myriad site-specific factors that affect performance.

The discussion of the TMDL and its implementation measures uses tautological arguments that are not convincing. The argument repeatedly presented is that, because the TMDL is designed to achieve success and meet water quality goals, implementation of the implementation plans and associated practices must by definition lead to the water quality goals. This is further assured, we are told, because of periodic monitoring that leads to readjustments in implementation plans over time. However, not until chapter four do we learn that this is not possible—in other words, verifiability is not possible--because the nature of the nitrogen and phosphorous pollution problem itself and its legacy effects with the hydrologic system. This same tautological argument can be constructed for every option that one can conceive to address water quality problems in the Bay.

The report, Table 4-1 presents practices that are not defined and hence cannot be independently evaluated as to their likely effectiveness. For example, what does "improved nitrogen management" mean in practice. And if it is so improved, why is the practice not already adopted since nutrients are a cost to a farmer? Similarly, what does "improved conservation practices" mean? Again, if they really are improved, then there should be some discussion as to why they have not been adopted by a rational person.

The report contradicts itself repeatedly. It makes the argument that a Conowingo at dynamic equilibrium is not important but then states a Conowingo at dynamic equilibrium necessitates revision of the TMDL in order to achieve water quality. If a revision to the TMDL is already needed (page 97), then clearly it is important and the conclusions are wrong. Which is it? The science presented in the report suggests that the conclusion is unsupported and thus just plain wrong.

The report fails to acknowledge the unique opportunity to change the management of a key component in the ecosystem of the Bay—i.e., the node at a critical juncture point represented by the Conowingo Dam. Instead of presenting and examining innovative options for how to use this opportunity for improvements in the protection of the resilience of the system, it recycles old tautological arguments for staying the course and just focusing on implementation of the Chesapeake Bay TMDL. In doing so, it sheds no new light on what the path forward should be.

For example, there could and should be discussion of options for reducing the volume of stormwater laden with sediment and nutrients that surge through the system at times of extreme weather events. Such options could include arrangements or contracts with farmers and landowners on lands adjacent or directly connected to the river to allow for temporary water storage at times of anticipated high flow. Thus temporary storage could serve to reduce the volume of water at key high flow times through the reservoir and the dam and to slow down and allow for settling out of sediment and associated nutrients in areas upstream from the reservoir. Examining a broader array of options than what the Corps of Engineers traditionally identifies is in fact now since December 2015 a requirement [See http://www.whitehouse.gov/administration/eop/ceq/initiatives/PandG/] For a discussion of how more storage capacity can be effected, please see http://www.jswconline.org/content/55/3/285.short. See also http://www.rff.org/Publications/WPC/Pages/Options-Contracts-for-Contingent-Takings.aspx and On Risk and Disaster: Learning from Hurricane Katrina by Ronald Daniels, Donald Kettl, and Howard Kunreuther.]

Conclusion and recommendation

In conclusion, the report, as it is currently written, does not adequately address public and interested party concern regarding the loss of sediment storage capacity behind the dam nor does it illuminate options for managing the dam for future protection of the Bay ecosystem. We recommend engaging a broader set of stakeholders, such as the National Capital Chapter of the Soil and Water Conservation Society and other professional organizations that deal with the conservation of soil and water resources, in reviewing and drawing new conclusions from the data that exist that pertain to the issue.

STATE WATER QUALITY ADVISORY COMMITTEE

Julie Pippel
Chair

Fred Jacobs, Ph.D.
1st Vice Chair

Sarah Taylor Rogers, Ph.D.
2nd Vice Chair

January 9, 2015

Anna Compton
U.S. Army Corps of Engineers, Baltimore District
P.O. Box 1715
Baltimore, MD 21203

RE: Lower Susquehanna River Watershed Assessment (LSRWA) Draft Report

Via Email: LSRWAcomments@usace.army.mil

Dear Ms. Compton:

As a balanced advisory committee comprised of 32 members representing private citizens, public officials, economic interests and public interest organizations from different geographic areas of the State, the Maryland State Water Quality Advisory Committee (SWQAC) offers comments on the Lower Susquehanna River Watershed Assessment (LSRWA) Draft Report as invited during the public comment period.

The SWQAC commends the U.S. Army Corps of Engineers, Baltimore District (USACE), and the Maryland Department of the Environment (MDE) and multiple partners, on the objective science and research performed and summarized in this document. The report provides much needed information for management decisions to ensure water quality is protected and improved.

The SWQAC supports the four specific recommendations outlined on ES-5 and section 8.1 'Future Needs and Opportunities in the Watershed'. Furthermore, the SQWAC recommends that reliable and sustainable sources of funding, staffing and commitments should be secured to ensure the recommendations are fully implemented.

In addition, we support the continued efforts of WIPs in recognition that 89 of the 92 Bay segments might achieve water quality goals by 2025, given the Lower Susquehanna is just one of multiple stressors on the Bay. We also recommend that the findings from the Report and any new information on the impacts of Conowingo Dam reaching "dynamic equilibrium" be used to inform the Chesapeake Bay TMDL 2017 Mid-Point Assessment.

Thank you for the opportunity to provide comments on this document. We look forward to reviewing future updates, and providing additional thoughts and perspectives on infill, redevelopment, and revitalization.

Sincerely,
Julie Pippel, Chair

Cc: MDE, DNR Sec and EPA Region III,

"Advisors to the State of Maryland on Water Quality Issues"

c/o Christine Thomas ♦ MDE/WMA ♦ 1800 Washington Boulevard ♦ Baltimore MD 21230
410-537-3524 or tollfree 1-800-633-6101 ♦ FAX 410-537-3553 ♦ Website: www.marylandwaterquality.org

SUPPORT CONOWINGO DAM

January 8, 2015

To whom it may concern:

The Conowingo Dam has played a key role in providing clean reliable electricity to the region for more than 85 years. I am submitting a petition that endorses the work of the U.S. Army Corp of Engineers, numerous Maryland state agencies and the many other stakeholders for a science-based approach to developing a course of regional action in improving the water quality in the Chesapeake Bay.

On behalf of the more than 11,500 signers of this petition we thank the Corp and those involved for the work already completed on this issue and look forward to the continued work on addressing this regional issue.

Sincerely,
Jan Nethen

Petition Language:

For more than 80 years, the Conowingo Dam has been a source of clean, carbon-free, reliable energy for thousands of residents and businesses in the Chesapeake Bay region. It is also an economic powerhouse for the region, generating $273 million in economic benefits for our state. The dam also supports 265 full-time jobs and pays about $10 million in state and local taxes annually, including $3.8 million in property taxes.

The Conowingo Dam also offers a wealth of recreational opportunities like boating, hiking, fishing and bird watching. As a result, it is an incredibly popular destination in northeastern Maryland, drawing an estimated 250,000 visitors each year.

In addition to providing recreational opportunities for the community, the Conowingo Dam protects the Chesapeake Bay by trapping more than 2 million tons of sediment each year – sediment that would have otherwise flowed into the bay.

The Conowingo Dam has never created one ounce of sediment and although the dam is not responsible for sediment in the Chesapeake Bay, the bay's health is an important issue that requires all of our attention and action. While others are pointing fingers and playing politics, we believe that the best way to reduce sedimentation and protect the Chesapeake Bay is to let the science lead.

The U.S. Army Corps of Engineers is currently conducting a study to evaluate and provide recommendations on the most effective ways to improve the bay's health. This study will be instrumental in determining what steps should be undertaken to address the long-term health of the Chesapeake Bay.

The Conowingo Dam's relicensing should be led by science, not politics. That's why Maryland, its neighboring states, and the federal government need to adopt a regional approach that includes all of us doing our part in reducing pollution in the Chesapeake Bay.

The Conowingo Dam helps protect the Chesapeake Bay, powers the Maryland economy, is the state's largest source of renewable energy and is a cherished recreational resource for the state. Please support Conowingo Dam and preserve the many benefits it provides to our region.

More information about Conowingo Dam is available at www.SupportConowingoDam.com.

A full list of all petition signatures follows.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, Maryland 21401
http://www.fws.gov/chesapeakebay

January 8, 2015

Anna Compton
U.S. Army Corps of Engineers
Baltimore District
P.O. Box 1715
Baltimore, MD 21203-1715

Re: Lower Susquehanna River Watershed Assessment Draft Report

Dear Ms. Compton:

We appreciate the opportunity to comment on the Lower Susquehanna River Watershed Assessment and want to extend the U.S. Fish and Wildlife Service's support of the findings in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). We agree with the Future Needs and Opportunities in the Watershed and look forward to the reporting of those outcomes. It is critical that we understand how sediment and nutrients impact Chesapeake Bay water quality and health. The Chesapeake Bay is a national treasure and we support any findings to help clean up and restore the health of the Bay and enhance fish and wildlife resources. Again thank you for the opportunity to review and comment on the assessment.

If there are any questions please contact Robbie Callahan of my staff at 410-573-4524.

Sincerely,

Genevieve LaRouche
Supervisor

TAKE PRIDE® IN AMERICA

210 S. Cross Street, Suite 101
Chestertown, Maryland 21620
Phone: (410) 810-1381
Fax: (410) 810-1383
www.CleanChesapeakeCoalition.com

January 9, 2015

VIA Electronic Mail
U.S. Army Corps of Engineers
Baltimore District
Attn: Anna Compton
P.O. Box 1715
Baltimore, MD 21203
LSRWAcomments@usace.army.mil

Re: Clean Chesapeake Coalition – LSRWA Draft Report Comments

Dear U.S. Army Corps of Engineers:

The Maryland counties that have combined their efforts and resources in order to address concerns relative to the improvement of the water quality of the Chesapeake Bay in a meaningful and cost effective manner known as the Clean Chesapeake Coalition ("Coalition")[1] provide their comments and concerns with the Draft Lower Susquehanna River Watershed Assessment ("DLSRWA") [2] collectively instead of separately and individually. The Coalition appreciates this opportunity to provide comments.

The Coalition counties and their representatives have been precluded from participating in the scoping of the study underpinning the DLSRWA report and the quarterly progress meetings reviewing the progress of such studies and the report. At the quarterly progress meetings, critical decisions have been made about the scope and direction of the study, the information to be considered during the study, the underlying assumptions on which the modelling and study efforts have been predicated and the conclusions to be determined and reported based on the study and modelling results. Coalition members have requested to have meaningful input into this process and have been denied that opportunity by U.S. Army Corps of Engineers ("USACE") and the Federal and State agencies and private persons (including Exelon and Exelon's representatives) that are undertaking the Lower Susquehanna River Watershed Assessment ("LSRWA"). Indeed, handpicked "stakeholders" such as Exelon and The Nature Conservancy were afforded several months to review the draft report and appendices before its release while local government officials of the Coalition counties, along with the general public, got their first look in mid-November 2014 and have been pressed to review and analyze the roughly 1,500 pages that comprise the DLSRWA to meet today's public comment deadline.

[1] Coalition counties include Allegany, Caroline, Carroll, Cecil, Dorchester, Frederick, Harford, Kent, Queen Anne's and Wicomico.
[2] Dated October 2014. *See* link: http://mddnr.chesapeakebay.net/LSRWA/report.cfm.

Coalition counties have been mandated by the Maryland Department of the Environment and the Maryland General Assembly with planning, funding and implementing nutrient and sediment load allocation reductions in order to enable Maryland to meet the objectives of the U.S. Environmental Protection Agency's ("EPA") 2010 Chesapeake Bay TMDL ("2010 Bay TMDL"). Given the necessary role of Maryland local governments in the Bay restoration program (*i.e.*, watershed implementation plans), the concerns of the Coalition counties with the DLSRWA must not be ignored. Otherwise, we will continue spending billions of dollars to earn D+ "State of the Bay" report cards from the Chesapeake Bay Foundation for years to come.[3]

The human environment (*e.g.*, the economic, social and cultural, and natural environments) of the Coalition counties has been and will continue to be directly impacted by the conclusions and results of the LSRWA. Such conclusions and results are being used to direct the Environmental Impact Statement being prepared in the Federal Energy Regulatory Commission's pending relicensing of the Conowingo Hydroelectric Project and the relicensing of other power projects in the lower Susquehanna River, and will inform the EPA's 2017 recalibration of load allocations under the 2010 Bay TMDL.

The USACE and the other Federal and State agencies who have conducted the LSRWA have failed to coordinate with the Coalition member counties in the preparation of the LSRWA and have deprived them of their rights under the National Environmental Policy Act ("NEPA") and the Federal Advisory Committee Act ("FACA") as well violating a number of U.S. Presidential Executive Orders in the manner in which the study and report processes has been conducted to date. The Coalition counties urge USACE and the participating Federal and State agencies to revise their approach as they move forward with the LSRWA.

The Coalition counties observe with interest the report detailing the concerns of the Scientific and Technical Advisory Committee (STAC) of EPA's Chesapeake Bay Program with respect to the DLSRWA and generally concur with all of the STAC's comments and concerns, which have yet to be adequately addressed.[4] It is disingenuous for any person familiar with the STAC report to suggest that the DLSRWA has been favorably peer reviewed or has been endorsed by the scientific community.

We take issue, however, with one observation made by the STAC and with one issue overlooked by the STAC. The STAC suggests that the harm caused by an increased loading of sediments due to scour from the floors of the reservoirs behind the hydroelectric dams in the lower Susquehanna River will not be as harmful as the nutrients bound to the sediments, particularly phosphorus, to the Bay estuary. In their 2012 Native Oyster Restoration Master Plan USACE has documented the harmful impact of sediments to the habitat necessary to allow

---

[3] CBF 2014 State of the Bay Report. *See* link: http://www.cbf.org/about-the-bay/state-of-the-bay-report-2014.

[4] Freidrichs, C., T. Dillaha, J. Gray, R. Hirsch, A. Miller, D. Newburn, J. Pizzuto, L. Sanford, J. Testa, G. Van Houtven, and P. Wilcock, *Review of Lower Susquehanna River Watershed Assessment*, Publication No. 14-006 of the Chesapeake Bay Scientific and Technical Advisory Committee (Aug. 2014).

bivalves (oysters, clams and mussels) to reproduce in the Bay.[5] The watermen working out of the Coalition counties on the Bay will testify about the harmful impact of the massive quantities of sediments entering the Bay during significant storm events such as the storms events of 2011 and how such events have devastated the habitat for bivalve breeding and have suffocated hibernating crabs and destroyed the SAV necessary to protect young of year crabs from predators. We observe that while the scientific credentials of the 11 member STAC team that reviewed the DLSRWA are not disclosed, none appear to have any, or an extensive, background in the marine science of bivalves or blue crabs. The National Oceanic and Atmospheric Administration and the U.S. Fish & Wildlife Service should be consulted before making such sweeping generalizations.

Neither the STAC nor the persons conducting the LSRWA have given any consideration to the toxic pollutants that are documented (*see* Susquehanna River Basin Commission reports to the Maryland Department of the Environment) as being in the sediments impounded in the reservoirs behind the hydroelectric power dams: herbicides; pesticides; sulfur and acid mine drainage; coal; PCBs; and other aromatic hydrocarbons and heavy metals, in addition to the nitrogen and phosphorus bound in such sediments. Such toxic pollutants must be accounted for in determining the impact of scour and in undertaking a benefit cost analysis of dredging above the dams in the lower Susquehanna River.

The initial pages of the attached comments and concerns provide a slightly more comprehensive overview of the comments and concerns of the local government members of the Coalition. The latter pages contain more detailed questions, comments and concerns focused on individual portions of the DLSRWA and the attached appendices. The Coalition members expect that the comments presented in each section of the attached review will be considered and addressed.

Given the predictive failure of the HEC-RAS and AdH models, upon which the major findings and conclusions of the DLSRWA are predicated and the reported fact that the underlying goals and objectives of the LSRWA were changed in midstream, the DLSRWA undisputedly is a mishmash of information rapidly cobbled together in a report and appendices in order to fulfill a political agenda. The DLSRWA is not scientifically sound and does not achieve valid objectives and outcomes. The Coalition urges the USACE and the other Federal and State agencies utilizing the report in conjunction with relicensing and regulatory objectives to restart

[5] The sediments deposited in the Bay during and in the aftermath of Hurricane Agnes in 1972 destroyed the oyster beds north of the Bay Bridge. (2012 MP § 4.6.3 at 83-84.) Sediments smother and kill oysters and prevent oyster spat from seeding because spat require hard clean shell on which to attach in order to grow new oysters. (2009 EA § 3.3.1 at 13 (sediments now cover most historic oyster beds and planted shell becomes covered in an average of 5.5 years); Chesapeake Bay Oyster Recovery: Native Oyster Restoration Master Plan, Maryland and Virginia dated September 2012 (2012 MP) § 2.1.1 at 17 ("Shell is being lost due to burial by sediments. Larval oysters require hard substrate on which to settle to grow."), § 4.1.1 at 49 (sediments eliminate oyster habitat), § 4.1.1.4 at 56 (sediment smothers oysters), § 5.5.4.5 at 150 (oyster growth must exceed sedimentation rates in order for oysters to survive).)

the process and to proceed in legal compliance with NEPA, FACA, the regulations of the Council of Environmental Equality implementing NEPA, and the applicable Executive Orders.

There is no denying that the hydroelectric power dams in the lower Susquehanna River have profoundly altered the lower Susquehanna River estuary and the Chesapeake Bay estuary. If the ongoing impact of the dams and the other power projects in the lower Susquehanna River are not addressed, the downstream efforts and expenditures undertaken by Marylanders will not achieve meaningful and lasting improvement to the upper Bay or overall Bay water quality.

The Coalition counties have suggestions about how a natural oyster bed cultivation and seeded shell relocation program could serve as a viable and cost effective alternative to full-scale dredging behind the dams. Again, if a proper NEPA process is instituted, such alternatives could be preliminarily scoped and given due consideration. The failure to adhere to such legal mandates will be more expensive and cause greater delay and expense for all involved in the long run.

Any questions about the Coalition's comments concerning the DLSRWA may be directed to Jeff Blomquist (jblomquist@fblaw.com or 410-659-4982), Michael Forlini (mforlini@fblaw.com or 410-659-7769) or Chip MacLeod (cmacleod@fblaw.com or 410-810-1381).

Very truly yours,

Ronald H. Fithian

Enclosures

cc: United States Environmental Protection Agency
United States Geological Survey
Maryland Department of the Environment
Maryland Department of Natural Resources
Maryland Geological Survey
Susquehanna River Basin Commission
The Nature Conservancy
Clean Chesapeake Coalition

Clean Chesapeake Coalition

Comments, Questions & Observations

Draft Lower Susquehanna River Watershed Assessment Report

January 9, 2015

Background

The Lower Susquehanna River Watershed Assessment ("LSRWA") was originally undertaken in 2011, before a number of Maryland counties coalesced to form the Clean Chesapeake Coalition (the "Coalition") in last quarter of 2012 and began to shine the spotlight on the problem of scour from the floors of the reservoirs behind the three major hydroelectric power dams in the lower Susquehanna River: the Safe Harbor Dam (Lake Clarke is the reservoir behind that dam); the Holtwood Dam (Lake Aldred is the reservoir behind that dam) and the Conowingo Dam (the Conowingo Pond is the reservoir behind that dam).[1] The Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment, Dec. 29, 2010 ("2010 Bay TMDL") was published in December 2010 and concluded that Lake Clarke and Lake Aldred already had reached dynamic equilibrium,[2] but that the Conowingo Pond would not reach dynamic equilibrium until sometime between 2025 and 2030. The United States Environmental Protection Agency ("USEPA"), therefore, erroneously concluded in the 2010 Bay TMDL that 50% of the sediments flowing down the Susquehanna River would continue to be trapped in the Conowingo Pond. The LSRWA study originally was undertaken by the United States Army Corps of Engineers ("USACE") and the Maryland Department of the Environment ("MDE") to begin to consider the impact that the sediments accumulating in the three reservoirs would have once the Conowingo Pond reached dynamic equilibrium some 15 to 20 years down the road. There was no urgency to the study and there was very little in funding procured for the study.

---

[1] Shawn A. Seaman, in the comments submitted by the Maryland Department of Natural Resources to FERC in Project No. P-405-106 on January 31, 2014 at 2, stated: "[T]he [LSRWA] was never intended to be part of FERC's licensing process." MDE and MDNR have repeatedly taken the position that Exelon must be required "to conduct appropriate sediment and nutrient studies to determine the Project's impacts on water quality and living resources of the Lower Susquehanna River and the Chesapeake Bay." (Footnote omitted.) (*Id.*) Nevertheless, USEPA, by letter dated December 29, 2014 from John R. Pompomo, the Director of Environmental Assessment and Innovation Division of USEPA, to FERC Secretary Kimberly Bose, requested FERC to include and consider the DLSRWA in the EIS being prepared by FERC for the Conowingo Hydroelectric Power Project. The LSRWA has morphed into something it never was intended to be.

[2] "Dynamic equilibrium" is the term used to indicate that the amount of sediments (suspended solids) in the water above the dam would be equivalent to the amount of suspended solids in the water below the dam. Before any of the hydroelectric dams were built in the Susquehanna River, it was a narrow, rapidly flowing river with whitewater rapids and falls. Most of the suspended solids in the river flowed into the Chesapeake Bay. When the hydroelectric dams were constructed, they were built well above the natural top of the river in order to build up and trap a large reservoir of water behind the dams that could be used to steadily turn (*i.e.*, power) the turbine electric power generators installed along the sluce gates in the bottom of the dams so that even during drought conditions there would be sufficient water with enough head space to power the generators. These dams acted as stormwater management ponds. They significantly slowed the flow of the water in the Susquehanna River and significantly deepened the river. As soon as the water deepened and slowed, suspended solids that used to flow down the river into the Bay began to settle out in the reservoirs behind the dams.

The issue of what would happen when dynamic equilibrium was reached was always "the elephant in the room" that the regulatory agencies and NGOs have avoided addressing, because it was too complicated and there is no existing legal framework that empowers the Federal or State regulators to directly address the problems that will result from such eventuality. Today, there is no commitment, plan, responsible party or budget to specifically address the devastating amounts of nutrients, sediment and other contaminants that are scoured into the Chesapeake Bay during storm events and in equally harmful proportions now on a regular basis.

Total Maximum Daily Loads

In 2008, the Chesapeake Bay Foundation, in a friendly lawsuit, sued USEPA to make it use its authority under the Clean Water Act to promulgate a total maximum daily load ("TMDL") for the Chesapeake Bay, in order to take control of the agenda for the clean-up of the Bay. In settlement of the lawsuit, USEPA generated the 2010 Bay TMDL and assigned to each Chesapeake Bay watershed state load allocations for the amount of nitrogen, phosphorus and sediments that each state would have to remove from the amount of such pollution currently being discharged to Bay tributaries. After the State of Maryland received its load allocation under the 2010 Bay TMDL, it determined that in excess of $14.5 billion dollars would have to be spent to meet its load allocation obligations. The State was unwilling to redirect its spending and/or to pass the additional taxes and fees necessary to fund this unprecedented obligation. The State, therefore, required each Maryland county to prepare a watershed implementation plan ("WIP") for meeting the 2010 Bay TMDL load allocation assessed against Maryland by USEPA and, among other mandates, passed legislation requiring the largest counties to adopt stormwater management fees (aka "rain tax") to raise the money necessary to implement the WIPs.

As counties undertook the WIP process and began examining what MDE and the Maryland Department of Natural Resources (MDNR) were doing and requiring counties to do in order to address Maryland's load allocation under the 2010 Bay TMDL, they recognized how useless the regulatory initiatives would be in making any meaningful improvement to the water quality of the Bay and how expensive, unproductive and inequitable Maryland's regulatory initiatives have been and would continue to be. They also recognized that the largest problems contributing to the pollution of the Bay were being ignored.

Major Sole Source of Sediment and Nutrient Loading

One of the largest problems being ignored was the impact of scour from the floors of the reservoirs behind the three hydroelectric power dams in the lower Susquehanna River during storm events. During storm events, suspended solids that were trapped behind the dams during low flow and normal flow conditions are agitated, become re-suspended in the river and flow into the Bay. Over the course of a 2 - 8 day storm event, including the high flows that are generated by runoff from the storm, as much as one-half-year to 12+ years of the average loading of suspended solids from the Susquehanna River are scoured and dumped in the upper Bay (*i.e.*, the Maryland portion of the Bay) over such 2 - 8 day period. Such massive loading over such a short period of time has a devastating impact, and a much greater impact than if such solids flowed into the Bay when they originally became suspended in the river.

Reports studying the impact of Hurricane Agnes on the Bay published by the Johns Hopkins University Press in 1978 concluded that 56% of the sediments flushed into the Bay during the hurricane were scoured from the floors of the reservoirs behind the hydroelectric power dams in the lower Susquehanna River - 20 million tons of sediments out of the 32 million tons of sediments flushed into the upper Bay from the Susquehanna River by the hurricane.

In August 2012, Robert M. Hirsch of the Department of Interior's U.S. Geological Survey ("USGS") published a report concluding that the Conowingo Pond had virtually reached dynamic equilibrium.[3] In presenting the report, Mr. Hirsch discussed the scour phenomena but advised that the bathymetric data (*i.e.*, raw data of the depth from surface to floor of the reservoirs before and after storm events) did not exist. The bathymetric data necessary to determine the amount of scour during different storm events still does not exist and has never been generated. Exelon, in the pending Federal Energy Regulatory Commission ("FERC") relicensing proceeding for the Conowingo Hydroelectric Project, has requested a year-to-year extension of its current license while it collects the bathymetric data after storm events necessary to engage in meaningful modelling and prediction.[4]

Mistaken Conclusions

Different persons are reporting that the LSRWA Draft Report ("DLSRWA") concludes that scour from the floor of the reservoir of the Conowingo Pond is not a significant source of pollution to the Bay. Such a conclusion, as discussed more fully below, is devoid of any scientific validation and support. The raw data necessary to make such a determination is nonexistent. There is no bathymetric data sufficient to enable a scientifically valid determination of the amount of scour from the floors of the reservoirs behind the hydroelectric power dams in the lower Susquehanna River. There is no scientific data on which to predicate a determination of the volume of nutrients bound to sediments in the Susquehanna River or what percentage of such bound nutrients become bioavailable when such scoured sediments are flushed into the Bay.

When the LSRWA was undertaken, the impact of scour on the Bay was not an issue. That issue became a hot topic because it was raised in the FERC relicensing proceeding for Conowingo Dam by the Coalition and because the Coalition has focused public attention on the issue.

---

[3] Robert M. Hirsch, USGS, Scientific Investigations Report 2012-5185, *Flux of Nitrogen, Phosphorus, and Suspended Sediment from Susquehanna River Basin to Chesapeake Bay during Tropical Storm Lee, September 2011, as an Indicator of the Effects of Reservoir Sedimentation on Water Quality* at 4, 13 (August 30, 2012) (observing, when the Conowingo Reservoir is full and no longer has any trapping capacity, even at normal flows, there will be a 2% increase in total annual nitrogen loading from the Susquehanna River, a 70% increase in total annual phosphorus loading, and a 250% increase in annual sediment loading).

[4] Letter dated December 22, 2014 from Jay Ryan on behalf of Exelon to John B. Smith, Chief of the Mid-Atlantic Branch of the Division of Hydropower Licensing of FERC re: Conowingo Hydroelectric Project, FERC Project No. 405, Response to Letter from Office of Energy Project Regarding Withdrawal of Section 401 Water Quality Certification Application.

Several truths are inescapable:

(A) Instead of dredging sediments from behind the dams from the Bay after they have been flushed into and dispersed throughout the upper Bay causing damage to the marine environment and fisheries of the Bay, such sediments should be dredged from above the dams (thus ensuring that such pollution never reaches the Maryland portion of the Bay).

(B) Before Marylanders spend billions of dollars to implement clean-up programs that can be rendered completely useless by scour from a significant storm event and pollution above the dams, the harm caused by above the dam sediments and pollution needs to be addressed. It is a fool's errand to spend money on band-aids to cover superficial cuts before stopping the bleeding from the artery; and that is precisely what is happening when billions of tax dollars are spent on *de minimus* issues downstream while nothing meaningful is done to abate the harm above the dams.

(C) Years worth of the average annual loading of sediments and nutrients have been discharged from the Susquehanna River into the Bay in the matter of days during recent storm events. If the sediments and nutrients are not from scour, they are from upstream (above the dams) sources. None of the other states in the Chesapeake Bay watershed have adopted wastewater treatment discharge limits that are close to as stringent as those imposed on Maryland by MDE. None of the other states in the Chesapeake Bay watershed have stormwater management requirements that are as demanding and expensive to meet as those in Maryland. No other state in the Chesapeake Bay watershed has a "phosphorus management tool" that is as stringent and as costly to comply with as that mandated by the recently re-promulgated Maryland regulations. No other state in the Chesapeake Bay watershed has individual septic requirements that are as stringent and costly to comply with as Maryland. The above has been true for several decades, yet the additional expenditures paid by Marylanders have not resulted in any meaningful overall improvement to the water quality of the Bay. Instead, such regulations and expenditures have driven businesses and residents out of Maryland and caused fatigue among those being taxed to "save the Bay."

The foregoing inconvenient truths are ignored because such truths cause the public to question the actions being advocated by such agencies and organizations.

The DLSRWA attempts to minimize the significance of scour to the Bay without adequate scientific underpinning. Regulatory agencies and environmental organizations are stating that the DLSRWA concludes that the problems at the Conowingo Dam are not as bad as scientists thought. The statement is almost laughable because the problem had been completely ignored until it was raised by the Coalition. No thought was given to the problem, and now the problem is recognized as real such that MDE has required Exelon to engage in additional data compilation and studies before MDE will even begin its consideration of the Section 401 Clean Water Act water quality certification needed by Exelon in the FERC relicensing process for

Conowingo Dam. What is disconcerting for the reasons explained more fully below is that the DLSRWA discusses predicted minimum impacts instead of discussing the full range of impacts discussed in the projections underpinning the report.

DLSRWA Modelling Concerns

The work underpinning the DLSRWA is a misguided exercise in modelling. Considerable time and effort has been spent discussing and manipulating models to generate meaningless results instead of gathering and modeling meaningful information.[5] At least nine (9) different models were used to generate data for use in other models and for making predictions and estimations:

(1) The Chesapeake Bay Environmental Model Package (CBEMP) is used to project the water quality of the Chesapeake Bay. That model is predicated on a suite of models consisting of:

(a) A watershed model (WSM);

(b) A hydrodynamic model (HM);

(c) A water quality eutrophication model (WQM);

(2) A computational hydrodynamics in a three-dimensions model (CH3D);

(3) A USACE integrated compartment water quality model (CR-QUAL-ICM), which model is predicated on a suite of models consisting of:

(a) An ICM model;

(b) A WQM model; and

(c) A WQSTM model;[6]

(4) An adaptive hydrodynamics model (ADH), which was used for estimating sediment erosion in the Conowingo Pond based on projected data derived from other models; and

(5) A hydrodynamic engineering center river analysis system model (HEC-RAS), which was used to generate a rating curve for use in the ADH.[7]

---

[5] "The [DLSRWA] investigation involves the use of numerous predictive environmental models and the transfer of information between the models." Carl F. Cerco & Mark R. Noel, *Application of the Chesapeake Bay Environmental Model Package to Examine the Impacts of Sediment Scour in Conowingo Reservoir on Water Quality in the Chesapeake Bay, A Report to the U.S. Army Corps of Engineers, Baltimore District, September 2014 Final Report* at 2.
[6] *Id.* at Fig. 1-2.
[7] *Id.* at 3.

DLSRWA Data Concerns

What little raw data was used in the CBEMP model was generated from raw data collected in the period from 1991 - 2000.[8] This outdated data as well as data generated by other models not designed to determine scour was used to run applications under the ADH for 2008 - 2011 timeframe. The ADH was run to project the amount of scour from the floors of the Conowingo Pond and Lakes Aldred and Clarke that serve as the reservoirs behind the three major hydroelectric power dams in the lower Susquehanna River: the Conowingo Dam, the Holtwood Dam and the Safe Harbor Dam.

Peter Moskos, a Harvard educated criminologist, author and professor, made a comment that appropriately captures the deficiency of the modelling exercises underpinning the DLSRWA: "And if you have bad data, it doesn't matter what fancy quantitative methods you use. It's putting lipstick on the damn pig of correlation." In short, a modelling conclusion is only as good as the data underpinning the modelling effort. When the data needed to generate a predictive model does not exist, the predictive conclusions generated from a cluster of other models used to generate data for use in the predictive model are meaningless.

Nowhere does the DLSRWA concisely list the raw data underpinning the reported results of the ADH modelling efforts. Nowhere does the DLSRWA clearly describe what actual data was used in what manner to generate the data on which particular modelling exercises were run. To provide such data would expose how the findings and conclusions of the DLSRWA are superficial.

The raw data necessary to determine the impact of scour from the ponds/lakes/reservoirs in the lower Susquehanna River on the Bay during storm events simply does not exist.

No bathymetry has been run before and after a major storm event in the Conowingo Pond, Lake Aldred or Lake Clark. Such bathymetry runs would show the elevation of the floor of such lakes and pond before and after a storm. From the difference in depth, the volume of scour could be determined and the amount of scour from a storm event with a peak flow measured in cubic feet per second through each dam could be determined. There is, therefore, no raw data from which to determine the volume of sediments scoured from the floors of such reservoirs during a storm event with a known flow rate.

Measuring bathymetry is not complicated. Sonar technology in conjunction with global positioning system (GPS) technology is relatively inexpensive and widely available. Such technology could be installed on any small and transportable boat and used to rapidly and efficiently chart the bathymetry of the lakes and pond before and after storm events. NOAA has published how its vessels equipped with such technology can record the topography/bathymetry of floor of the Bay so accurately that NOAA employees can detect if oysters have been illegally harvested from a harvest restricted area of the Bay.[9]

---

[8] *Id.*

[9] *See* link: http://www.stardem.com/news/environment/article_f6f9782b-fbef-50de-890a-c99d918d2210.html, NOAA *analyzing oyster habitat, restoration* (Sept. 16, 2014). The National Oceanic and Atmospheric

Further evincing the complete void of data necessary to determine scour from the floor of the Conowingo Pond during storm events and the impact of such scour on the Bay is the December 22, 2014 letter from Jay Ryan on behalf of Exelon to John B. Smith, Chief of the Mid-Atlantic Branch of the Division of Hydropower Licensing of FERC re: Conowingo Hydroelectric Project, FERC Project No. 405, Response to Letter from Office of Energy Project Regarding Withdrawal of Section 401 Water Quality Certification Application. In the letter, Exelon's representative explains to the FERC why it withdrew its application for a Clean Water Act 401 water quality certification from MDE, why Exelon will keep re-filing and withdrawing the application over the next several years while it accumulates the raw data before and after storm events necessary to meaningful prepare an analysis of the impact of sediment scoured from the floor of the Conowingo Dam during storm events on the Bay, and why it would like FERC to issue one year renewal licenses for as many years as it takes to obtain the raw data necessary to meaningfully analyze the amount of scour and the impact of scour from the floor of the Conowingo Pond during storm events. If the data to conduct a meaningful analysis already existed, it would have been completely unnecessary for Exelon to make this request and for MDE to demand that additional raw data being gathered and analyzed before MDE is willing to consider Exelon's Clean Water Act 401 water quality certification application. The actions of MDE and Exelon constitute an admission that the raw data necessary to determine the amount of scour during storm events and the impact of such scour on the Bay simply does not exist.

DLSRWA Guesstimates and Assumptions

For the DLSRWA, scour has been guesstimated by comparing samples of total suspended solids (TSS) taken at various points above and below the Conowingo Dam and guesstimating the portion of such suspended solids attributable to stormwater runoff versus the portion attributed to scour from the floor of the Conowingo Pond, Lake Aldred and Lake Clark.

There is no analysis or even any discussion from a statistical science perspective of the confidence level of any data generated by any of the models or any conclusions or determinations made based on any of the modelling analysis. Undoubtedly that is because any such discussion would acknowledge that there is insufficient raw data to generate any meaningful modelling data or to draw any meaningful conclusions to a reasonable degree of scientific certainty.

Michael Langland, one of the USGS scientists, has admitted that there was insufficient data to calibrate the ADH model for river flows greater than 600,000 cfs. The table of predicted scour during storm events generating different flow rates in the lower Susquehanna River evidences the wide range of scour estimates based on the available data and modelling efforts.[10] The existing data and modelling efforts predict that between one-half million (500,000) tons and

---

Administration has a boat with a multibeam – a surveying technology outfitted with 256 laser beams to get a data driven view of the bottom by bouncing sonar and laser beams off the bottom and collecting the data through a system on the boat – such surveys can be resolved both horizontally and vertically to within a few centimeters.

[10] *See* Michael J. Langland & Edward H. Koerkle, *Calibration of One Dimensional Hydraulic Model HEC-RAS for Simulating Sediment Transport through Three Reservoirs, Lower Susquehanna River Basin, 2008 - 2011*, USGS, Attachment A-1: Additional Information for Susquehanna River at Marietta, Pa. and Conowingo, Md. and Conowingo Reservoir at 41, Table A3.

1.5 million tons will be scoured from the floors of the lakes and pond during a one-in-five-year storm event (between 21% and 44% of the total sediment load during such a storm event). Thus, a single 1 - 3 day storm event will generate flows sufficient to scour from the floor of the Conowingo Pond and Lakes Aldred and Clarke one-half to 1 year-worth of the average annual sediment loading from the Susquehanna River and deposit such amount in the upper Bay in such 3-day period. The existing data and modelling efforts predict that between 10.5 million tons and 15.5 million tons will be scoured from the floor of the lakes and pond during a one-in-sixty-year storm event (between 39% and 50% of the total predicted sediment load during such a storm event).[11] Thus, one such 4 - 8 day storm event will scour and deposit from the floor of the Conowingo Ponds and Lakes Aldred and Clarke between 8 - 12 years-worth of average annual sediment loading from the Susquehanna River and deposit such amount in the upper Bay over the course of eight days. The Safe Harbor Dam, the Holtwood Dam and the Conowingo Dam have so altered the flow of the Susquehanna River and sediments in the Susquehanna River that one to twelve years or more of the average annual sediment loading from the Susquehanna River can be delivered over the course of a week or less to the upper Bay.

Marginalizing Storm Events

The last 60 year storm event occurred in 1972 (*i.e.*, Hurricane Agnes). The next 60-year storm event will occur during the term of the 40+ year license requested by Exelon from FERC for the continued operation of the Conowingo Hydroelectric Power Project. This means that during the next 20 years, we can expect that scour from the floor of reservoirs behind the three dams in the lower Susquehanna River will completely annihilate the marine habitat in the upper Chesapeake Bay if no action is taken to reduce the volume of sediments in those reservoirs.

The persons who drafted and edited the DLSRWA inexplicably chose the lowest levels of predicted scour to report in the DLSRWA and upon which to predicate the findings and conclusions made in the draft report without providing any explanation of why the lowest values, as opposed to the highest values or the middle values were selected. What agenda is served and whose interests are benefitted by downplaying the impacts of sediment scour?

Toxic Pollutants and Dredging

USACE does not want to dredge above Conowingo Dam because it will have to deal with the hazardous and toxic pollutants that are in those accumulated sediments. Currently, when USACE dredges sediments from the navigable channels of the Bay, it does not have to give significant concern to the hazardous and toxic substances found in the sediments in looking for a place to safely deposit such sediments. Such sediments historically have been deposited in impoundments in the Bay such as Poplar Island and other islands composed of dredged sediments in the Bay. Attention will be focused on the hazardous and toxic sediments that are dredged above the dams in the lower Susquehanna River in determining how and what to do with such sediments. The cost, therefore, in properly disposing of such sediments will be magnified, because instead of allowing such hazardous and toxic pollutants to discharge into the Bay and

[11] *Id.*

then largely ignoring them when determining where to deposit sediments dredged from the navigable channels, such hazardous and toxic pollutants will have to be addressed up front.

Exelon does not want to dredge sediments from behind the dams because in so doing it will exercise control over such sediments and in so doing will become responsible for disposing of such sediments in a manner that the hazardous and toxic pollutants in such sediments do not leach into the environment. Dredging sediments under the current legal framework will confer liability on Exelon for such hazardous and toxic substances. In fairness to Exelon, much of the hazardous and toxic pollutants in the accumulated sediments were not generated by Exelon or the power companies acquired by Exelon, so Exelon will fight hard not to dredge.

The DLSRWA is devoid of any analysis or meaningful discussion of the nutrients and pollutants that are bound to the sediments resting on the floor of the lakes and pond behind the three dams in the lower Susquehanna River. Studies conducted by the Susquehanna River Basin Commission ("SRBC") for MDE have determined that that the following nutrients and pollutants are bound to such sediments:

(i) Herbicides;

(ii) Pesticides;

(iii) Sulfur and acid mine drainage;

(iv) Coal;

(v) Polychlorinated Bi-phenyls (PCBs);

(vi) Nitrogen; and

(vii) Phosphorus.

The presence of such hazardous and toxic pollutants comes as no surprise given the extensive agricultural, mining and power generation activities that have historically been conducted in the Susquehanna River watershed.

During the December 9, 2014 presentation on the DLSRWA made at the Harford County Community College, Dan Bierly of the USACE, with acquiescence from the other panelists (*i.e.*, Bruce Michael from MDNR, Mark Bryer from The Nature Conservancy, Rich Batiuk from USEPA Reg. III, Matthew Rowe from MDE and Michael J. Langland from USGS) acknowledged that such nutrients and toxic and hazardous pollutants were bound to the sediments deposited on the floors of the pond and lakes in the lower Susquehanna River.

No study has been conducted to determine what nutrients that are bound to the sediments in the lower Susquehanna River estuary are released into the water of the Bay in the less oxygenated, more saline, more acidic, and warmer Bay estuary. Assumptions, for example, that none of the phosphorus that is bound to such sediments above the Conowingo Dam were released into the Bay estuary when such sediments were transported over or through the dam and into the Bay simply are unfounded. There are 4 - 8 ppm of salt in the Bay waters as far north as Tolchester and phosphorus and nitrogen that are bound to such sediments while they were in the Susquehanna River undoubtedly are released into the water in the Bay once such sediments are scoured and flushed into the Bay. Likewise, the coal, herbicides, pesticides, sulfur and acid mine drainage, and other toxic substances bound to such sediments above the dam probably are released into the Bay when such sediments are flushed through or over the dam. Again, during the December 9, 2014 presentation on the DLSRWA made at the Harford County Community College, Messrs. Bierly and Rowe acknowledged that no such analysis was made and there currently is no scientific basis for determining the impact of the release of nutrients bound to the sediments scoured from the floor of the lakes and the pond behind the dams in the lower Susquehanna River. Mr. Bierly further expounded on the limited scope of the LSRWA, the limited funding for the study and the limited sampling conducted in conjunction with the study.

Mr. Bierly stated some of the problems with dredging, *e.g.*, there are hundreds of millions of tons of sediments in the pond and lakes behind the three dams that have accumulated over the last 80 ± years and very limited places to deposit such sediments in close proximity to such ponds and lakes. The following concerns were not spoken, but undoubtedly influence the decision making process:

(a) USACE only has to dredge the navigable channels in the Bay. Sediments scoured and flushed into the Bay during storm events settle out all over the shallows and non-dredged tributaries in the upper Bay, and so a lesser percentage of such sediments that enter the Bay from above the dams probably need to be dredged by USACE, although no study ever has been conducted to make such a determination.

(b) Sediments dredged from the Bay historically have been deposited on manmade islands and containment areas in the Bay with little to no thought given to the leaching of nutrients and toxic and hazardous pollutants from such islands and containment areas. This historical course of dealing has generally allowed USACE to ignore the impacts of such nutrients and toxic and hazardous pollutants. Withdrawal of sediments above the dams will entail the analysis of such nutrients and pollutants and regulators will not allow the disposal of above the dam sediments until there has been an accounting of how such nutrients and toxic and hazardous substances will be neutralized or responsibly addressed.

(c) No one has been willing to answer the question of whether Exelon will assume liability for the nutrients and toxic and hazardous pollutants in above-dam sediments if it undertakes dredging operations. In fairness to Exelon, the dams impact the timing of the release of such nutrient and toxic and hazardous pollutant laden sediments into the Bay and the devastating shock of the massive releases over a short period of time due to the trapping and scour phenomena caused by the dams. With the exceptions of the PCBs and chemicals associated with keeping power company water intakes and discharge lines free and clear of biological life and growth, such nutrients and pollutants were not generated by the power companies, so it is not fair to saddle them with liability for such nutrients and toxic and hazardous pollutants in conjunction with remedial action undertaken to ameliorate the impact from trapping and scour.

Exelon's Involvement

Exelon has directly and indirectly contributed millions of dollars to Federal and State campaigns and has made undisclosed contributions, probably in the millions of dollars, to the environmental organizations that were allowed to participate in the decision making process underpinning the preparation of the DLSRWA. Exelon funded a large portion of the study underpinning the DLSRWA. Exelon's consultants, Gomez & Sullivan, had a voice in and directly participated in the decisions made about how to conduct the study, what assumptions to make, what data to use, and what conclusions to report. Exelon undoubtedly expects and demands a return on this investment. Exelon undoubtedly has influenced the politics underpinning the decision making processes that have led to the findings and conclusions reported in the DLSRWA.[12]

Non-Compliance With Federal Law

The studies underpinning the DLSRWA and the preparation of the DLSRWA were not undertaken in compliance with the National Environmental Policy Act (NEPA), the Federal Advisory Committee Act (FACA), the NEPA-implementing regulations of the President's Counsel of Environmental Quality (CEQ), or applicable Presidential Executive Orders. Select special interest groups including Exelon and environmental organizations that probably have been the recipients of significant monetary and non-monetary contributions from Exelon, Exelon executives and officials and non-profits funded by Exelon were granted a seat and voice at the study table. Exelon, directly and indirectly, was given considerable influence over the reported outcomes and there has been no opportunity for persons with countervailing perspectives to influence the decisional process and the reported outcomes. NEPA, FACA and the CEQ regulations were promulgated to preclude exactly what has happened in generating the DLSRWA. The report legally is not entitled to be given any deference in any governmental decision making process.

[12] The Coalition repeatedly was denied a right to participate in quarterly meetings where decisions relative to the data to obtain and to utilize and the assumptions to be made and utilized in generating the modelling efforts and reported the conclusions underpinning the DLSRWA were made. The process was and is not open and has wholly failed to comply with the requirements of NEPA, FACA, the regulations of the President's CEQ, and Presidential Executive Orders. The process is not open and has not been transparent.

The Elephant In The Room

Unfortunately, Federal and State environmental and natural resources agencies have conveniently chosen to ignore the impact to the Bay estuary of the hydroelectric power dams in the lower Susquehanna River for over eight (8) decades. USEPA conveniently and quite erroneously predicted in the 2010 Bay TMDL that the Conowingo Pond would not reach dynamic equilibrium and discontinue acting as a net trap of sediments until 2025 or 2030.[13] The same suite of models used to support that erroneous assumption in the 2010 Bay TMDL were used in the "studies" underpinning the DLSRWA.

Mr. Batiuk of USEPA Region III, during the December 9, 2014 presentation at Harford County Community college, as well as the other presenters (Messrs. Bierly and Michael), admitted that the Conowingo Pond is now in a state of dynamic equilibrium- *i.e.*, the Conowingo Pond no longer acts as a net trap of sediments and pollutants washing down the Susquehanna River to the Bay. They acknowledge that EPA's 2010 Bay TMDL prediction based on the CBEMP was off by 12-17 years.

MDNR and MDE completely ignored the impact of sediment scour from the floors of Lake Aldred, Lake Clarke and the Conowingo Pond in the 2010 Bay TMDL process and the FERC relicensing process until the Coalition made it an issue that those agencies could no longer ignore. Maryland's WIP makes no mention whatsoever of Conowingo Dam or sediment scour due to storm events. Shamelessly, Bruce Michael of MDNR explained during the December 9, 2014 informational meeting how MDNR and the other regulatory agencies have been aware of the problem for decades, and indeed they have been. Studies prepared and disseminated by the SRBC have documented the problem of sediment scour from the lower Susquehanna River for several decades. Unfortunately, the warnings sounded by such reports have been ignored throughout that period of time.

Conclusion

The LSRWA has been integrally linked with the FERC relicensing process for Conowingo Dam. The Draft Environmental Impact Statement prepared by FERC repeatedly references the LSRWA and what will be learned and divulged by that report.

At the December 9, 2014 public presentation, Mr. Batiuk of USEPA Region III stated that because of the findings of the DLSRWA, USEPA was in the process of recalibrating the 2010 Bay TMDL to recognize that the Conowingo Dam no longer acted as a net trap and, therefore, all waste load allocations would have to recalculated and revised.

By letter dated December 22, 2014 Exelon, in the FERC relicensing proceeding, requested FERC to issue temporary 1-year license renewals while it participated in the LSRWA with MDE in order to determine the impact of its operation on the water quality of the Bay.[14]

[13] 2010 TMDL, Apx. T at T-2.
[14] *See*, *supra*, FN4.

In short, the LSRWA is the linchpin for two major federal actions that will have significant and far reaching environmental impacts: (1) the FERC long-term relicensing of the Conowingo Hydroelectric Power Project and (2) the USEPA 2017 Chesapeake Bay TMDL recalibration. Given that this study will inform such major Federal actions, it should be conducted in compliance with NEPA, FACA, the CEQ regulations implementing NEPA, and the applicable Executive Orders issued by Presidents of the United States.

The Clean Chesapeake Coalition counties are stakeholders in both of the foregoing Federal actions and in myriad efforts to improve the water quality of the Chesapeake Bay. MDE and the Maryland General Assembly have empowered and tasked the counties with developing, funding and implementing WIPs and to implement and fund other local legislative and regulatory programs to improve the water quality of the Bay. The ability of the counties to implement such programs is directly impacted by the TMDL and the FERC relicensing of the Conowingo Dam. Economic development in the counties and the ability of the counties to retain existing businesses (including but not limited to agricultural and fishery dependent businesses) and to attract new businesses and residents is directly dependent on expenditures and programs associated with the WIPs, the 2010 Bay TMDL and the health of the Bay.

The members of the Clean Chesapeake Coalition request USACE, FERC and USEPA to set aside the DLSRWA and to reinstitute the study process in full compliance with NEPA, FACA, the NEPA implementing regulations promulgated by the President's CEQ, and a number of Presidential Executive Orders.

As discussed, the DLSRWA and appendices contain a host of information that was not well organized or concisely and clearly presented as required by NEPA and the NEPA implementing CEQ regulations. What follows, in no particular order, are additional concerns, questions and observations relative to the DLSRWA. The attached "Summary and Comments on Lower Susquehanna River Watershed Assessment Draft Report and Appendices" are by no means meant to be comprehensive or all inclusive; but are expected to be considered and addressed.

Any questions about the Coalition's comments concerning the DLSRWA may be directed to Jeff Blomquist (jblomquist@fblaw.com or 410-659-4982), Michael Forlini (mforlini@fblaw.com or 410-659-7769) or Chip MacLeod (cmacleod@fblaw.com or 410-810-1381).

Summary and Comments on Lower Susquehanna River Watershed Assessment Draft Report and Appendices

The following outline contains statements made in the Draft Lower Susquehanna River Watershed Assessment report and the Clean Chesapeake Coalition's (Coalition) comments regarding the Draft Report and its Appendices. Page numbers are included to provide reference to those statements made within the Draft Report.

DRAFT REPORT

Statements Regarding the Use and Limitations of Models in the Draft Study:

- According to the Draft LSRWA Report ("Draft Report"), an HEC-RAS model was designed primarily for non-cohesive sediment transport (sands and coarse silts) with additional, but limited, capability to simulate processes of cohesive sediment transport (generally medium silts to fine clays). Thus this model may not be suitable for all reservoir simulations, especially in areas of highly variable bed shear stress (the force of water required to move bed sediment) and active scour and deposition. Limitations of the model most likely resulted in less than expected deposition for the 2008 - 2011 simulation and less than expected erosion (scour) for the Tropical Storm Lee seven day event simulation, when compared to other approaches and estimates. (Pg. 33).

Comment DR-1: A one dimensional model cannot account for scour since there is no lateral variable to account for sediment load on the river basin. This was Langland's (*i.e.*, USGS') same concern regarding Exelon's use of the HEC6 model in their Sediment Transport Study.

- Produced two sediment inflow scenarios: Scenario 1 which included no scour from upper reservoirs and Scenario 2 which attempted to account for scour by estimating that 1.8 million tons of scour from the upper two reservoirs for a total inflow load of 24 million tons.

Comment DR-2: USACE's two dimensional AdH model computed detailed hydrodynamics and sediment transport in and out of Conowingo Reservoir, and the response of the reservoir and flats area to various sediment management scenarios and flows. According to the Draft Report the AdH simulates hydrodynamics and sediment transport. However, this may not the case given the following limitations:

- A one dimensional model, HEC-RAS, was used to provide data for the AdH model; the two dimensional AdH model utilized the HEC-RAS model results (sediment load and flow) from Holtwood Dam as the inflowing sediment load boundary condition. (Pg. 66).

- Through a validation process, the application of the AdH two dimensional model to the Conowingo Reservoir and Susquehanna Flats system was determined to be adequate for simulating general reservoir sediment scour and deposition modelling scenarios for the LSRWA. However, there is some uncertainty that remains with the estimates provided by the AdH model. (Pg. 37).

Comment DR-3: What was the validation process? Was it consensus at the meeting? By whom?

- The AdH sediment model (a two dimensional model) required bed sediment data. Only 8 bed core samples were taken from Conowingo Reservoir to a maximum depth of only one foot. Core samples were required to determine the inception of erosion (critical shear stress for erosion) and the erosion rate used to develop six material zones. (Pg. 19). The sediment bed in the AdH Model was approx. 3 feet deep. The properties of the lower 2 feet were either approximated from the SEDFlume data results (which is the one foot data) or determined from literature values.

Comment DR-4: How old is the SEDFlume data? If the age of the data is different than model runs how is this an accurate portrayal? What literature values were used?

- The hydrologic period used for these scenarios was 2008-11. This 4-year time period was utilized because it included low (less than 30,000 cfs.) moderate (30,000 to 150,000 cfs.) and high (greater than 150,000 cfs.) flows as well as two major flood events (above 400,000 cfs.). Each HECRAS simulation provided a range of probable conditions and also provided a range of uncertainty in the boundary condition flows. (*See* Appendix A for more details on the HECRAS analyses and model.) (Pg. 33).

- The second modelling tool utilized for this LSRWA effort was the AdH model. The AdH model was developed at the USACE's ERDC, located in Vicksburg, MS, and has been applied in riverine systems around the country and world. For this assessment, the AdH model was constructed and applied from Conowingo Reservoir to the Susquehanna Flats just below the Conowingo Dam, as shown in Figure 3- 2. Modelling scenarios were run by ERDC team members. (Pg. 34). Additional details about the AdH model and analyses are available in Appendix B. The AdH model was selected for the LSRWA effort and for use in the Conowingo Reservoir/Susquehanna Flats area (vs. HECRAS) because of the higher uncertainty of conditions and processes in this area, particularly in comparison to the upper two reservoirs which were understood to be in dynamic equilibrium for several decades. (Pg. 35). All AdH simulations that were run for the LSRWA effort were conducted with the same Susquehanna River flow and inflowing sediment boundary conditions. Using the HECRAS input, the 4-year flow period from 2008 - 2011 was simulated in the model. As noted earlier, this time period was utilized because it included low, moderate and high flows as well as two major high-flow events (above 400,000 cfs.). (Pg. 36). The AdH model was also utilized to estimate the effectiveness of selected sediment management strategies to reduce sediment loads transported through Conowingo Reservoir and Susquehanna Flats. Ultimately, the AdH model output was sediment transport, scouring loads or erosion from the reservoirs which were utilized in Chesapeake Bay Environmental Model Package (CBEMP) to compute the impact of the sediment management strategies on water quality in Chesapeake Bay. (Pg. 37).

Comment DR-5: AdH output data put into a model that has incorrect data based on 2010 TMDL with incorrect estimates? How can a two dimensional model rely on data generated from a one dimensional model?

- Through a validation process, the application of the AdH two dimensional model to the Conowingo Reservoir and Susquehanna Flats system was determined to be adequate for simulating general reservoir sediment scour and deposition modelling scenarios for the LSRWA. However, there is some uncertainty that remains with the estimates provided by the AdH model that were considered in results, as described below. One source of uncertainty was that the AdH model was not capable of simulating sediment passing through the flood gates of Conowingo Dam. Therefore, dam operations are not simulated in detail in the model; these include flood gate operation and Peach Bottom Atomic Power Station sequences. (Appendix K provides a description of dam operations.) For this study Conowingo Dam was modeled as an open boundary with downstream control represented by the water surface elevation at the dam. This limitation impacted how sediment was spatially distributed in the lower reach of Conowingo Reservoir near the dam. To minimize this uncertainty more sophisticated methods would need to be developed to incorporate dam operations in Conowingo Reservoir. (Pg. 37).

Comment DR-6: How can the two dimensional model (AdH model) provide accurate results with an open boundary approach? This approach is very limited given the cyclical movement of water (kicking up more sediment scour) as it is resisted by the dam.

Comment DR-7: According to Chesapeake Bay Program's (CBP) Scientific and Technical Advisory Committee (STAC): "The AdH application in this study has been developed to the point that scour and deposition is consistent with what is already known from survey and sampling observations. However, the AdH model application does not refine that empirical understanding. The uncalibrated and weakly constrained model application provides an essentially heuristic basis for scenario evaluation and the AdH model has not, as yet, added substantial new understanding of the sediment dynamics of the reservoir. The modelling does not strongly reinforce the existence of a scour threshold at 300,000 and 400,000 cfs. At best, it can be said that an uncalibrated model was found that produces results that are consistent with that particular threshold." (Pg. 22, Attachment I-7). How is the sediment dynamic of the reservoir evaluated and taken into account? Especially during episodic events?

- Another source of uncertainty concerned fine sediment flocculation and consolidation. Sediment transport models in general do not have a sophisticated approach to simulating fine sediment flocculation. Suspended fine sediment can either exist as primary silt and clay particles or in low energy systems such as reservoirs form larger particles in the water column due to flocculation. Particles that flocculate are larger and have higher settling velocities, thus their fate in the reservoir can be quite different than the lighter primary particles (Ziegler, 1995). When fine sediment particles deposit on the reservoir bed they compact and consolidate over time. As they consolidate the yields stress increases, meaning that the resistance to erosion becomes greater. Higher flows and subsequent bed shear stresses are required to scour the consolidated bed. Laboratory results show that sediment that erodes from consolidated beds may have larger diameters than the primary or flocculated particles (Banasiak, 2006). Scour may result in re-suspension of large aggregates that re-deposit in the reservoir and do not pass through the dam. To add to the complexity of this phenomenon, the large aggregate particles scoured from the bottom during a high flow event can break down to smaller particles in highly turbulent conditions. Thus the fate of inflowing sediment particles in the reservoir is highly variable and difficult to capture with current modelling techniques. The AdH model has the capability to relate flocculation to concentration but not to other variables such as shear stress which determines flock particle size and the overall fate of the sediment. The ability to predict flocculation dynamics is important to track the fate of sediment in a reservoir. To quantify this uncertainty numerous model simulations were conducted to determine a potential range of values. To reduce uncertainty more sophisticated methods would need to be developed to predict the flocculation dynamics. (Pg. 38).

Comment DR-8: How many numerous models were used? What is the margin of error pertaining to these models?

- The last major source of uncertainty was the limited data of suspended loads during storms and bed sediment erosion characteristics. Currently, the suspended sediment samples are collected from one location in Conowingo Reservoir. Because of the danger of sampling during large storms samples are not currently collected at the peak of the largest storms. To verify the estimations of bed scour during large storms improved field methods are required for sampling storm concentrations or turbidity over the entire storm hydrograph. Additionally, more samples of the reservoir bed would provide more data on the erosional characteristics of the sediment which would reduce uncertainty. (Pg. 38).

Comment DR-9: Please explain those improvements to field measurements or methods?

- CBEMP. The final modelling tool utilized for this LSRWA effort was CBEMP. CBEMP is an umbrella term used to describe a series of models that are applied to the Chesapeake Bay and its watershed. CBEMP was developed by CBP, the state-federal partnership responsible for coordinating the Chesapeake Bay and watershed restoration efforts. CBEMP has had almost three decades of management applications supporting collaborative, shared decision-making among the partners (USEPA, 2010b). This suite of environmental models has an unrivaled capacity to translate loadings in the watershed to water quality in the Chesapeake Bay (Linker et al., 2013). CBEMP includes the same models and was applied using the same scenario development and simulation methods for this LSRWA effort as were used in the development of the 2010 Chesapeake Bay TMDL (USEPA, 2010a, Appendix D). (Pg. 39). In addition, the full suite of Chesapeake Bay models has been regularly updated and calibrated based on the most recently available monitoring data, about every 5 to 7 years over the past three decades. Linker et al. (2013) provides a complete description of the different phases and versions of the Chesapeake Bay models. Used properly, CBEMP provides the best estimates of water quality and habitat quality responses of the Chesapeake Bay ecosystem to future changes in the loads of nutrient and sediment pollutants. For this LSRWA effort, CBEMP had two major applications. The first application was a series of modelling runs conducted by USACE ERDC documented within Appendix C. These CBEMP application scenarios were utilized to estimate water quality impacts of selected watershed and land use conditions, reservoir bathymetries, a major storm (scour) event (January 1996) at different times of year, and selected sediment management strategies. Sediment erosion or scour from the bed of Conowingo Reservoir estimated from AdH was utilized as input for selected CBEMP scenarios. The second CBEMP application was a series of modelling runs conducted by CBP, as described, *infra*, in more detail in Appendix D.

- Chesapeake Bay WSM Model. The Chesapeake Bay WSM simulates the 21-year period (1985 - 2005) on a 1-hour time step (USEPA, 2010b). Nutrient inputs from manure, fertilizers and atmospheric deposition are based on an annual time series using a mass balance of U.S. Census of Agriculture animal populations and crops, records of fertilizer sales and other data sources. Best management practices (BMPs) are incorporated on an annual time step; nutrient and sediment reduction efficiencies are varied by the size of storms. Municipal and industrial wastewater treatment and discharging facilities and on-site wastewater treatment systems' nitrogen, phosphorus and sediment contributions are also included in the Chesapeake Bay WSM. (Pg. 39).

Comment DR-10: How is this model run protective of scour entering Maryland's waters?

- Chesapeake Bay Estuarine Models. The hydrodynamic model computes intra-tidal transport using a three dimensional grid framework of 57,000 cells (Cerco et al., 2010). The hydrodynamic transport model computes continuous three dimensional velocities, surface elevation, vertical viscosity, and diffusivity, temperature, salinity, and density using time increments of 5 minutes. The hydrodynamic model was calibrated for the period 1991 - 2000 and verified against the large amount of observed tidal elevations, currents, and densities available for the Chesapeake Bay. Computed flows and surface elevations from the hydrodynamic model were output at 2-hour intervals for use in the water quality model. Boundary conditions were specified at all river inflows, lateral flows and at the mouth of the Chesapeake Bay.

- The eutrophication model, referred to as the Chesapeake Bay Water Quality/Sediment Transport Model 6, computes algal biomass, nutrient cycling and DO, as well as numerous additional constituents and processes using a 15-minute time step (Cerco and Cole, 1993; Cerco, 2000; Cerco et al., 2002; Cerco and Noel, 2004). In addition, the Chesapeake Bay Water Quality/Sediment Transport Model incorporates a predictive sediment diagenesis component, which simulates the chemical and biological processes which take place at the bottom sediment-water interface after sediment is deposited (Di Toro, 2001; Cerco and Cole, 1994). (Pg. 40).

- The Chesapeake Bay Water Quality/Sediment Transport Model simulates water quality, sediment, and living resources in three dimensional in 57,000 discrete cells, which extend from the mouth of the Bay to the heads of tide of the Bay and its tidal tributaries and embayments, as depicted in Figure 3-5. The primary application period for the combined hydrodynamic model and eutrophication model covers the decade from 1991 - 2000. For LSRWA applications the 1991 - 2000 hydrologic record was retained as this is the hydrologic period that CBEMP is based upon. Additionally, this is the same hydrologic period employed by the CBP partners in development of the 2010 TMDL (USEPA, 2010a).

- 1996 January High-Flow Event Scenario. The January high-flow event in 1996 was selected as the event to observe water quality impacts for LSRWA scenarios requiring a storm event because it is the highest observed flow within CBEMP's 1991 - 2000 hydrologic period. High-flow events wash in loads (sediment and nutrients) from the watershed; if there is high enough flow these events scour additional loads from the reservoir beds behind the three dams on the lower Susquehanna River. (Pg. 44).

- A one-dimensional HEC-RAS model computed hydraulic conditions and sediment transport in the reservoir system and sediment loads to Conowingo Reservoir for use in the two-dimensional model the Adaptive Hydraulics (AdH) model.

Comment DR-11: MDE admitted that this data was limited in terms of the number of core samples and the depth taken at the DLSRWA Public Hearing Meeting in December 2014 at Harford Community College.

- Model was not capable of passing sediment through the gates, therefore, for this study the dam was modeled as an open boundary with downstream control represented by the water surface elevation. (Pgs. 38 and 149).

- Flow rates capped at approximately at 620,000 cfs. - 640,000 cfs. for Tropical Storm Lee. (Pg. 62; *see* Figure 4.1). Table 4.3- Pg. 63 shows an event of 798,000 cfs. having an occurrence of 1 in 25 years.

- Each reservoir bed consists of a number of layers. The lowermost layer is considered an inactive layer that will rarely, if ever, scour to any degree. Above that, there is an "active" scour and depositional zone. The surface of the active layer consists of a relatively thin mixing layer that is unconsolidated and may have a high potential for scour at flows less than the scour threshold. For modelling purposes, the active layer is estimated to have a depth of approximately of 2 to 3 feet; however, it is spatially variable due to bed composition and consolidation. (Pg. 65).

Comment DR-12: How do 8 core samples with a depth of 1 foot delineate the reservoir bed in a 14 mile reservoir?

- Sediment transport is directly related to particle size. (Pg. 60). Storms can potentially scour the silts and clays, which are easier to transport, while frequently leaving behind the coarser, sand-sized sediment. For example, in the lower portion of Conowingo Reservoir in 1990, particle size analysis from 2-foot deep sediment cores indicated the area had about 5 percent sand; in 2012, it was projected to have 20 percent sand based on all previous cores. The reservoir sediment data collected show that generally there is more sand in the bed upstream and silts and clays are more prevalent closer to the dam for all three reservoirs. Silt is the dominate particle size transported from the reservoir system with little sand (less than 5 percent) transported to the upper Chesapeake Bay (*see* Appendix A for further discussion). (Pg. 60).

Comment DR-13: Was this 20 year old data used to address the inadequacies of the 8 core samples?

Comment DR-14: Core samples used in model runs from Conowingo Pond are inadequate given discussion later in the DLSRWA on Pg. 60. Generating data from a one dimensional model to be used in a two dimensional model is uncomforting and frightening. In addition, the following statements quoted below from the DLSRWA shows the lack of data in the models as it relates to scour. Such statements attempt to justify insufficient data in the model runs:

- "…more samples of the reservoir bed would provide more data on the erosional characteristics of the sediment which would reduce uncertainty." (Pg. 38).

- "Uncertainties in the total sediment load entering Conowingo Reservoir will affect scour and deposition, and thus affect the total load output to the Bay. Consequently, to provide more information on reservoir mass balance, future sampling program should extend both upstream and downstream of Conowingo Dam. To quantify the uncertainty of the limited data available to the LSRWA effort numerous model simulations were conducted to determine a potential range of values." (Pg. 38).

- "In summary, of all the modelling uncertainties that exist, three are most critical for interpreting the Conowingo Reservoir modelling results. These include the potential for flocculation of sediment flowing into the reservoir, the potential for large sediment aggregates to erode from cohesive beds and dam operations. Because of these uncertainties the AdH model may potentially over-predict to some degree the transport of scoured bed sediment through the dam to the Chesapeake Bay. Appendix B provides further detail on the uncertainty associated with AdH, as well as documentation of the model inputs, outputs and calculations." (Pg. 39).

Comment DR-15: Over-predict? The Corps is saying that the lack of data is somehow portraying the problem in a negative light to undermine the severity of this problem. How could there be an over-prediction of the transport of scour bed sediment when model runs are capped at 600,000 - 640,000 cfs. instead of running the models at the more appropriate level of 900,000 cfs.?

- Chesapeake Bay Environmental Model Package ("CBEMP" – Chapter 3 of the DLSRWA). This model is used to determine dredging effectiveness. (Pgs. 136-140). Developed by CBP and based on computed loads from the watershed at key locations in the reservoir system including the Conowingo inflow and outflow. Watershed loads at the Conowingo outfall computed by the Watershed Model ("WSM") were supplemented by bottom scour loads estimated through AdH and through data analysis. The WSM is considered part of the CBEMP.

- CBEMP includes the same models used in the development of the 2010 Chesapeake Bay TMDL, and is based on land use, management practices, wastewater treatment facility loads, and atmospheric deposition from the year 2010. (Pg. 39). This run is considered to represent existing conditions to provide assistance with projected land use, management practices, waste loads, and atmospheric deposition upon which the 2010 Chesapeake Bay TMDL was based. (Pg. 45).

- CBEMP produces estimates, not perfect forecasts. Hence, it reduces, but does not eliminate, uncertainty in environmental decision-making. There are several sources of uncertainty summarized and discussed in more detail in Appendix C. (Pg. 49).

- One source of uncertainty is the exact composition of nutrients associated with sediment scoured from the reservoir bed. Two alternative sets of observations are presented in Appendix C, one based on observations at the Conowingo Dam outfall in January 1996 and one based on observations collected at Conowingo Dam during Tropical Storm Lee in September 2011. The nutrients associated with suspended solids differ in the two events with 1996 being lower. In fact, both data sets represent a mixture of solids from the watershed and solids scoured from the bottom so that neither exactly represents the composition of scoured material alone. The 2011 observations are consistent with samples collected in the reservoir bed (Appendix C, Attachment C-1), are more recent and represent a typical tropical storm event rather than the anomalous circumstances of January 1996. For this reason nutrient composition observed at Conowingo Dam in 2011 is preferred and was utilized to characterize the future and is emphasized in the DLSRWA. Several key scenarios were repeated with the 1996 composition, however, to quantify the uncertainty inherent in the composition of solids scoured from the reservoir bottom. (Pg. 50).

- Another source of uncertainty is the availability (*i.e.*, bioavailability) and reactivity of the nutrients scoured from the reservoir bottom. The majority of analyses of collected data at the Conowingo Dam outfall and from within the reservoir bed sediment quantify particulate nitrogen and particulate phosphorus without further defining the nature of the nitrogen or phosphorus. For the LSRWA effort, modelers opted to maintain the accepted, consistent particle composition that has been employed throughout the application of CBEMP. Uncertainty in the particle composition, and consequently, the processes by which particulate nutrients are transformed into biologically available forms still exists. (Pg. 50).

- Some uncertainty in computed storm effects on Chesapeake Bay would result from considering solely a January storm. Bay response to storms in other seasons might vary. To reduce this uncertainty the January storm was moved to June and to October. The June storm coincides with the occurrence of the notorious Tropical Storm Agnes, which resulted in the worst recorded incidence of storm damage to the Bay. The October storm corresponds to the occurrence of Tropical Storm Lee and is in the typical period of tropical storm events. (Pg. 50).

- CBEMP evaluated water quality impacts from a single large flow event (January 1996). Lower flow, more frequent events may also have a cumulative impact over time in the future. Future modelling work could investigate the potential effects of smaller more frequent events to reduce uncertainty and expand understanding of how various flows influence Chesapeake Bay water quality. (Pg. 50).

Comment DR-16: This study has a schizophrenic analyses and discussion considering that the 2010 TMDLs need to be revised and yet the models that established those numbers are acknowledged and used to determine the effectiveness of dredging in the DLSRWA.

- Chesapeake Bay Estuarine Models – used to compute the impacts of sediment and nutrient loads to the estuary on light attenuation, SAV, chlorophyll, and DO concentrations in Chesapeake Bay tidal waters. (Pgs. 39-40).

- The eutrophication model, referred to as the Chesapeake Bay Water Quality/Sediment Transport Model6, computes algal biomass, nutrient cycling, and DO, as well as numerous additional constituents and processes using a 15-minute time step. (Pg. 40).

- In addition, the Chesapeake Bay Water Quality/Sediment Transport Model incorporates a predictive sediment diagenesis component, which simulates the chemical and biological processes which take place at the bottom sediment-water interface after sediment is deposited (Di Toro, 2001; Cerco and Cole, 1994). (Pg. 40).

- The primary application period for the combined hydrodynamic model and eutrophication model covers the decade from 1991 - 2000. For LSRWA applications the 1991 - 2000 hydrologic record was retained as this is the hydrologic period that CBEMP is based upon. Additionally this is the same hydrologic period employed by the CBP partners in development of the 2010 TMDL (USEPA, 2010a).

Comment DR-17: More predictions and scientific buzz words in establishing variables and definitely less science. Why not used data from the same years or timeframe as the other model runs? The eutrophication model does not include Tropical Storm Lee given the timeframe of 1991 - 2000.

- In order to compute water quality impacts with CBEMP, nutrient loads associated with sediment (in particular, nutrient loads carried over Conowingo Dam as a result of sediment scour from the reservoir bottom) were calculated by assigning a fractional nitrogen and phosphorus composition to the scoured sediment (solids). The initial fractions assigned for nitrogen and phosphorus were based on analyses of sediment cores removed from the reservoir (Appendix C, Attachment C-1). However, further analysis was done to ensure the most appropriate nutrient composition of loads was being utilized. (Pg. 46).

Comment DR-18: Are these the same core samples that were limited to 1 foot? If not, from where were these sediment core samples taken? And why weren't these samples used in the AdH Model run?

SAV

- "SAV species in the upper Bay were strongly affected by Hurricane Irene and Tropical Storm Lee which increased river flow and sediment loads in this region for almost two months (Gurbisz and Kemp, 2013). However, the dense SAV bed on the Susquehanna Flats persisted through the storms demonstrating how resilient SAV beds can be to water quality disturbances (CBP, 2013)." (Pg. 71).

- Regarding oysters, Maryland's 2011 oyster survey conducted after Tropical Storm Lee indicated that those high freshwater flows from heavy rains in the spring and two tropical storms in late summer impacted oysters in the upper Bay, although ultimately representing a relatively small proportion of the total oyster population. The lower salinities proved to be beneficial to the majority of oysters in Maryland by reducing disease impacts to allow the yearling oysters to thrive (MDNR, 2012). (Pgs. 71-72).

Comment DR-19: How was sediment scour ruled out given that this analysis seems to be based on observations? Who at DNR made these observations? Do DNR field notes exist that make such an observation?

Major Storms

- "The "Big Melt" event occurred in January 1996. The instantaneous peak flow for this event was 908,000 cfs. (Pgs. 73-74).

- Hurricane Agnes was the largest flood in the Susquehanna River basin since 1896, when recording of flow began at Harrisburg, PA. During the Agnes event the flow over Conowingo Dam peaked at 1,098,000 cfs.

- "As discussed in Chapter 3, the LSRWA modelling efforts included Tropical Storm Lee and the January 1996 high-flow event because these storms were included in the hydrologic period of the modelling tools utilized for this effort and because there was existing collected data available for these storms." (Pg. 74).

- Attachment 4 of Appendix J includes detailed information on "Septic Systems." (Pgs. 29-33).

Comment DR-20: Septic systems are not discussed at all in the corresponding tables for the cost analysis in Attachments 2 and 3. Why not?

Comment DR-21: However, the flow rate for model runs was set at approx. 620,000 cfs. - so how does the LSRWA modelling account for these storms? Figure 4.7 seems to undermine the "1996 Big Melt" by capping the flow rate at 600,000 cfs.

- "On average, flows above 800,000 cfs. produced a scour load that comprised about 30 to 50 percent of the total load entering the Bay. Flows of this magnitude are rare with a recurrence interval of 40 years or more." (Pg. 76). Keep in mind, that Pg. 63 shows an event of 798,000 cfs. having an occurrence 1 in 25 years. The assumptions and conclusions regarding the potential number of storm events in a given interval are inconsistent and result in minimizing the adverse impacts on the Bay.

- SAV, Chlorophyll and light attenuation relied on three model storms: January, June and October. (Charts on Pgs. 80-83).

- The June scour event had an estimated increase in deep-channel DO water quality standard nonattainment (negative impact) of 1 percent, 4 percent, 8 percent, and 3 percent in segments. (Pg. 93).

- The severity of the DO hypoxia response estimated by the degree of nonattainment of the deep channel and deep-water DO standards was greatest in the June storm scenario, followed by the January and October storm scenarios. The seasonal differences in water quality response, despite the same magnitude of nutrient and sediment loads in the June storm, October storm, and January storm scenarios, is thought to be because of the fate and transport of nutrients in the different seasons. (Pg. 94).

- CBEMP does not model direct storm wave damage to aboveground or belowground SAV tissue, nor direct impacts of excess storm bottom erosion and deposition upon SAV. Accordingly, to consider these other effects of major storms on SAV, it was appropriate to consider the CBEMP model outputs as well as other recent and historical information in this study. Effects of storms can differ based on SAV bed health, size, and density. (Pg. 95). Admission.

Comment DR-22: To investigate the effect of the storm season, scenarios were completed with the January 1996 Susquehanna storm flows and loads moved to June and October 1996. (Scenario 6 from Table 4-9, with three CBEMP model runs). Only one model run occurred during the growing season. Effects are discussed in terms of light attenuation, chlorophyll and DO. (Pg. 91). The models do not account for direct storm wave damage to above ground or below ground SAV. (Pg. 95).

- "Nitrogen loads associated with the scoured sediment exceed the phosphorus loads, as noted in Table 4-9. The excess of nitrogen over phosphorus in Conowingo Reservoir bed sediment indicates that the scoured nitrogen load will exceed the scoured phosphorus load any time bottom material is scoured (eroded), regardless of the quantity of bottom material." (Pg. 96).

Sediment Management Strategy

- "Storms will continue to occur and will vary in track, timing and duration. Due to global climate change it is predicted that there will be increased intensity of precipitation in spring and winter potentially causing more frequent scour events." (Pg. 99).

- "Watershed loads of sediment, nitrogen and phosphorus will continue to decrease compared to today due to the continued implementation of Pennsylvania, New York and Maryland WIPs to meet the 2010 Chesapeake Bay TMDL allocations. Predicted higher temperatures and continued warming of Chesapeake Bay's tidal waters could have negative implications on DO causing intense hypoxia to occur substantially earlier or end substantially later in the year making it more difficult to meet Chesapeake Bay water quality standards, potentially increasing costs to achieve the Bay TMDL." (Pg. 99).

- "In reducing the amount of sediment available for a scour event, water quality could be improved and impacts to aquatic life could be reduced." (Pg. 100).

Comment DR-23: According to the Draft Report: "It is important to note that if suspended sediment was passively transported (*e.g.*, via modification of reservoir operations, flushing, sluicing, or agitation) as discussed in this section, a permit may not be required. However, if sediment transport were done actively through dredging or a pipeline, a permit would be required (Elder Ghigiarelli, MDE, Deputy Program Administrator, Wetlands and Waterways Program, Water Management Administration, personal communication, 2013). (Pg. 107) Does the Study group still believe that a permit would not be required under a new Maryland Gubernatorial Administration?

- "There are hundreds of combinations of ways to dredge, manage and place material. However, there are two main types of dredging – hydraulic dredging and mechanical dredging". (Pg. 110).

Comment DR-24: What type of dredging did the Draft Study focus on in their cost estimates?

- Quarries appear to be the best option for material placement due to: (1) they can accept wet or dry material; (2) large volumes could be placed; and (3) there are several quarries nearby that can have material pumped in directly from Conowingo Reservoir without the need for costly re-handling or trucking. (Pg. 120).

- Additional analyses characterizing sediment to be dredged including grain size, plasticity and percent moisture, metals, non-metals, pesticides, PCB's and PAH's, paint filter, and elutriate tests. (Pg. 120).

- Must meet state regulations (PADEP for PA and MDE for MD). Transport containers must be watertight. Long transport distance. Water may need to be decanted, requiring another pipeline to return the effluent to the Susquehanna River. Mine owners contacted had no interest in sediment because of limitations on their mining permits. (Pg. 124).

Dredging Effectiveness

- It was assumed that 3 mcy (2.4 million tons) were removed by dredging from an area above the Conowingo Dam on the eastern side of the reservoir approximately 1 to 1.5 miles north of the dam. This dredging area was selected because large amounts of sediment still naturally deposit at this location. Although changing the dredging area location will likely influence results, removing such a relatively small quantity of sediment will have a minimal impact on total load delivered to the Bay when large flood events occur. (Pg. 136). The estimated scouring of sediment and nutrients was reduced by 32 percent in comparison to scour with a 2011 bathymetry (with all other parameters remaining the same). Dredging had little effect on model simulated water quality conditions in the Chesapeake Bay. (Pg. 136).

- CBEMP estimated a decrease (a positive improvement) of 0.2 percent nonattainment in the deep channel DO water quality standard for segments. (Pg. 137).

- The results imply that if 31 mcy (25 million tons) of sediment were removed, there would be a 9 percent decrease in total load to the Bay (from 22.3 to 20.3 million tons), a 40 percent decrease in bed scour (from 3.0 to 1.8 million tons) and a 50 percent increase in reservoir sedimentation or deposition (from 4.0 to 6.0 million tons). (Pg. 139).

Comment DR-25: Please provide the data and models used for this analysis.

- "However, these calculations do not take into account that the storage capacity would be increasing and thus more incoming sediment could be depositing." (Pg. 139).

- It was assumed that the average Susquehanna River flow during the winter months was 60,000 cfs., approximately twice that of the median flow of about 30,000 cfs. At 60,000 cfs., the average suspended sediment measurement below the dam was assumed to be about 12 mg/L, which equates to a daily load of about 1,940 tons of sediment passing through the dam. (Pg. 140).

Comment DR-26: CBEMP model is being used to determine dredging effectiveness. How could this be the case given that the CBEMP model has many uncertainties? (*See* Pgs. 3-4 of this outline). Moreover, calculations do not take into account that storage capacity is increasing in the reservoir behind the dam.

Findings

- "Sediment bypassing results in increased suspended solids computed in the Bay during the bypassing period. The bypassed sediment settles quickly after bypassing stops." (Pg. 141).

- "CBEMP estimated that deep-channel DO and deep-water DO water quality standards were seriously degraded as a result of nutrients associated with the bypassed sediment." (Pg. 141).

- "Bypassing costs are still high but not as high as dredging. Bypassing is just as effective as dredging at increasing sediment deposition and reducing available sediment for scour events. However, this method increases total sediment loads to the Bay. The environmental costs (diminished DO, increased chlorophyll) are roughly 10 times greater than the benefits gained from reducing bed sediment scour in Conowingo reservoir." (Pg. 142).

Comment DR-27: NEPA is required for these investigations. "It should be noted that the LSRWA effort was a watershed assessment and not a detailed investigation of a specific project alternative(s) proposed for implementation. That latter would likely require preparation of a NEPA document. The evaluation of sediment management strategies in the assessment focused on water quality impacts, with some consideration of impacts to SAV. Other environmental and social impacts were only minimally evaluated or not evaluated at all. A full investigation of environmental impacts would be performed in any future, project-specific NEPA effort." (Pg. 143).

Public Participation Concerns

- "The team sent out study coordination letters to various federal and state resource agencies in February 2012 to inform agencies of the initiation of the study and to request the level of involvement each agency would like to have with the study. Two response letters were received requesting involvement in the study as well as various emails from agencies confirming their willingness to participate in study. A study initiation notice was distributed via email in February 2012 as well." (Pg. 147).

- "The team held quarterly meetings to discuss, coordinate, and review technical components of the assessment, as well as management activities. These meetings were open to all stakeholders to attend. Agendas and handouts were provided to stakeholders via email prior to the meeting and the meeting summary with items presented at quarterly meetings was posted to the public website after quarterly meetings. A total of 10 quarterly meetings were held from November 2011 to January 2014, with attendance ranging from 30 to 50 participants. These participants represented 19 different stakeholder groups." (Pg. 147).

- "Throughout the duration of the assessment, the LSRWA team coordinated with other pertinent Chesapeake Bay groups, so as to be included on their agendas to provide updates and get feedback on the LSRWA. Feedback received from these other Chesapeake Bay groups was reported back to the rest of the LSRWA team and was incorporated into this LSRWA report." (Pg 147).

- "Throughout the duration of the assessment, email updates were sent out periodically to interested stakeholders on study progress and news. This email distribution list was started by the original Sediment Task Force (included interested stakeholders) that Susquehanna River Basin Commission led in 1999 and 2000. The team has been updating this list since 2009 with people interested in this effort." (Pg. 147).

- "Prior to public release the draft LSRWA report was reviewed by the agencies involved in quarterly meetings. Additionally, the STAC sponsored an independent scientific peer review of the draft LSRWA report in June - August of 2014. STAC provides scientific and technical guidance to the Chesapeake Bay Program on measures to restore and protect the Chesapeake Bay. More information about STAC is located here: www.chesapeake.org/stac. Appendix I, Attachment I-7 contains the comments and LSRWA team responses to the LSRWA quarterly group's reviews and the STAC sponsored independent scientific peer review." (Pg. 147).

- At least one public meeting is expected to be held later in 2014. Once that meeting is held, a description of the meeting(s) will be placed here and will include a location, date, participants, and feedback received. All comments will become part of Appendix I, Attachment I-7. (Pg. 147).

Comment DR-28: Please explain how this study group involved public participation. How does the LSRWA's approach address NEPA public participation requirements and those required by the Federal Advisory committee Act (FACA)?

- Recommendation – U.S. EPA and Bay watershed jurisdictional partners should integrate findings from the LSRWA into their ongoing analyses and development of the seven watershed jurisdictions' Phase III WIPs as part of Chesapeake Bay TMDL 2017 mid-point assessment. (Pg. 160).

Comment DR-29: Having such findings integrate with 7 watershed jurisdictions requires a FACA approach. Was FACA ever discussed? If not, why not? If so, how was FACA addressed?

Finding #1: Conditions in the Lower Susquehanna reservoir system are different than previously understood. (Pg. 151).

- Conowingo Reservoir is essentially at full capacity; a state of dynamic equilibrium now exists. Previously, it was thought that Conowingo still had long-term net trapping capacity for decades to come.

- Storm event based scour of Conowingo Reservoir has increased. Previously, it was not fully understood how scouring was changing as the reservoirs filled. (Pg. 152).

- The LSRWA modelling efforts indicate that the scour threshold for the current Conowingo Reservoir condition ranges from about 300,000 cfs. to 400,000 cfs. (Pg. 152).

- Modelling simulations comparing current conditions of the Conowingo Reservoir to the mid-1990s indicate that a higher volume of sediment is scoured currently at flows above 150,000 cfs. in comparison to the mid-1990s, with the threshold for mass scouring occurring at about 400,000 cfs. (Pg. 152).

- Sediment transport is related to particle size. Storms can potentially scour the silts and clays (easier to transport) leaving behind the coarser sand-sized sediment. (Pg. 152).

Finding #2: The loss of long-term sediment trapping capacity is causing impacts to the health of the Chesapeake Bay ecosystem. (Pg. 153).

- The assessment indicates that the ecosystem impacts to the Chesapeake Bay result from the changed conditions and are due primarily to extra nutrients associated with the scoured sediment as opposed to the sediment itself.

Comment DR-30: Modelling estimates showed that the sediment loads (not including nutrients they contain) from Conowingo Reservoir scour events are not the major threat to Bay water quality. The models do not account for the sediment smothering that is occurring. Low DO was estimated to persist in the deeper waters of northern Chesapeake Bay for multiple seasons due to nutrient storage in the Bay's bed sediment and recycling between the bed sediment and overlying water column. (Pg. 153). This needs to be reviewed and there needs to be concern with the bed sediments and smothering.

- Full WIP implementation won't fully restore the Chesapeake Bay given changes to the Conowingo Reservoir sediment and associated nutrient trapping capacity. (Pg. 154).

- The Susquehanna River watershed, not the Conowingo Dam and its Reservoir, is the principal source of adverse pollutant impacts on upper Chesapeake Bay water quality and aquatic life. (Pg. 154).

Comment DR-31: So why has the U.S. EPA not declared the Susquehanna River (in Pennsylvania) impaired?

- On average flows above 800,000 cfs. produced scour load that comprised about 30 to 50 percent of the total load entering the Bay; however, an event of this magnitude is extremely rare with a recurrence interval of 40 years or more. (Pg. 155).

Comment DR-32: *See* Figure 4.1. (Pg. 62). Table 4.3 shows an event of 798,000 cfs. having an occurrence of 1 in 25 years. (Pg. 63). Exelon's relicensing application with FERC is for a 46 year license. So how is such an occurrence of flows above 800,000 cfs. a rarity? Why weren't the model runs conducted with a flow rate of at least 798,000 cfs., having an occurrence of 1 in 25 years?

APPENDIX A

Introduction – Facts

- Susquehanna River largest tributary to the bay transports about ½ of the total fresh water input.

- The three lower Susquehanna River reservoirs involve nearly 32 miles of river and have a designed storage capacity of 510,000 acre-feet at normal pool elevation. (Pg. 2).

- This Appendix begins with a discussion regarding a one dimensional model. Please keep in mind that the one dimensional model is utilized when water depth and laterally average conditions can provide adequate results to a problem and lateral sediment transport conditions are not considered.

- According to Appendix A the primary objective is to produce boundary conditions (data daily streamflow, sediment load and particle size) at a site monitored just upstream and at the upper Conowingo Reservoir. Between the Susquehanna River at Marietta, Pennsylvania streamgage (01576000) and the Susquehanna River at Conowingo, Maryland streamgage (01578310), Jan. 1, 2008 - Dec. 31, 2011. (Pg. 5).

- This one dimensional model was calibrated with downstream data from the USACE's bathymetric changes from 2008 - 2011.

Comment A-1: Two one dimensional models were used instead of more and current data and considering a three dimensional model.

Statements Regarding the Use and Limitations of Models in the DLSRWA

- Due to data limitations two one dimensional model simulations were produced: one for the modelling period 2008 - 2011 (representing net deposition) and a second for a high streamflow event using Tropical Storm Lee to represent net scour. (Pg. 1).

- Each simulation used the same model data inputs but model parameters were changed. The depositional model resulted in a net deposition of 2.1 million tons while the scour model resulted in a net loss of 1.5 million tons of sediments. (Pg. 1).

- Dynamic equilibrium results in increased loads that may have a greater impact on sediment and phosphorus that tend to transport in the particles phase and have less of an impact on nitrogen which tends to transport in a dissolved phase. (Pg. 4).

- It is implied that increasing concentrations and loads are due to the loss of storage capacity from a decrease in the scour threshold. These increases are not certain but likely involve changes in particle fall velocities, increased water velocity, transport capacities, and bed shear. (Pg. 4).

- The HEC-RAS one dimensional model simulates the capability of a stream to transport sediment, both bed and suspended flow, based on yield from upstream sources and current composition of bed. The HEC-RAS transport equations are designed mainly for sand and coarser particles. (Pg. 13).

Comment A-2: How does the HEC-RAS model account for clay sediments?

- Sediment loads entering and leaving a reservoir can be determined from a sediment (*i.e.*, transport) curve or from actual concentration data from upstream and/or downstream sites(s). (Pg. 11).

Comment A-3: Figure 6 (Pg. 1) portrays the discharge flow rate capped at 425,000 cfs., which triggers data manipulation concerns. Figure 7 portrays flow rate at approximately 625,000 cfs. The core samples utilized for the Conowingo Reservoir were limited to 8 samples of less than 12'' in depth. *See* Figures 7 and 8.

- At the time that this assessment began, there was concern about the issue of the reservoirs and their reduced trapping capacity because of the implications to sediment and the associated nutrient loads to the Chesapeake Bay and management of those loads. More specifically, there were significant implications to the then ongoing development of the Chesapeake Bay TMDL by EPA working collaboratively with the six watershed states and the District of Columbia. In the 2010 Chesapeake Bay TMDL report, EPA and its seven partner watershed jurisdictions documented their assumption that the Chesapeake Bay TMDL allocations were based on the Conowingo Dam and Reservoir's sediment and associated nutrient trapping capacity in the mid-1990s, the midpoint of the 10 years of hydrology (1991-2000) used in the underlying model scenarios (USEPA, 2010a). EPA documented within its 2010 Chesapeake Bay TMDL main report and supporting technical appendix that if future monitoring shows the trapping capacity of the dam were reduced, then EPA would consider adjusting the Pennsylvania, Maryland, and New York sediment and associated nutrient load reduction obligations based on the new delivered loads to ensure that they were offsetting any new loads of sediment and associated nutrients being delivered to Chesapeake Bay (USEPA, 2010a). (Pg. 9).

Comment A-4: Admission. It is interesting that they don't discuss this assumption in terms of its impact on the models.

- According to the DLSRWA the 52 flood gates that span the dam begin to open at a flow rate greater than 86,000 cfs. Each flood gate generally has the capability to pass up to about 15,000 cfs. (Pg. 14).

- During a large flood that requires the majority of the gate to be open, the spatial distribution of discharge shifts from the western side of the dam where the power plant resides, to the center of the channel. This shift in flow distribution and subsequent sediment load causes the sediment load on the eastern side of the reservoir t increase resulting in a high deposition rate in the area. (Page 14). "Thus depending on the reservoir inflows the spatial and quantitative fate of sediment in Conowingo Reservoir can be quite variable and difficult to stimulate with current modelling methods."

Comment A-5: Concerns expressed in the DLSRWA that the Conowingo Reservoir is quite variable and difficult to simulate. So how is the simulations conducted?

- A report prepared for the LSRWA study discusses modelling uncertainties in Attachment B-1. (Pg. 14).

- Susquehanna River Inflows- the AdH (2 dimensional) simulations used flow rates from 2008-2011- all but one - **Question:** what was the one's flow rate? (Pg. 15).

- Tropical Storm Lee (September 2011) with a peak discharge of 700,000 cfs. (Pg. 15) - 776,000 cfs. (Pg. 66).

Comment A-6: Peak flow rate is marginalized at 776,000 cfs. This rate seems to change throughout the report as a way to run the models with marginalized flow rates. The bathymetric discussion on Pg. 67 makes no sense.

- The HEC-RAS one dimensional model sediment rating curve produced two sediment inflow scenarios: scenario one no scour from upper reservoirs and scenario 2 with 1.8 million tons of scour from the upper two reservoirs for a total inflow load of 24 million tons. (Pg. 16).

Comment A-7: How are these numbers derived given the statement on Pg. 14 that stated the Conowingo Reservoir is quite variable and difficult to simulate?

- The one dimensional model HEC-RAS was used to provide data for the AdH model (two dimensional model). (Pg. 17). Figure 6 shows a sediment rating curve with this data at a flow rate slightly above 600,000 cfs. (Pg. 17). What does this purport to represent?

- In addition, the AdH sediment model requires bed sediments. This data was also manipulated as only 8 bed core samples were taken from the Conowingo Reservoir to a maximum depth of only 1 foot. Core samples were required to determine the inception of erosion (critical shear stress for erosion) and the erosion rate (Pg. 18) used to develop six material zones (Pg. 19). According to the DLSRWA the sediment bed in the AdH Model was approximately 3 feet. (Pg. 23). The properties of the lower 2 feet were either approximated from the SEDFlume data results (which is the one foot data) or determined from literature values. (Pg. 23).

Comment A-8: A general trend was established with this tenuous data which is used to account for sediment size and critical shear stress. Figure 11 is a not based on core samples but rather approximations. (Pg. 26). Figure 12's presentation of suspended sediment concentrations undermined Tropical storm Lee to 600,000 cfs. given that it relied on approximations from Figure 11.

Comment A-9: Because of the uncertainty of measured model boundary conditions the AdH two dimensional model was validated by comparing model output to the total suspended sample measurements below the Conowingo Dam. (Pg. 23). Where is this data from? How could these flow rates above the dam correlate with flow rates below the dam?

- "The hydrodynamics were successfully implemented in the AdH; however, the model was not capable of passing sediment through the gates, therefore, for this study the dam was modeled as an open boundary with downstream control represented by the water surface elevation at the dam. This limitation impacted how sediment was spatially distributed in the lower reach of the Conowingo Reservoir near the dam." (Pg. 60).

Comment A-10: This is an important factor to consider in the two dimensional AdH Model, yet the dam is somehow removed for the model run and flow rates above the dam are compared to flow rates below the dam. How does this account for scour from behind the dam and the circular river flow motion against the dam?

APPENDIX B

Two dimensional modelling results describe the transport of sediment solids and do not imply that a relationship exists between solids and after with nutrient loads. (Abstract (iii)).

Introduction

- The Susquehanna watershed is approximately 27,000 square miles. There exists three hydroelectric dams in the Lower Susquehanna River: Safe Harbor Dam (1931) – Lake Clarke located approximately 32 miles upstream of the Chesapeake Bay with water storage capacity of approximately 150,000 acre-feet; Holtwood Dam (1910) – Lake Aldred located approximately 25 miles upstream from Chesapeake Bay with water storage capacity 60,000 acre-feet; and Conowingo Dam (1928) which is approximately 10 miles upstream of the Bay with water storage capacity of 300,000 acre-feet. (Pg. 1).

Comment B-1: "Conowingo Reservoir currently is approaching a dynamic equilibrium state and continues to store inflowing sediments from non-flood periods." (Pg. 2) This discussion is not consistent or current throughout the DLSRWA as the Dam has indeed reached a state of dynamic equilibrium.

Background

- "The USGS estimates that the average inflow of sediment is about 3.2 million tons per year into the Conowingo reservoir, with deposition ranging from 1.0 to 2.0 million tons per year." (Pg. 5). HEC-6 model one dimensional mode under-predicted the trap efficiency. (Pg. 5).

Comment B-2: Exelon's report is cited as a good summary, which is concerning given that Exelon revised the USGS HEC-6 model and conducted a series of simulations to evaluate scour potential of the three reservoirs. (Pg. 5-6). Please keep in mind this is the same model (Exelon's HEC-6 model) that Langland criticized in his notes and review of the FERC required Exelon Sediment Transport Study.

Study Approach and Goals

- Models: Two dimensional model: AdH and HEC-RAS. (Pg. 7).

- Data: "The USGS provided reservoir surveys from 1996 and 2008 with Exelon Corporation providing the most recent 2011 survey. The survey was modified by USGS to represent a sediment capacity condition." (Pg. 7-8). "The 4-year flow period from

2008 - 2011 was simulated in the model. The flow and sediment entering the upstream model boundary (the channel below the dam of Lake Aldred) were provided by USGS from HEC-RAS (one dimensional model simulations of the 4 year period)." (Pg. 8).

Comment B-3: Not only is Exelon providing the model data to establish a full sediment capacity condition but the 1996 - 2008 reservoir data is being used with 2008 - 2011 flow data. The one dimensional model is not taking into account the impact of scour no matter what data manipulation is being considered. Why not use the USACE's bathymetric changes from 2008 - 2011 data (*see* Pg. 1) instead of Exelon's data? Wasn't there USGS data to consider?

Description of Modelling Uncertainties

- A report was prepared for the DLSRWA effort discussing modelling uncertainties. (Pg. 14).

Comment B-4: Where is this report?

- One dimensional models are typically utilized when depth and laterally average conditions can provide adequate results to a problem. Two dimensional models are appropriate when lateral sediment transport conditions need to be resolved. Model results are depth averaged with model results available throughout the domain area. Two dimensional models can be used to stimulate sediment transport over years or decades for long term simulations. Three dimensional models are the most complex and provide problem resolution in all three dimensions (*i.e.*, depth, lateral and longitudinal). However, three dimensional models are computationally intensive and require long periods of simulation time to rum relatively short problem durations. If the goal of a study is to better understand reservoir stratification in low flow, low turbulence conditions than a three dimensional model is required to differentiate vertical properties.

- "During a large flood that requires the majority of the gates to open, the spatial distribution of discharge shifts from the westerns side of the dam where the power plant resides, to the center of the channel. This shift in flow distribution and subsequent sediment load causes the sediment load on the eastern side of the reservoir to increase resulting in a high deposition rate in this area." (Pg. 14). According to Exelon: a flow rate greater than 86,000 cfs. the 52 flood gates that span the dam begin to open. Each flood gate generally has the capability to pass up to about 15,000 cfs." (Pg. 14).

Comment B-5: Having all gates operating at full capacity the flow rate would allow for 780,000 cfs. In addition two dimensional models are limited in the short term and are using data obtained from a one dimensional model.

Model Flow and Sediment Boundary Conditions

2008-2011 Time Period

- First two years had relatively low flows of approximately 300,000 cfs. The last two years had flows that reached or surpassed the scour threshold of 400,000 cfs. Tropical Storm Lee occurred in September 2011 with a peak discharge of approximately 700,000 cfs. (Pg. 15).
  - HECRAS Output Sediment 1st scenario indicated no scour from the upper two reservoirs and inflow of sediment into Conowingo of 22 million tons.
  - HECRAS Output Sediment 2nd Scenario indicated approximately 1.8 million tons of scour from the upper two reservoirs with inflow of sediment estimated at 24 million tons.

Comment B-6: According to the DLSRWA Tropical Storm Lee had a peak discharge of 776,000 cfs. (Page 66). The approximation marginalizes this storm by lowering the peak discharge to 700,000 cfs. Keep in mind that models aren't even running the flow rate at 700,000 cfs., but rather the 620,000 cfs. (Page 22).

- The scour load from the upper two reservoirs is needed because the maximum load may influence transport capacity in Conowingo and thus impact bed scour potential. Therefore, the 24 million ton HECRAS load was increased by 10 percent to reflect a potential maximum scour load from the upper reservoirs." (Pg. 17).

Comment B-7: What is the model or science behind this 10% increase?

- "Figures 6 and 7 show loads increasing exponentially after the 400,000 cfs. scour threshold…" (Pg. 17).

Comment B-8: Figure 6 shows that the AdH model is only considering a 600,000 cfs. flow rate and not a 700,000 cfs. that was initially discussed. (Pg. 17). Keeping in mind that as this is increasing exponentially these lower marginalized numbers significantly lower the scoured sediment amounts. How did these number associated with Tropical Storm Lee get to 600,000 cfs.? Again the actual numbers regarding Tropical Storm Lee (*i.e.*, the USGS number for Tropical Storm Lee is 709,000 cfs. (*see* Pg. 2 of Hirsch 2012 Report)) are being marginalized.

<u>Model Validation</u>

- SEDflume analysis of bed sediments. The AdH sediment model requires bed sediment properties for each layer in the bed. Eight bed core samples were taken from Conowingo. "The bed was sampled to a maximum depth of only one foot because the resistance of the more consolidated sediments at deeper depths." (Pg. 18).

Comment B-9: Figure 12 states 630,000 cfs. as the mean daily flow for Tropical Storm Lee. These numbers are being downplayed. The USGS number for Tropical Storm Lee is 709,000 cfs. (*See* Hirsch 2012 Report, Pg. 2). (Pg. 25). When simulated in the so-called "Hydrodynamic

Model" Tropical Storm Lee's flow velocity near the peak event was now 600,000 cfs. (Pg. 54). This data was used to address the sediment releases on the Susquehanna Flats SAV. One foot core sample limit makes no sense when other reports included much deeper samples.

- "A relatively small number of bed samples were taken from Conowingo Reservoir. Eight samples were used to represent the entire domain. Analysis of these samples revealed how the sediment size distribution coarsened with distance from the dam, and the subsequent variation of the critical shear stress and erosion rate. With such a small data set it was necessary to conduct a parametric model study in which variables were varied or adjusted to reflect the potential variation in bed properties."

Comment B-10: The meeting notes reveal that the core sample number was originally set at 16 instead of 8 and was reduced only due to cost concerns. (Pg. 28). Keep in mind that the HECRAS model was one dimensional and that the AdH model was used for a two dimensional approach to address lateral sediment transport conditions. Two dimensional model results are depth averaged throughout the domain area (which was stated earlier on Pg. 12) and are inadequate during well-mixed turbulent conditions. Not only is this model inadequate in predicting scour in high flow rate conditions but the data needed for the depth averaged in the domain area relied on only 8 samples of 1 foot depth. Due to the inadequate amount of samples, data had to be obtained from another model and assumptions had to be made. Given the foregoing what are the margins of error? This is a very serious concern given the limitations of both one dimensional and two dimensional models when considering sediment transport during turbulent conditions. (Pg. 12). The explanations associated with data and models have not shown model validation but rather the reverse.

<u>Model Simulations – Impact of Temporal Change in Sediment Storage Capacity</u>

- The scour load during Tropical Storm Lee comprised of 20% of Tropical Storm Lee's total load (*i.e.,* about 3 million tons of the 14.5 million tons). (Pg. 45). The reservoir will have more capacity as a result of this scouring. The large periodic storms like Tropical Storm Lee will continue to transport large quantities of sediment to the Bay which are much higher than the reduced scour loads resulting from sediment removal operations. (Pg. 45).

Comment B-11: The August 2012 USGS Hirsch Report determined sediment loads of 4 million tons from scour and 19 million tons of suspended solids. Why is this data different and why are these numbers being marginalized?

<u>Simulation of Sediment Management Alternatives</u>

- "Impact of Sediment Removal - assumed the removal of 2.4 million tons of sediments above the dam. Total outflow load to bay was reduced by about 1.4% from 22.3 to 22 million tons, scour load decreased by 10 % (from 3.0 to 2.7) and the net reservoir sedimentation increased by about 5.0% (4.1 to 4.3 million tons). For this simulation, the scour load decreased approx. 3.3 percent for every million cubic yards removed." (Pg. 47).

- "Although changing the dredging area location will likely influence model results, removing such a relatively small quantity of sediment will have a minimal impact on total load delivered to the Bay when large flood events occur." (Pg. 47).

Comment B-12: Simulation was run on inadequate data. *See* discussion, *infra*, in Section 6.

Conclusions

- "A number of conclusions can be drawn from the modelling study. Although the uncertainty of the modelling is high due to the uncertainty of sediment boundary conditions and model limitations, the existing versus alternate approach to simulations reveals change in sediment transport based on the alternate condition scenario." (Pg. 57).

Comment B-13: What is the meaning of this statement? That modelling uncertainty is high?

- The AdH sediment transport model results only estimated the transport and fate of sediments that enter the reservoir and scour from the bed. The model does not predict nutrient transport and does not imply any predictive relationship between nutrients and sediment transport. (Pg. 59).

Comment B-14: Nutrient transport is model limited and there is no relationship between nutrients and sediments.

Recommendations to Improve Future Modelling Efforts

- The AdH model was not capable of passing sediment through the gates, therefore, for the study the dam was modeled as an open boundary with downstream control represented by water surface elevation. (Pg. 60). This limitation impacted how sediment was spatially distributed in the lower reach of the Conowingo Reservoir near the dam.

Comment B-15: In this statement the DLSRWA admits its severe limitations. The model's limitations impacted how sediments were spatially distributed in the lower reach of the Conowingo Reservoir near the dam.

- Sediment transport models in general do not have a sophisticated approach to simulate fine sediment flocculation. The AdH model has the capability to relate flocculation to concentration, but not to other variables such as shear stress which determine flock particle size and overall fate. The ability to predict flocculation dynamics is critical to track the fate of sediment in a reservoir system. (Pg. 60).

Comment B-16: This is an admission by the DLSRWA regarding the inadequate modelling scheme utilized.

- Field data collection needs to continue both upstream and downstream of the Conowingo Dam to provide more information on reservoir balance. Currently, the suspended sediment samples are collected from one location near the power plant. (Pg. 60).

Comment B-17: This is an admission by the DLSRWA regarding the inadequate data.

Attachment B1 – Evaluation of Uncertainties in Conowingo Reservoir Sediment Transport Modelling, October 2012, Baltimore District Corps of Engineers, Stephen Scott

The Impact of Conowingo Dam on Hydraulics and Sediment Transport

- "The Presence of the dam creates a backwater effect, reducing the energy slope, thus reducing velocities and encouraging sedimentation. In the area adjacent to Conowingo Dam, circulation of water and sediment is directly impacted by both the Dam face and how water is discharged through the Dam.

- "There are 52 flood gates with a crest elevation of 89.2 feet NGVD 29. For flows exceeding 86,000 cfs., both the power plant and flood gates pass flow up to 400,000 cfs. At higher flows the power plant is shut down with all flow passing through the gates."

Significance of Low Flow Sediment Transport

- "Wind and wave action may impact how sediment moves through reservoir system."

- Suspended sediment transport is an inherently three dimensional process. Correction factor was used in the two dimensional model (AdH model) to account for three dimensional stratification by simulating three dimensional suspended sediment transport.

Comment B-17: How was this correction factor obtained? Does the correction factor also address the open boundaries once the dam was removed in the model run?

Attachment B2 – SEDflume Erosion Data and Analysis

- Cohesive sediment transports are a mixture of sand, silt, and clay particles. Cohesive forces are equivalent to or greater than the gravitational forces that dominate san transport. There are no quantitative methods available to determine erosion rate from cohesive sediment properties.

APPENDIX C

- "Application of the Chesapeake Bay environmental Model Package to examine the Impacts of Sediment Scour in Conowingo Reservoir on Water Quality in Chesapeake Bay," Report of the US Army Corps of Engineers.

- This report examines the impact of reservoir filling on water quality in the Chesapeake Bay with emphasis placed on chlorophyll, water clarity and DO.

- Models: numerous, predictive environmental models and transfer of information between the models. (Pg. 2).

- CBEMP consist of three independent modes: (1) Watershed Model (WSM 5.3.2); (2) Hydrodynamic model; and (3) WQM- Water Quality or Eutrophication Model.

- Analytical Model: Steady state – Reservoir volumetric inflow must equal volumetric outflow and sediment sources must equal sediment sink. Bottom shear stress is the product of shear velocity and fluid density. (Pg. 9).

- Results from Analytical Model: When volumetric flow is below the erosion threshold the solids concentration in the reservoir is independent of depth. (Pg. 10). As reservoir depth decreases the flow required to initiate erosion diminishes. (*Id*). When the erosion threshold is exceeded, the sediment concentration in the outflow is inversely proportional to depth. (Pg. 11). One significant insight is that the reservoir is never completely filled. Solids accumulate continuously until an erosion event occurs. As the reservoir fills, however, the flow threshold to initiate an erosion event diminishes. Erosion events become more frequent and severe. Equilibrium implies a balance between suspended solids inflows and outflows over a time period defined by erosion events. The conventional threshold for erosion of ≈ 11,000 m3 s-1 has a recurrence interval of five years (Langland, 2013) implying the equilibrium exists over roughly that period. If we believe the threshold for erosion is below 11,000 m3 s-1, when volumetric flow is below the threshold, the solids concentration in the reservoir is independent of depth. (Pg. 10). As reservoir depth decreases, the flow required to initiate erosion diminishes.

Comment C-1: The use of existing models and practices that the LSRWA points out as being advantageous to the DLSRWA since these tools could not be developed within the time and budget limitations of the LSRWA. The individual models within Chesapeake Bay Environmental Model Package (Watershed Model, Hydrodynamic Model, and Water Quality Model) are documented, reviewed and used. CBEMP relies on the flawed TMDL model.

- "The resources necessary to acquire raw observations, create model input decks, execute and validate the individual models within the CBEMP for the years 2008 - 2011 was beyond the scope of the LSRWA." (Pg. 17).

- Data limitations: "…[M]eans were required to transfer information from the 2008 - 2011 AdH application to the 1991 - 2000 CBEMP." (Pg. 17).

Comment C-2: What kinds of means were required?

- "The crucial transfer involved combining scour computed by AdH for Tropical Storm Lee with watershed loads computed by the WSM model for a January 1996 flood and scour event represented by the CBEMP. (Pg. 17). "The WSM provides computations of volumetric flow and associated sediment and nutrient loads throughout the watershed and at the entry points to Chesapeake Bay. Flow computations are based on precipitation, evapotranspiration, snow melt, and other processes. Loads are the result of land use, management practices, point-source wasteloads, and additional factors. The loads computed for 1991 - 2000 are no longer current and are not the loads utilized in the TMDL computation. To emphasize current conditions, a synthetic set of loads was created from the WSM based on 1991 - 2000 flows but 2010 land use and management practices. The set of loads is designated the "2010 Progress Run." The TMDL loads are a second set of synthetic loads created with the WSM. In this case, the 1991 - 2000 flows are paired with land uses and management practices sufficient to meet the TMDL limitations." (Page 17).

Comment C-3: Limited observations of sediment associated nutrients are available at the Conowingo outfall during the 1996 flood event.

- Major storm events occur at different times of the year. In order to examine the effect of seasonality of storm loads on Chesapeake Bay, the January 1996 storm was moved, within the model framework, to June and to October. The loads were moved directly from January to the other months. No adjustment was made for the potential effects of seasonal alterations in land uses. New Chesapeake Bay hydrodynamic model runs were completed based on the revised flows, to account for alterations in flow regime and stratification within the Bay. (Pg. 18).

Comment C-4: Limitations on the impact on growing cycles. Table 3-1 needs to reference the flow rate used in model runs. (Pgs. 20-21) What were the flow rates?

- Loads from the watershed are calculated by the CBP WSM for two configurations: existing conditions (2010 Progress Run) and total maximum daily load (TMDL). (Pg. 21).

- Nutrient loads associated with bottom erosion were calculated by assigning a fractional nitrogen and phosphorus composition to the eroded solids. The initial fractions assigned, 0.3% nitrogen and 0.1% phosphorus, were based on analyses of sediment cores removed from the reservoir (Cerco, 2012). (Pgs. 24-25).

Comment C-5: Sediment core samples from the reservoir were limited to 8 samples at less than 1 foot deep.

- Dilemma discussed in Appendix C (Pg. 25): Employment of the 1996 nutrient composition to characterize the nutrients associated with sediment eroded in 1996 results in reasonable agreement between observed and computed nutrients at the Conowingo outfall (Figures 4-5, 4-6) but presents a dilemma. Which nutrient fractions should be used in subsequent scenario analysis? The 1996 composition, which accompanied the 1996 event and was observed during the 1991 - 2000 scenario period? Or the 2011 composition which is more recent and characterizes a typical tropical storm event? In view of the dilemma, several key scenarios have been run with alternate composition, presenting a range of potential outcomes.

- The ADH model was run for several bathymetry sets including: existing (2008) bathymetry; equilibrium bathymetry; bathymetry following 1996 storm; and bathymetry resulting from dredging 2.3 x 106 m3 (3 million cubic yards).

- In all cases, the procedure for determining the scour load followed the same steps: Solids loads into and out of Conowingo Reservoir using the hydrologic record for the period 2008 to 2011were provided by the ADH model; Solids scour for two events in 2011 was determined by the excess of outflowing solids loads over inflowing solids loads; Scour for the 1996 hydrologic record was estimated by interpolation based on excess volume; Nutrient composition was assigned to the scoured solids based on 2011 observations; and For key scenarios, an alternate set of nutrient loads was constructed based on 1996 observed nutrient fractions.

Comment C-6: Mixing 1996 data for the ADH model that used the hydrogeological record for 2008 - 2011. When reviewing the tables in report please keep in mind that 1 cubic meter per second = 35.3146667 cfs. Table 4-3 (Pg. 29) sets the highest flow rate at 17,479 cubic meters per second multiplied by 35.3 result in 617,009 cubic feet per second, which is well below Tropical Storm Lee's flow rate. Table 4.4 (Pg. 30) is not much better at 621,986 cubic feet per second.

- Output Formats. A separate supplemental publication is planned to describe results of scenarios conducted for the EPA CBP. (Pg. 40).

- A scenario was run with Conowingo Reservoir removed from the system. This was accomplished by routing directly to the bay the calculated WSM loads into Conowingo Reservoir. The initial intent was to simulate a reservoir-full condition. In this interpretation, loads to the reservoir would pass directly through in the absence of deposition. This interpretation was superseded by a revised conceptual model in which settling occurs even under reservoir-full conditions.

APPENDIX D

- Estimated Influence of Conowingo reservoir Infill on Chesapeake Bay Water Quality.

- The Susquehanna River delivers about 41 percent of the nitrogen loads, 25 percent of the phosphorus loads, and 27 Percent of the suspended solids on an annual basis (CBOP 1991 - 2000 simulation period).

Comment D-1: The simulation period is flawed. Why was that simulation period, which doesn't take into account episodic event, such as Tropical Storm Lee, considered? As for the Phase 5.3.2 Watershed Model this relies on 2010 TMDLs. Doesn't the 5.3.2 model also have a problem with nutrient load estimations?

- The mid-point assessment of the Chesapeake TMDL is planned for 2017 to account for Conowingo Dam infill and to offset any additional sediment and associated nutrient loads to the Bay. (Pg. 3).

Comment D-2: Although the TMDL model is admittedly flawed for nutrient and sediment load, why is it still being used by the LSRWA team to estimate influence of the Conowingo reservoir infill on the Bay's water quality? Modelling for the Chesapeake Bay TMDL consisted of an assessment of the entire hydrologic period of 1991 - 2000, which only takes into account one high flow rate of the big ice melt in 1996. Why isn't flow rate ever discussed in terms of magnitude and velocity in the model? (Pg. 8).

APPENDIX E

Introduction

- May, 2, 2012 – Maryland Geological Survey (MGS) conducted 16 sediment grab samples (surficial grab samples) taken in the Susquehanna Flats area of the upper Chesapeake (Figure 1). (Pg. 2).

- Sample locations were determined through consultation with USACE based on existing sediment sample data available. (Pg. 2) Two samples sites located in the Susquehanna were not sampled because of concerns regarding bedrock.

- Sediment grab samples were analyzed for water content, bulk density and grain size. Two homogenous splits of each sample were processed with one for bulk property analyses and the other for gain-size characterization. (Pg. 4).

Comment E-1: How deep or what was the depth of these samples?

- Shephard's (1954) classification of sediment types presented in Figure 2. (Pg. 7).

Comment E-2: What is "1954 classification data"? Haven't the characteristics of sediments changed in the last 60 years?

- Table 3 – Results shows the field data of grain size based on the grab samples.

Comment E-3: The table emphasized the fact that samples were too shallow or very difficult to get. How were these limitations addressed?

APPENDIX F

- Need for updated chemical and physical measurements of suspended sediment flowing through Conowingo Dam.

- During four storm flow events in water year 2010 (October 1, 2010 - September 30, 2011) large volume samples were collected to support analysis of detailed suspended sediment with six fractions and physical and chemical measurements of sediments.

Comment F-1: What model runs used the USGS data described above?

- Ten samples were taken during four high flow events during water year 2011. The U.S. Department of Interior (MD-DE-DC Water Science Center, Baltimore, MD).

Comment F-2: At which high flow events were the ten samples taken during water year 2011?

- Table 4. Elements in suspended-sediment samples collected at the Susquehanna River at Conowingo, Maryland (USGS 01578310) were determined by cold vapor atomic absorption spectrophotometry.

Comment F-3: Were hazardous constituents such as PCBS also monitored in the ten samples? If not, why not?

APPENDIX G

- October 2011, Gomez and Sullivan Engineers conducted bathymetric surveys of the Conowingo Reservoir. These 2011 bathymetry survey data and methods were evaluated and approved by the USGS for the LSRWA's effort. Their efforts included: measured depth data combined with water surface elevation (WSE); the unit measured bottom depths several times per second, recorded averages. To account for the WSE difference, the WSE gradient between Conowingo Dam and Peach Bottom was used to determine the WSE throughout Conowingo Pond. (Pg. 3).

Comment G-1: How are the influences by Holtwood and the Muddy Run operations accounted for in this analysis? How were depth measurement points calculated between the two measurement areas?

- Sediment volume change for each cross section was calculated using the weighted and unweighted water volume methodologies. (Pg. 5).

Comment G-2: This study relied on a comparison of 2008 and 2011 data to get some insight into the sediment transport process focusing in the Conowingo Pond.

Comment G-3: Although these samples were taken in a short period of time they cannot really provide what the sediment transport rate would be with one major episodic event.

Comment G-4: Gomez and Sullivan stated that the 2011 cross-section data may serve as a reference point for future surveys. (Pg. 7). What additional surveys would be recommended by Gomez and Sullivan if these surveys were used as a reference point?

Comment G-5: According to Gomez and Sullivan's findings and conclusions, it appears that the zone of dynamic equilibrium has expanded farther downstream that in previous surveys, extending to about 3.7 miles upstream of the Conowingo Dam. (Pg. 8). Did any of the model runs account for this recent observation and conclusion? If not, how will this impact the model runs? Will scour amounts be adjusted to address this recent observation?

APPENDIX H

- A question that was not addressed in the DLSRWA is related to the various techniques for sediment management explored in the literature review of Appendix H. While different kinds of dredging are mentioned in the Appendix and in the body of the report, a technique known as hydro-suction dredging is mentioned several times in the Appendix but not mentioned explicitly in the DLSRWA. This technique would be especially useful for sediment bypassing because it makes use of the huge natural head difference between the reservoir and the river below the dam to maintain flow through a dredging pipe or bypass tunnel. (Pg. 35, Appendix 1-7).

Comment H-1: Was this technique considered in figuring the relatively low cost of bypassing, or not? Would it make a difference?

- The literature review in Appendix H ignored nutrients." (Pg. 35, Appendix 1-7).

- A literature search was conducted on managing watershed/reservoir sedimentation in Appendix H. Findings and lessons learned from the literature search were incorporated into refining sediment management strategies for this Assessment. Results of this literature search are presented in Appendix H.

Comment H-2: How could findings and lessons learned from case studies in which there is no consistency in the data presented for each LSRWA? For example, many of these case studies have no data for cost/funding or amount of sediment removed.

Comment H-3: Please explain why the case studies in Appendix H actually include the Susquehanna River Dams (*see* Pg. 26, No. 19). Oddly, the information contained for the Susquehanna River Dams is based on 1990 data. Why wasn't this information updated? How is old information and data useful and or important for the DLSRWA? If the Susquehanna River Dam information is outdated, how can the Study group ensure that case studies in Appendix H contain current and accurate information? Is this just a data dump that includes dams and reservoirs or was most of this information used for the DLSRWA? If it was used for the DLSRWA, how was it used?

- From the research found, especially overseas, warping technique was found to be often used where river water with high sediment loads is diverted onto agricultural land. The sediment deposition on the land enhances its agricultural value. (Pg. 52).

Comment H-4: Doesn't the warping technique increase the potential for erosion and greater sediment and nutrient runoff?

Comment H-5: Why does Appendix H include overseas sites located in China, Switzerland, Pakistan, etc.? Where is the value regarding such information?

- Minimizing Sediment Deposition includes a description of alternatives such as selectively diverting water. (Pg. 51).

Comment H-6: When these potential alternatives were identified, was there consideration given to the multiple uses of the Susquehanna reservoirs? For example the Peach Bottom Nuclear Plant relies on reservoir water for cooling, which begs the question: do these alternatives impact the industrial use of the Susquehanna River?

Comment H-7: One case study that was not listed in Appendix H is the Plainwell Impoundment located on the Kalamazoo River, Plainwell, Michigan. The dredged sediments associated with the Plainfield Impoundment contained levels of PCBs. Please keep in mind that recently EPA expressed this concern regarding the Conowingo sediments. This Plainwell Impoundment provided detailed cost data that could be very useful in the event that detectable levels of PCBs are present in the Conowingo sediments. Why was the Plainfield Impoundment overlooked? More information regarding the Plainfield Impoundment can be obtained from the following EPA Region V URL site: http://www.epaosc.org/site/site_profile.aspx?site_id=2815.

APPENDIX I-6

- The LSRWA revisited the goals that were developed for the study early on in the scoping process of the LSRWA in order to refine these goals. The purpose of the goals are to create bounds and focus for the team on what will be accomplished with the LSRWA and to communicate to stakeholders what the LSRWA will accomplish. Such goals included evaluating sediment management, and to determine the effects to the Chesapeake Bay from the sediment and nutrient storage located behind the dam. (Pg. 5).

- Exelon, the owner and operator of the dam, must undertake a variety of studies as requested by state and federal resource agencies to get an understanding of impacts of the dam. Several of the requested studies deal with sediment transport and accumulation in the dam system which relates to LSWRA efforts. At this time, most of the relicensing studies dealing with sediment transport and accumulation undertaken by Exelon are simply a compilation of existing literature and data. Their study findings were that 400,000 cfs. (cubic feet per second) is not the threshold where sediments are scoured from behind the Conowingo Dam and that overall Tropical Storm Agnes did not scour sediments but ended up depositing more sediment behind Conowingo Dam. Mike said that this latter finding is not supported by USGS at this time. (Pg. 5).

Comment I-6-1: Knowing that Exelon was responsible for studies dealing with sediment transport and accumulation behind the Dams as part of the license requirement, why did the LSRWA workgroup deicide to take on this task? Why would tax payer funds be used to perform these tasks when the burden was clearly on Exelon?

- Mike Langland noted in the past, USGS utilized a one dimensional HEC-6 model to assess sediment deposition and transport in the entire reservoir system including sediments from the watersheds. Mike noted that there were shortcomings to this model. As part of his LSRWA efforts, Mike will construct and calibrate an updated one dimensional HEC-RAS model that will route inflowing sediment through the reservoirs, accounting for both sediment deposition and erosion in the upper reservoirs. The output of this model will provide boundary conditions for the two dimensional model simulations that Steve will be conducting as part of his scope in the Conowingo Reservoir.

Comment I-6-2: STAC commented on limitations of the HEC-RAS and AdH models. These limitations were not made sufficiently clear in the DLSRWA. The HEC-RAS modelling effort was largely unsuccessful and the HEC-RAS simulation was largely abandoned as an integral part of the DLSRWA. (Pgs. 8-9, Appendix I-7). What were the limitations associated with the HEC-RAS model? Was USGS able to obtain a level of comfort with this model?

- Bruce Michael noted that there was minimal scouring during the spring 2011 high flow events. However, this was the worst year on record for hypoxia and second highest flow on record. (Pg. 8).

Comment I-6-3: Please provide the data that Bruce Michael based his observation on in the spring of 2011.

- Jeff noted that scouring occurred during Tropical Storm Lee from behind the Conowingo Dam. These sediments appeared to bypass the upper Bay and accumulated more in the middle Bay. The approach channels to the C&D Canal were scoured according to Philadelphia District and there did not appear to be significant burial of organisms since sediment was widely dispersed. (Pg. 8).

Comment I-6-4: Please provide the data source for Jeff's comments.

- Discussion ensued about the status of federal funding for this study. The study received funding for FY12 by mid-February. [Update: $300,000 received in February 2012.] The FY13 budget will be coming out in a few weeks and then it will be determined if funding is available for next FY. [Update: This project is not in the president's FY13 budget.] (Pg. 3 – January 23, 2012 Meeting at MDE).

Comment I-6-5: Again please explain why taxpayer money being used when the study should have been conducted by Exelon as part of the FERC relicensing application.

- Dave added that it is important as we finalize the watershed assessment that we make sure to refer back to the public outreach plan and follow what we have laid out to engage the public in the LSRWA. (Pg. 5).

Comment I-6-6: Why weren't the public involvement procedures established by the Federal Advisory Committee Act (FACA) followed and adhered to? What is this public outreach plan that is discussed above? Please provide a copy of this plan.

- Shawn Seaman will contact Michael Helfrich to notify him of quarterly meetings to see if he can attend. (Pg. 2).

Comment I-6-7: Is this how the public outreach plan works? There seems to be exclusivity involving who can participate.

- Herb mentioned that he, Secretary Summers (MDE) and Paul Swartz (Executive Director, SRBC) met with the Maryland delegation from the Eastern Shore. He noted that feedback from these meetings was that there is a lot of interest in water quality in the Bay; farmers feel like they are being picked on (it will be important to engage agriculture groups in study); and the costs of the implementation of the TMDL and the proposed "flush tax" to cover the cost of implementation of TMDL. (Pg. 5 – 2/16/2012).

Comment I-6-8: How were agriculture groups engaged in the DLSRWA? If not, why not?

- The Conowingo Dam has been undergoing the 5-year FERC relicensing process. Out of this relicensing process Exelon (owner and operator of Conowingo Dam) was required to conduct several studies that relate to sediment accumulation and transport. Year 2 study reports are due by January 23, 2012. Several contractors of Exelon attended the quarterly meeting and provided results of these studies to the LSRWA team. Marjie from URS explained that the objective of the sediment transport and accumulation study they conducted was to provide data that will be useful in the future development of an overall sediment management strategy for the Susquehanna River and Chesapeake Bay.

Comment I-6-9: Was Exelon's sediment transport and accumulation study relied upon or used in the overall sediment management study? Why didn't any workgroup member state that Exelon should be responsible for the LSRWA study given Exelon's contractor's (*i.e.*, URS) comment?

- Anna will send out an update via the large email distribution list that started with the original Sediment Task Force (includes academia, general public, federal, non-government organization (NGO), and state and counties representatives) notifying the group of LSRWA kick-off meeting and study start and will periodically update this group as the LSRWA progresses. (Action Items from November Meeting.)

Comment I-6-10: Was this update distributed? Did this update include future dates for meetings for all to attend? If so, why didn't the Clean Chesapeake Coalition receive this notice?

- Shawn will notify the team when the most recent Exelon study reports are released. Status – Recent report was sent out to the team; ongoing action. Shawn was not in attendance so Tom let the group know that the Exelon application for the Conowingo Dam license will be filed with FERC at the end of August [2012] and all required studies will be completed by the end of September with the exception of two fish studies. (Pg. 3 – 8/16/2012).

Comment I-6-11: Did LSRWA workgroup members review Exelon's required studies? If so, were deficiencies identified and discussed with Exelon and or its consultants?

- The LSRWA identified their mission as: "To comprehensively forecast and evaluate sediment and associated nutrient loads into and from the system of hydroelectric dams located on the Lower Susquehanna River above the Chesapeake Bay and consider structural and non-structural strategies to manage these loads to protect water quality and aquatic life in the Chesapeake Bay." (Pg. 4 – 8/16/2012).

Comment I-6-12: Did anyone on the LSRWA team question this mission, given that this was Exelon's obligation in the FERC relicensing application? How many scientists in the LSRWA were involved in this comprehensive study? Please provide their names and degrees. Did the LSRWA consist of any hydro engineers?

- Matt Rowe will compare the results from the analysis of sediment cores taken from behind the Conowingo dam in 2006 to the decision framework criteria laid out in the 2007 IRC report to help the team better understand the suitability of the sediments in the lower Susquehanna river watershed for innovative reuse options. (Pg. 2 – 12/26/2012).

Comment I-6-13: How does comparing 2006 data help in the decision making process? Doesn't Tropical Storm Lee in 2011 have a significant impact on this data?

- Currently the law firm Funk and Bolton is proposing and accepting money from counties for a study to be conducted by this law firm on the Bay TMDL. (Pg. 3 – 12/26/2012). Michael added that there has been concern raised by this coalition that MD has county WIPs while PA does not. Pat Buckley noted that PA has "WIP planning targets" in lieu of "County WIPs".

Comment I-6-14: Is there a reason why the Clean Chesapeake Coalition wasn't invited to attend this meeting? How does the Clean Chesapeake Coalition's attendance interfere with the LSRWA's mission to comprehensively forecast and evaluate sediment and associated nutrient loads into and from the system of hydroelectric dams located on the Lower Susquehanna River above the Chesapeake Bay and consider structural and non-structural strategies to manage these loads to protect water quality and aquatic life in the Chesapeake Bay? How is Funk & Bolton even relevant to this study?

- Carl noted that his previous efforts involved running modelling scenarios that removed Conowingo from the system to understand what it would look like with all sediments flowing into the bay and no longer being trapped by Conowingo. With this latest simulation, Carl looked at what the system would look like (*i.e.,* impacts on water quality) if there were a scouring event. More specifically, he took the system's current condition (Conowingo still trapping) with WIPs in place, using bathymetry from after the 1996 scour event. (Pg. 5 – 03/22/2013).

Comment I-6-15: How is a scoring event measured if the dam is removed in the model runs? How is the circular flow hitting the dam and scoring sediments adjusted in such a model run?

- Lew Linker noted that the results may not represent effects on SAV; a period of reduced light could really impact SAV. Carl noted that for the final report these final outputs need to be remedied. (Pg. 8 – 06/07/2013)

Comment I-6-16: Were these final outputs ever obtained? If so, please provide a copy of this study.

- Michael Helfrich noted that Carl's modelling is using the 4th biggest event we have on record to show storm scouring (the 1996 winter storm event). What about the storms that have occurred on record that were larger than this event? Also the loads (nutrient and solids) shown in Condition 6 (scour event in summer, fall, and winter) are less than loads in Conditions 3 - 5, which all included a simulation of the same storm event. Why is this? (Pg. 9 – 06/07/2013).

Comment I-6-17: Please provide an answer to Michael Helfrich's statement.

- "The group determined that data on nutrient (and sediment) in water outflows from Conowingo Pond was inadequate, and collecting data to fill gaps was scoped into the study. It was recognized that it would be useful to have additional information on Conowingo Pond bottom sediment biogeochemistry, particularly with regard to phosphorus. However, it was determined that existing information/data was adequate for study modelling purposes, and it was decided to not undertake such investigations in light of need to control study costs." (Pg. 3 – 09/24/2013).

Comment I-6-18: How does the use of old data to fill in the gaps effect the LSRWA's mission to comprehensively forecast and evaluate sediment and associated nutrient loads into and from the system of hydroelectric dams located on the Lower Susquehanna River above the Chesapeake Bay and consider structural and non-structural strategies to manage these loads to protect water quality and aquatic life in the Chesapeake Bay?

- With regard to (P) phosphorus biogeochemistry, Carl had identified Jordan and others (2008) as presenting a concept applicable to utilize for our situation. P is generally bound to iron in fine-grained sediments in oxygenated freshwater and of limited bioavailability. Under anoxic/hypoxic conditions iron is reduced and P can become more bioavailable. P rebinds to iron in sediments if oxygen is again present. P adsorbed to Conowingo Pond bottom sediments would remain bound to those sediments in the freshwater uppermost Bay. In saltwater, biogeochemical conditions change. Jordan and others (2008) indicate that as salinities increase above about 3-4 ppt/psu (parts per thousand/practical salinity units, P is increasingly released from sediments and becomes mobile and bioavailable to living resources, which is likely due to increased sulfate concentrations in marine water (*e.g.*, Caraco, N., J. Cole, and G. Likens, 1989. Evidence for Sulphate-controlled Phosphorus Release from Sediments of Aquatic Systems. (Pg. 3 – 09/24/2013).

Comment I-6-19: More recent studies show phosphorus is released and no longer bound to sediment s in the presence of higher salinity in water. Why weren't these more recent studies evaluated?

APPENDIX I 7

- The charge from STAC to the review team was: "You should focus your comments on the following [questions], but you are encouraged to provide additional comment that would improve the analyses, report or its recommendations." (Pg. 6).

Comment I-7-1: How were the questions developed that the review team focused on?

- "The science associated with assessing the evolving condition of the Lower Susquehanna River and its effects on the Chesapeake Bay is exceptionally challenging. As far as the reviewers are aware the Conowingo situation is truly unique. A major reservoir that had been an effective trap for fine sediment and associated nutrients has largely transitioned to one that no longer has an ability to perform this long-term function." (Pg. 6).

Comment I-7-2: If this were the case, how could the science associated with the LSRWA continuously flip flop back and forth on whether the reservoir still has trapping capacity or whether reservoirs are in dynamic equilibrium?

- "The goals stated in the main report (which stress both sediment and nutrient management) are inconsistent with the methodological approach taken by LSRWA (which mainly emphasized sediment) and appear not to be the study's original goals. This review recommends that the original goals of the study (*i.e.*, sediment management to extend the life of Conowingo Dam more than nutrient management to protect Chesapeake Bay water quality) be presented in the introduction followed by a fuller explanation of how and why the focus of the study evolved in time." (Pg. 7).

Comment I-7-3: If that is the case how adequately does the draft report stress both sediment and nutrient management?

- "It must also be stressed early and repeatedly that the dollar costs associated with alternative sediment management approaches specifically focus on the cost of reducing the amount of total sediment behind the dam, not on the cost of managing the impact of associated nutrients on the Chesapeake Bay. Further analysis would be required to appropriately rank the alternative strategies based on a more environmentally relevant total cost in terms of dollars per pound of nitrogen and/or phosphorus reduction." (Pg. 8).

Comment I-7-4: Such an analysis is extremely important and lost in the DLSRWA. If conducted, will the relevant total cost in terms of dollars per pound of nitrogen and/or phosphorus reduction be compared to all the BMPs and activities discussed in the DLSRA?

- "Although the report lists and discusses sources of uncertainty, it expresses the expected confidence intervals on its model predictions less often. Although there is no single accepted procedure for reporting uncertainty in the context of scenario modelling, a part of the report should more explicitly explain why confidence intervals on predictions are generally not provided." (Pg. 8).

Comment I-7-5: Why isn't there any reporting of uncertainty in the context of scenario modelling? Are the uncertainties that significant in terms of considering a margin of error analyses?

- "Key areas of concern which are expanded upon in response to Questions 3 and 4 include: (1) Stated sediment discharges from the Conowingo Dam are inconsistent with the literature. The report authors should either correct their numbers or present a clear explanation that reconciles why their estimates are significantly different from other estimates that are based on analysis of observed data. (2) Reduced deposition associated with reservoir infilling has been neglected. The fundamental issue motivating the LSRWA study is that the net trapping efficiency of Conowingo Reservoir has decreased dramatically over the past 15 to 20 years. Net trapping efficiency is the sum of increases in average annual scour and decreases in average annual deposition. However, the simulations and calculations in the study only considered the increase in scour. (3) Grain size effects within and exiting the reservoir were not sufficiently considered. The combination of two grain size effects – (i) changing grain size in time in the reservoir and (ii) the greater effects of fine sediment in transporting nutrients - mean that the effects of the reservoir on water quality have not reached a full dynamic equilibrium. However, the report did not address whether reservoirs were in dynamic equilibrium with respect to nutrients other than by assuming that if sediment was at equilibrium, then nutrients were also. (4) Limitations of the HEC-RAS and AdH models were not made sufficiently clear in the main report. The HEC-RAS modelling effort was largely unsuccessful, and the HEC-RAS simulation was largely abandoned as an integral part of the main report. Although consistent with four observed, integrated sediment-related properties of the system, the AdH model was not fully validated, and the AdH model was forced by boundary conditions outside the range of observed values. This means that the AdH model alone was not reliably predictive, and until the AdH model has been improved, observations should instead be emphasized to support the most important conclusions of the LSRWA study." (Pgs. 8-9).

Comment I-7-6: These are serious concerns and misinformation, how will this comment be addressed in the DLSRWA? The inconsistencies in data that pertains to sediment discharge, low rates, trapping capacity, dynamic equilibrium, grain size has a significant impact on model runs. How will this be addressed? How can Models be analyzed and compared with such inconsistencies? The DLSRWA authors should correct the fact that the Conowingo Dam is no longer trapping.

Comment I-7-7: If the AdH model alone was not reliably predictive, and needs substantial improvement, how can observations instead be emphasized to support the important conclusions of the study that relied heavily on the AdH two dimensional model? Does this statement mean that observations trump scientific data? Or does the statement mean that scientific data is not required?

- "Many of recommendations for future work and modelling tool enhancement are very good and are consistent with the views of this review." (Pg. 9).

Comment I-7-8: How could this statement be made given the statements above and the data inconsistencies and that the AdH model alone was not reliably predictive?

- "…[T]he HEC-RAS modelling effort was ultimately unsuccessful, and results of the HEC-RAS simulation did not form an integral part of the main report, and (ii) the existing application of the AdH model, although generally consistent with the validation data used, was not reliably predictive beyond constraints provided by a few integrated observations of sediment-related properties of the system."

Comment I-7-9: How can STAC say that these models did not provide an integral part of the report? If these models were not integral, why were they discussed and used? Why were these models used to identify concerns and also used to discuss the financial value of sediment management strategies if they were ultimately unsuccessful?

- The purpose of this assessment was to analyze the movement of sediment and associated nutrient loads within the lower Susquehanna watershed through the series of hydroelectric dams (Safe Harbor, Holtwood, and Conowingo) located on the lower Susquehanna River to the upper Chesapeake Bay. This included analyzing hydrodynamic and sedimentation processes and interactions within the lower Susquehanna River watershed, considering strategies for sediment management, and assessing cumulative impacts of future conditions and sediment management strategies on the upper Chesapeake Bay." A similar "purpose" statement appears in the Introduction. (Pgs. 5-6). Note that the word "nutrient" appears only once in the above statement, and the purpose of the study was mainly to address "sediment management".

Comment I-7-10: How was that purpose conducted through the use of unsuccessful modelling?

- "The report only briefly states that during the course of the study it became clear that nutrients were more important than sediment. More background is needed in the introduction regarding how and why this judgment was made and how the course of the study then evolved." (Pgs. 11-12).

Comment I-7-11: Once again the Report relies on assumptions. Is there any scientific background to this concern?

- "Although it is not specifically described as such in the draft report, the overall economic analysis in the LSRWA is in essence a cost-effectiveness analysis (CEA). In contrast to cost-benefit analysis in which the positive and negative impacts of alternatives are expressed and directly compared in monetary terms, CEA expresses some key impacts in non-monetary but still quantitative terms." (Pg. 14).

Comment I-7-12: Will a cost-benefit analysis be performed on this DLSRWA in terms of BMPs and sediment management strategies?

- "The report should also emphasize that further analysis would be required to appropriately rank the alternative strategies based on a more environmentally relevant total cost in terms of dollars per pound of nitrogen and/or phosphorus reduction." (Pg. 15).

Comment I-7-13: The Clean Chesapeake Coalition agrees with this comment. Will the final DLSRWA include alternative strategies based on environmental relevance with total cost in terms of dollars per pound of nitrogen and phosphorus reduction?

- "Although there is no single accepted procedure for reporting uncertainty in the context of scenario modelling, a part of the report should more explicitly explain why confidence intervals on predictions are generally not provided." (Pg. 16).

- **"**In many of the modeled scenarios, the changes in attainment of water quality criteria with fairly large management actions would appear to a non-technical reader to be very small. For instance, p. 135 states: "…estimated…nonattainment…of 1 percent, 4 percent, 8, percent, 3 percent…" One should ask if such estimates are statistically significant. Similarly, in appendix A, p. 25, the net deposition model indicated that ~2.1 million tons net deposition in the reservoirs occurred in 2008-11. This is the difference of two order-of-magnitude larger numbers (22.3M tons entered the reservoir, 20.2M tons entered the Bay). There is a rule-of-thumb in sedimentology: ±10% in concentration or transport is 'within error'." (Pg. 16).

Comment I-7-14: Does the precision of the computed difference fall within the margin of error in these metrics?

- On p. 113 the report states, "A close inspection of the model simulation results indicate that trace erosion does occur at lower flows (150,000 to 300,000 cfs.), which is a 1- to 2-year flow event. This finding is consistent with prior findings reported by Hirsch (2012)." The Hirsch (2012) findings are different from what is expressed here. The relevant statement from Hirsch (2012) is: "The discharge at which the increase [i.e., the increase in suspended sediment concentrations at the dam] occurs is impossible to identify with precision, though it lies in the range of about 175,000 to 300,000 cfs. Furthermore, the relative roles of the two processes that likely are occurring – decreased deposition and increased scour – cannot be determined from this analysis."

Comment I-7-15: Does the DLSRWA and the model runs account for such a discrepancy? If so, how? If not, why not?

- "Also on p. 190, the report indicates that, "The total sediment outflow load through the dam… increased by about 10 percent from 1996 to 2011…" These results are so strongly at odds with other published numbers on this subject that some explanation and discussion is certainly required. Hirsch (2012) reports an increase in flow-normalized flux over the period 1996-2011 of 97 percent (*see* Table 3 of Hirsch). Also, Langland and Hainly (1997) published an estimate of change in average flux from about 1997 to the time the reservoir is full of 250%. Reporting a 10% increase in light of these two other findings appears erroneous."

Comment I-7-16: Why weren't Hirsch's and Langland's numbers used instead of 10%?

- From STAC: "p. 138 Paragraph 2: Oysters are discussed here within a section that otherwise discussed the modelling and simulation activities. Is there a description of how model analysis was used in this report to determine flow and management effects on oysters? Whatever the case, it should be clearly stated where the oyster effects fit into this report and whether or not model simulations were used to understand effects on oysters."

- LSRWA Response: No specific modelling simulations were run to quantify oyster impacts. However this resource is of high interest so this qualitative language was added. This paragraph was deleted from this section since the context here is specific LSRWA simulation results (*i.e.*, quantified results). Section 2.7.4 discusses oysters and impacts from storm events summarizing a DNR report on effects from Tropical Storm Lee.

Comment I-7-17: Were model runs conducted by DNR to determine impact on oysters or was it based on observations? If based on observation were sediment levels that blanketed the oysters considered as an impact?

- "As described in Section 5.2, "the LSRWA team relied heavily on the Bay TMDL work done by CBP and state partners to develop the watershed management strategies. As such, the LSRWA team adopted the CBP methodology and unit costs as the representative alternative for a watershed management strategy; additional cost and design analyses were not undertaken." Citations are included where appropriate (e.g. U.S. Environmental Protection Agency (U.S. EPA). 2010), however, personal communication by LSRWA was required to ensure that LSRWA interpretations of CBP work on watershed BMPs/strategies were accurate." (Pg. 35).

Comment I-7-18: Throughout the report, statements are made that the Bay TMDL work needs to be reevaluated given that the Conowingo Dam no longer has the trapping capacity that was once considered. Given that the DLSRWA adopted the outdated CBP methodology, how could the team ignore additional cost and design alternatives?

- Attachment I-7 includes a letter from Exelon to the Army Corps of Engineers (dated July 18, 2014) thanking the Corps of Engineers for the opportunity to review and comment om the Draft LSRWA Study. (No Page number provided).

Comment I-7-19: Please explain why Exelon received the DLSRWA several months earlier to perform an extensive review of the main report and appendices. Why weren't other commenters, such as the Clean Chesapeake Coalition given that opportunity? Are we to expect that Exelon will assist the LSRWA study group in addressing our comments?

APPENDIX J

***It is quite evident that the data and studies used in the Watershed Strategy Section are outdated and incorrect. Appendix J relies on the following incorrect statements:

- “Sediment deposition to Chesapeake Bay from the Susquehanna River is mitigated by the presence of three consecutive hydroelectric dams (Safe Harbor Dam, Holtwood Dam, and Conowingo Dam). These three dams form a reservoir system in the lower part of the River that These three dams form a reservoir system in the lower part of the River that has been trapping sediment behind the dams since they were constructed in 1910 (Holtwood Dam), 1928 (Conowingo Dam) and 1931 (Safe Harbor Dam). The uppermost two dams, Safe Harbor Dam and Holtwood Dam, have already reached their capacity to store sediment and sediment-related nutrients. Conowingo Reservoir, which is formed by Conowingo Dam, the lowermost and largest dam, has not reached storage capacity and is still capable of trapping.” (Pgs. 1-2).

Comment J-2: Appendix J begins with incorrect information by expressing the remaining storage capacity of the Conowingo Dam. (Pg. 2). Given that this Appendix is used to develop a watershed strategy, a major concern and comment is how could this be accomplished if the current status of the Conowingo Dam is not properly delineated or understood?

*The Appendix discusses further the importance of the TMDLs and the CBP 5.3.2 Watershed model run established in 2010.

- The Chesapeake Bay Program developed the E3 scenario from a list of approved agriculture and urban/suburban BMPs using output from the Phase 5.3.2 Watershed Model, which is also used for tracking towards the TMDL. “The BMPs that are fully implemented in the E3 scenario were estimated to produce greater reductions than alternative practices that could be applied to the same land base (Jeff Sweeney, personal communication).”

Comment J-3: Is personal communication is now the new standard in determining scientific merit? What science is Jeff Sweeney using to make such an evaluation of BMPs and to make such a statement?

- The Chesapeake Bay Program also developed unit costs for the approved BMPs. Most, though not all, of the BMPs used in the E3 scenario have associated unit costs in either acres or feet. The primary source of the unit costs was the Bay Program approved list; however, in order to have as complete a cost estimate as possible, in the absence of unit costs from the Bay Program, costs from the Maryland Department of the Environment (MDE) (Greg Busch, MDE, personal communication), and costs from the Maryland

Department of Agriculture (MDA) (John Rhoderick, MDA, personal communication) were used. (Pg. 5).

Comment J-4: Is there a cost benefit analysis associated with these expected costs on local governments? If so, is it based on science and data or someone's personal communication?

- Agriculture unit costs ranged from $2 per acre to develop conservation management plans to $1,948 per acre for "loafing lot management" (stabilizing areas frequently and intensively used by animals, people, or equipment).

Comment J-5: Where is the source of this data? Is it from the unit cost estimates from the Bay Program and other sources used to develop a range in the cost of achieving the theoretical maximum amount of sediment reduction to the Conowingo Reservoir (discussed on Pg. 6)? If so, where is this data and what are the other sources?

- "The maximum available load of sediment per year that could be reduced by additional BMP implementation above and beyond the WIPs throughout the Susquehanna River watershed is approximately 95,000 tons (equivalent to 190,000,000 lbs of sediment per year; or 117,284 cubic yards per year) 2,000 lbs is equivalent to approximately 1 ton; 190,000,000 lbs divided by 2,000 equals 95,000 tons per year; approximately 81 tons are in 1 cubic yard; or 1600 kilograms/cubic meter; 95,000 divided by .81 equals 117,284 cubic yards per year) at a cost of 1.5 to 3.6 Billion dollars. The amount of 95,000 tons is an order of magnitude less of what is estimated to flow over Conowingo Dam into Chesapeake Bay on an average annual basis, which is approximately, 1.8 million tons (1993-2012 hydrology)." (Pgs. 5-6).

Comment J-6: This no longer seems to be the case given that the Conowingo Reservoir was considered a trap and not a source of sediments and nutrients in these calculations.

Comment J-7: Attachments 2 and 3 (Pgs. 11-12) of Appendix J state the following: "Cost estimates are provided for planning purposes only, and are based on generalized costs of implementation. Project specific design and cost estimates would be required prior to actual implementation of any of these alternatives." What are the generalized costs of implementation? How do these attachments provide anyone with a true understanding of costs if design and cost estimates are not considered in the total cost analyses?

- "EPA uses unit costs for agricultural sediment or nutrient controls identified in the WIPs from USDA's Environmental Quality Incentive Program (EQIP), where available, and WIPs and prior studies where EQIP estimates are not available. In selecting relevant studies, EPA excludes those prior to 2000, and relies on EQIP and WIP estimates where feasible because these costs likely represent the most recent and best estimates of actual implementation costs."

Comment J-8: The U.S. Department of Agriculture's Environmental Quality Incentive Program (EQIP) is currently an interim rule open for comment. In addition, Executive Order 12866 and 13563 "Improving Regulation and Regulatory Review," directs agencies to assess all costs and benefits of available regulatory alternatives and, if regulation is necessary, to select regulatory approaches that maximize net benefits (including potential economic, environmental, public health and safety effects, distributive impacts, and equity). Executive Order 13563 emphasizes the importance of quantifying both costs and benefits, of reducing costs, of harmonizing rules, and of promoting flexibility. The Clean Chesapeake Coalition would appreciate an assessment of all costs and benefits of available regulatory alternatives, in particular analyses of how the unit costs were derived for the DLSRWA.

Comment J-9: Throughout the Document it is stated that: "EPA annualizes capital costs over the specified life of the BMP." How does EPA annualize capital costs?

> Forest buffers are linear wooded areas along rivers, stream, and shorelines. The recommended buffer width for riparian forest buffers (agriculture) is 100 feet, with a 35-foot minimum width required. Upfront installation costs associated with forest buffers typically include site preparation, tree planting and replacement planting, tree shelters, initial grass buffer for immediate soil protection, mowing (during the first 3 years), and herbicide application (during the first three years).

Comment J-10: Forrest Buffers are listed as a BMP. Has anyone evaluated Sapropel concerns from decaying leaves and their ability to seriously decrease deep water oxygen and increase Hydrogen sulfide deposits?

- Estimates pertaining to unit cost in association with frequent maintenance and pumping of septic systems is expected to reduce nitrogen loadings. (Pg. 29).

Comment J-11: What is the origin of these estimates? Where is the financial cost data associated with these estimates?

<u>Attachment J2: Cost Documentation – General Assumptions</u>

- The Costs associated with the Charts presented in Attachment J2 are "concept-level costs for planning purposes only. Detailed design and cost estimate would be required for any future studies investigation implementation of any of these alternatives. All alternatives assume the dredging of a location in Conowingo Reservoir which currently has the highest amounts of deposition in the entire lower Susquehanna reservoir system; similar costs could be developed for the other lower Susquehanna reservoirs."

Comment J-12: Given the assumption above, will the design and cost estimates be the same if the purpose of the DLSRWA were to comprehensively forecast and evaluate sediment and associated nutrient loads into and from the system of hydroelectric dams located on the Lower Susquehanna River above the Chesapeake Bay and consider structural and non-structural strategies to manage these loads to protect water quality and aquatic life in the Chesapeake Bay? (Pg. 4 – 08/16/2012, Attachment I- 6).

Comment J-13: Screening level estimates are included in charts that evaluate available capacity. Does the available capacity evaluation consider that the Conowingo Reservoir is still trapping? In addition, estimates are based on assumptions in the screening level cost estimates. How are the financial benefit analyses achieved with assumptions being made for estimates? Is there a margin of error available for these estimates? What is the source for the cost estimates related to temporary dewatering sediment?

<u>Attachment J-3</u>

- This analysis is based on planning level sediment management concepts. To fully understand and evaluate effects of any of these concepts detailed designs would be required. Fatal Flaw-Determined by team that strategy should be dropped from consideration.

Comment J-14: What is the basis for these management concepts? What scientific studies and/or data were considered in developing such concepts? According to the summary "…because of amount of variables, representative alternatives were developed to cover ranges of costs each one of these variables could impact." What are those variables and alternatives developed?

- Attachments 2 and 3 on Pgs. 12-13 in Appendix J show the costs by practice across the three states. However, the current information does not make it possible to assess the variation in cost effectiveness of the various urban and agricultural BMPs in meaningful terms, such as the dollars per cubic yard of sediment removal. Importantly, the cost-effectiveness between practice types typically varies by one or two orders of magnitude. Hence, the current analysis aggregates all practices types and reports an overall cost estimate at $3.5 billion in Table 3 (or Table 6-3). Then the report provides an overall average cost effectiveness of $256-$597 per cubic yard in Table 6-6, and seems to imply that this watershed BMP approach is supposedly the most expensive. But this assessment that aggregates all practice types may overlook the high degree of heterogeneity in costs between practice types. (Pg. 35, Appendix 1-7).

Comment J-15: Please explain how such an analysis is beneficial to the DLSRWA.

- Attachment 4 of Appendix J on pp. 29-33 includes detailed information on "Septic Systems". However, septic systems are not discussed at all in the corresponding tables for the cost analysis in Attachments 2 and 3.

Comment J-16: Please provide the cost analyses by different States.

APPENDIX K

Introduction

- Lake Clarke shallowest- averaging 15 feet deep.
- Lake Aldred is the deepest, with greatest depths of 80 to 120 feet.
- The deepest areas of Conowingo Reservoir are located near the dam, depths averaging 55 feet along the Spillway gates and about 70 feet near the turbine gates. (Pg. 4).
- Rolling hills of the Piedmont in the vicinity of the Conowingo Dam above the valley range in elevation from 250 to 400 feet maximum.
- The uplands above the gorge near the vicinity of safe harbor and Holtwood dams rise to about 750 feet in elevation.
- Climate trends in the last two decades have shown wetter conditions on average, than in previous decades. Increased precipitation has produced higher annual minimum flows and slightly higher median flows during summer and fall (Najjar et al., 2010). (Pg. 5).

Comment K-1: Why aren't climate change or climate trends considered in the draft model runs? If there were indeed considered why are the model runs capped at a flow rate slightly above 620,000 cfs.?

- As of 2003, 23 percent of the Chesapeake Bay watershed is used for agriculture and almost 12 percent has been developed. (Pg. 5).
- Water circulation in the Bay is primarily driven by the downstream movement of fresh water in from rivers and upstream movement of salt water from the ocean. Less dense, fresher surface water layers are seasonally separated from saltier and denser water below by a zone of rapid vertical change in salinity known as the pycnocline (CBP, 2013). The pycnocline plays an important role in Bay water quality acting to prevent deeper water from being reoxygenated from above (Kemp et al., 1999). Pycnocline depth varies in the Bay as a function of several factors. It shows general long-term geographic patterns as summarized in Table K-4, but varies over shorter time periods as a function of precipitation and winds. (Page 8) During warm weather months it promotes stronger stratification that can last for extended periods during a year. Conversely, sustained winds in a single direction for several days can cause the pycnocline to tilt, bringing deeper water up into shallows on the margins of the Bay.

Comment K-2: How do any of the models account for this water circulation or wave movement?

- Because of this partial seasonal separation into layers, or strata, the Bay is classified as a partially stratified estuary. Division of surface from deeper waters varies depending on the season, temperature, precipitation, and winds. In late winter and early spring, melting snow and high streamflow increase the amount of fresh water flowing into the Bay, initiating stratification for the calendar year. During spring and summer, the Bay's surface waters warm more quickly than deep waters, and a pronounced temperature difference forms between surface and bottom waters, strengthening stratification. In autumn, fresher surface waters cool faster than deeper waters and freshwater runoff is at its minimum. The cooler surface water layer sinks and the two layers mix rapidly, aided by winds. During the winter, relatively constant water temperature and salinity occurs from the surface to the bottom (CBP, 2013). (Pg. 9).

- USACE and SRBC recognize the Susquehanna River basin as one of the most flood-prone basins in the United States from a human impacts perspective. Flow conditions can vary substantially from month to month; floods and droughts sometimes occur in the same year. Floods can scour large volumes from the river bed and banks, and convey large quantities of nutrients and sediment downstream. (Pg. 11).

- Salinity is an important factor controlling the distribution of Bay plants and animals. Salinity is the concentration of dissolved solids in water and is often discussed in terms of parts per thousand (ppt). In Maryland, Bay surface waters range from fresh in headwaters of large tidal tributaries to a maximum of about 18 parts per thousand (ppt) in the middle Bay along the Virginia border. Salinity varies during the year, with highest salinities occurring in summer and fall and lowest salinity in winter and spring. (Pg. 13).

- The ETM zone is an area of high concentrations of suspended sediment and reduced light penetration into the water column. Each of the Bay's major tidal tributary systems has an ETM zone near the upstream limit of saltwater intrusion. The Susquehanna River ETM zone occurs in the upper Bay main stem. The position of the ETMs changes seasonally and with large freshwater flow events from storms. The ETMs extend further downstream into the Bay during times of year when lower salinities occur and following major storm events, and further upstream when seasonally higher salinities occur. The ETM zone is produced by a complex interaction of physical and biological processes, including freshwater inflow, tidal and wave-driven currents, gravitational circulation, particle flocculation, sediment deposition and resuspension, and biogeochemical reactions. (Pg. 13).

- Tidal resuspension and transport are primarily responsible for the maintenance of the ETM zone at approximately the limit of saltwater intrusion. Generally, fine-grained riverborne sediment in the ETM zones is exported further downstream into the main Bay only during extreme hydrologic events. The mainstem Bay ETM zone occurs in the upper Bay; in this region, most of the fine-grained particulate matter from the Susquehanna River is trapped, deposited, and sometimes resuspended and redeposited.

The mainstem ETM zone acts as a barrier under normal conditions for southward sediment transport of material introduced into the Bay from the Susquehanna River (USGS, 2003).

Eutrophication

- Anthropogenic nitrogen and phosphorus nutrient pollution delivered to the Bay exceeds the Bay ecosystem's capability to process it without ill effect. The Bay's physical character and circulation patterns tend to retain water-borne materials, thus exacerbating the effect of anthropogenic pollution. The Bay's natural capability to buffer the incoming nutrient loads are governed by seasonal stratification and limited tidal mixing rate (Bever et al., 2013). Anthropogenic nutrient pollution to the Bay derives from agricultural runoff and discharges, wastewater treatment plant discharges, urban and suburban runoff, septic tank discharges, and atmospheric deposition of exhaust (CBP, 2013). Water bodies possess a range of nutrient availability conditions. Water bodies possessing ample or excessive nutrients whether from natural or human sources are said to be eutrophic. The Bay became eutrophic because of inputs of large quantities of anthropogenic nutrients. Excess nutrients in the water column from human sources fuel the growth of excess phytoplankton. Zooplankton, oysters, menhaden, and other filter feeders eat a portion of the excess algae, but much of it does not end up being consumed by these organisms. The leftover algae die and sink to the Bay's bottom, where bacteria decompose it, releasing nutrients back into the water, fueling further algal growth. During this process in warm weather months, bacteria consume DO until there is little or none left in deeper bottom waters (CBP, 2013). Within the Bay, nitrogen is the principal limiting-nutrient regulating phytoplankton. The limiting nutrient is that nutrient available in lowest supply in proportion to biological demand. However, phosphorus is the limiting nutrient for phytoplankton growth in low salinity Bay waters in spring. Phosphorus is typically the limiting nutrient in freshwater ecosystems. (Pg. 16).

- Nitrogen and phosphorus actually occur in a number of different forms in the environment that differ in their biological availability and effects on water quality. (Pg. 17). Total nitrogen (TN) includes nitrate, nitrite, ammonia, and organic nitrogen. (Pg. 17).

- Ammonia is the dominant dissolved nitrogen form in deeper waters during warm months. Nitrite is generally unstable in surface water and contributes little to TN for most times and places. Organic nitrogen (mostly from plant material, but also including organic contaminants) occurs in both particulate and dissolved forms, and can constitute a substantial portion of the TN in surface waters. However, it is typically of limited bioavailability, and often of minimal importance with regard to water quality. Conversely, nitrate and ammonia are biologically available and their concentration is very important.

- Total phosphorus (TP) includes phosphates, organic phosphorus (mostly from plant material), and other phosphorus forms. Phosphates and organic phosphorus are the main components of TP. Phosphates tend to attach to soil and sediment where their bioavailability varies as a function of environmental conditions. Dissolved phosphate is readily bioavailable to aquatic plant life, and consequently promotes eutrophication (USGS, 1999). Phosphorus binds to river sediments and is delivered to the Bay with sediment. (Pg. 17).

Comment K-3: What model is used to address how phosphorus is bound to sediments? How are phosphorus levels and its impact addressed in the DLSRWA?

- Nutrient transport in rivers is usually considered in two fractions – that portion conveyed in dissolved form and that portion carried as particulates. Particulates include mineral sediments and plant debris. During downstream transport, bacteria and other stream organisms take up dissolved nutrients and convert them to organic form. When organisms containing these nutrients die, the nutrients return to the water in inorganic form, only to be taken up yet again by other organisms. This cycle is referred to as nutrient spiraling.

- Nutrient pollutants delivered to the Bay vary year to year as a function of amount and timing of precipitation. Wet years deliver greater nutrient pollution to the Bay than dry years. For example, the amounts of nitrogen and phosphorus transported during Tropical Storm Lee (a September 2011 high-flow event) were very large compared to long-term averages for the Susquehanna River over the past 34 years. However, this difference is less pronounced for nitrogen than it is for phosphorus, because on average, a large part of the nitrogen flux is delivered in dissolved form. Specifically, the amounts transported during the Tropical Storm Lee event were estimated to be 42,000 tons of nitrogen and 10,600 tons of phosphorus. For comparison, the estimates of the averages for the entire period from 1978 to 2011 were 71,000 tons per year for nitrogen and 3,300 tons per year for phosphorus (Hirsch, 2012). (Pg. 17).

Comment K-4: How were the phosphorus levels, namely 10,600 tons, generated for Tropical Storm Lee? Did the 10,600 tons number take into account phosphorus bound to sediments?

- Phosphorus is conveyed in rivers as phosphate adsorbed to sediment particles. It is also conveyed bound to calcium, and as organic particles. The processes by which phosphorus is released from sediments is complicated and affected by biological as well as physical chemical processes. In oxygenated fresh water, phosphorus adsorbed to fine-grained sediments remains bound and has limited bioavailability. Under anoxic or hypoxic freshwater conditions, phosphorus becomes more bioavailable, but phosphorus rebinds to sediments if oxygen is again present. In the Bay's saltwater environment, biogeochemical conditions change causing phosphorus bioavailability to differ from in freshwater. As salinities increase above about 3 to 4 ppt, phosphorus bound to sediments is increasingly released and becomes mobile and bioavailable to living resources (Jordan et al., 2008; Hartzell and Jordan, 2012). The uppermost Bay remains generally below salinities of 3 ppt all year, which tends to favor phosphorus immobilization in sediments, but otherwise the Bay is salty enough to allow phosphorus release from sediments (CBP, 2013). (Pg. 19).

- Conowingo Reservoir water temperatures range from about 59°F to 91°F during the period of April through October. The reservoir remains relatively constant in temperature vertically for much of the year, but reservoir water can be up to several degrees cooler at the bottom than at the surface for brief periods. DO in Conowingo Reservoir becomes depleted in waters of the reservoir greater than 25-foot depth under conditions of low river inflow (less than 20,000 cfs.) and warm water temperatures (greater than 75°F). Reservoir DO levels occasionally drop below 2 mg/L (Normandeau Associates and GSE, 2011). USGS collected and analyzed water samples of Conowingo Reservoir outflow during high-flow events during water year 2011 (which ran from October 1, 2010 to September 30, 2011) for this assessment. (Pg. 22).

Comment K-5: How did the models take into account reservoir water temperature? What type of model analysis was used to account for DO levels?

- The Susquehanna River transports large volumes of sediment to the Chesapeake Bay. Two flood events, associated with Hurricanes Agnes (1972) and Eloise (1975), contributed approximately 44 million tons of sediment to the Bay. Recent estimates calculate that the Susquehanna River transports 3.1 million tons annually, depositing 1.9 million tons behind Conowingo Dam with the remaining 1.2 million tons deposited in the Chesapeake Bay (1996-2008 evaluation periods) (Langland, 2009). In the upper Bay, the Susquehanna River is the dominant source of sediment influx, supplying over 80 percent of the total sediment load in the area (SRBC Sediment Task Force, 2001). (Pg. 27).

DECEMBER 9, 2014 PUBLIC MEETING

Comment Public Meeting: The three individuals at the December 9, 2014 meeting at Harford Community College that presented the DLSRWA (Messrs. Bierly, Michael and Bier) suggested that the report will be used to determine who should have responsibility for addressing harm to the Bay caused by sediment scour. The discussion overlooked the decades of harm from scour that already has occurred and the fundamental evolution of the surface solids that now settle in the reservoirs. When the dams were new and the reservoirs behind the dams were deep, clays and silts in addition to the larger grained sands settled in the reservoirs behind the dams. The clays are the easiest sediments to scour as they are the finest grained and lightest solids to settle out of suspension and become more easily resuspended. The clays also probably bond the most phosphorus and other pollutants and nutrients. Silts lie somewhere in the middle and the sands are the heaviest and probably bond the least amount of sediments and nutrients. For decades, the dams have deprived the upper Bay of sands and have allowed the less desirable and more harmful clays and silts to be scoured and flushed into the Bay in deathly quantities during storm events. Such clays and silts also are more likely to become resuspended during turbulent weather in the Bay than the sands. Now, much of the material remaining on the floor of the reservoirs consists of sand, as the clays and silts have been flushed into the Bay for the last 80 years, while the sand, due to particle size and weight, has settled to the bottom and has less frequently been scoured into the Bay. There are studies that confirm these phenomena. Any consideration of responsibility for scour should take into account how the dams already have materially altered and damaged the Bay estuary by depriving it of the more beneficial sand while flushing in the more harmful clays and silts, until the present, when most of what remains to be scoured consists primarily of sand.

Comment Public Meeting: The three individuals at the December 9, 2014 meeting at Harford Community College that presented the DLSRWA (Messrs. Bierly, Michael and Bier) suggested that the report had received favorable peer review. Peer review can take on several formats but it most commonly is understood as review by qualified scientists of written scientific reports to test and to assess the methodology used to reach findings and conclusions and to access the confidence level in/validity of the findings made and the conclusions drawn in the report. It is hard to imagine that the DLSRWA was peer reviewed because the report does not begin to explain the methodology used to derive any findings or conclusions. Only upon reading thousands of pages of appendices can one begin to assess what work was performed, and even then only in the most cursory of manners. For example, the flow chart used to diagram the models used to generate data is cursory. Nowhere is the raw data underpinning different modelling efforts set forth, let alone being adequately explained. If there was any meaningful peer review of the DLSRWA, any report or appendix attached to the report, or any of the findings and conclusions in the report, please identify by name and qualifications the each person who conducted any peer review and attach any written findings conclusions, and input made by each such individual or group of individuals. There should be a peer review document. Please identify and provide a link to such document.

Any questions about the Coalition's comments concerning the DLSRWA may be directed to Jeff Blomquist (jblomquist@fblaw.com or 410-659-4982), Michael Forlini (mforlini@fblaw.com or 410-659-7769) or Chip MacLeod (cmacleod@fblaw.com or 410-810-1381).

Exelon Generation

Colleen Hicks
Manager Regulatory
and Licensing, Hydro
Exelon Power

300 Exelon Way
Kennett Square, PA 19348
(610)765-6791
colleen.hicks@exeloncorp.com

January 9, 2015

Anna Compton
Study Manager, Planning Division
Baltimore District, Corps of Engineers
10 South Howard Street
Baltimore, MD 21201

Re: Lower Susquehanna River Watershed Assessment Draft Report
Comments of Exelon Generation Company, LLC

Dear Anna:

Exelon Generation Company, LLC (Exelon) appreciates the opportunity to provide feedback and comments to the U.S. Army Corps of Engineers (Corps) on the Lower Susquehanna River Watershed Assessment (LSRWA) Draft Report ("Draft Report") distributed for review on November 13, 2014. The Draft Report represents a tremendous amount of work by the project partners and represents an important step in understanding the Susquehanna River/Chesapeake Bay (the Bay) water quality interactions.

Exelon also appreciates the LSRWA authors' responses to the comments Exelon filed on July 18, 2014.[1] After extensive review of the Draft Report, including its appendices, Exelon has again developed detailed comments which are contained in the accompanying tables. As you will see upon review of the comment tables, Exelon expanded upon the responsiveness summary contained in Appendix I to include a new column with additional comments to LSRWA author responses or new comments pertaining to report content. While some comments raised in July 2014 were addressed in the updated report, a number of significant concerns previously identified are still relevant to the latest draft and are discussed below. Exelon hopes that these comments will assist the Corps in developing the most technically sound and understandable document possible.

In addition to the comments provided by Exelon in July 2014, Appendix I Section I-7 also contains comments provided by the Scientific Technical Advisory Committee (STAC) as well as the responses of the LSRWA authors to those comments. Upon review of Appendix I it is clear that both STAC and Exelon agreed that the LSRWA was generally well done and was a useful exercise to ascertain general trends. STAC and Exelon, however, identified a number of important concerns with the assessment. These concerns included: (1) the manner in which nutrients were addressed throughout the report given

[1] A working draft of the LSRWA report was distributed for Stakeholder review on June 23, 2014. Exelon filed comments with the Corps on July 18, 2014. The LSRWA leads responded to the Exelon comments in the form of a responsiveness table which can be found in Appendix I, Section I-7 of the LSRWA Draft Report issued November 13, 2014.

their impact was not fully understood until late in the study process; (2) the significant uncertainties pertaining to HEC-RAS and AdH results; (3) the lack of a quantitative discussion of the effects model uncertainties may have on study findings; (4) the lack of a clear, easy to follow explanation regarding model input parameters and the manner in which various models interacted with one another; and (5) the lack of information needed to further understand the diagenesis rates discussed in Appendix C.

While Exelon realizes the limitations of time and budget, we think it is important for the LSRWA authors to carefully consider the limitations highlighted by STAC and Exelon and reflect them as changes to the main report and the appendices. Furthermore, the LSRWA response to STAC comments is incomplete at this time as the majority of responses for comments pertaining to the AdH model were cited as still being under development by the ERDC AdH modeler. Exelon would appreciate the opportunity to review and comment on these responses prior to the final draft of the report being issued.

While the content of the LSRWA Draft Report represents some changes from the version distributed in June 2014, the report and its findings are substantively the same as the previous draft. As such, the points raised by Exelon in the letter dated July 18, 2014 are still relevant. Specifically, these points include the following:

The LSRWA Draft Report represents a significant contribution to the understanding of the overall positive benefit Conowingo Dam (Conowingo) provides for the health of the Bay.

- The report makes several well-supported conclusions, including the following: (1) the majority of the sediment that enters the Bay during storm events originates from the watershed rather than from Conowingo Pond scour; (2) given the small contribution of sediment from Conowingo Pond, the primary impact to the Bay is from sediment and nutrients from the Susquehanna River and Chesapeake Bay watershed; and (3) implementation of Watershed Implementation Plans has the largest influence on the health of the Bay.
- Furthermore, the report concludes that, while Conowingo Pond is in dynamic equilibrium, the Pond will continue to trap sediments and associated nutrients into the future during depositional periods. The report also states that from 1993-2012, the annual trapping efficiency of Conowingo Pond was 55-60%. This finding, which is consistent with the assumptions of the Chesapeake Bay TMDL, highlights the day-to-day benefits that Conowingo provides to the Bay.

The finding that "nutrients, not sediment, have the greatest impact on Bay aquatic life," came up late in the study process, is not fully understood at this time, and requires further investigation.

- As currently written, the report makes numerous definitive statements in regard to the impacts of sediment-bound nutrients on Bay water quality while admitting this is a subject that is not fully understood and requires additional investigation.
- A discussion of supporting nutrient data and quantitative nutrient model assumptions is conspicuous by its absence in the report. The final report should either provide the field and model data supporting these conclusions, with any appropriate qualifiers, or simply list nutrient interactions in the Susquehanna River and Chesapeake Bay as areas requiring additional study.
- Due to the disproportional focus on Conowingo Pond sediment and nutrient dynamics, the report gives the impression that sediment-bound nutrients scoured from Conowingo Pond are the main

threat to Bay water quality; even though 70-80% of sediment that flows to the Bay during a major storm originates from the watershed upstream of Conowingo Pond (including scour from Lake Clarke and Lake Aldred). In contrast, the appendices (in particular Appendix C) indicate that all nutrients entering the Bay threaten water quality, whether they are watershed-derived or bound to scoured sediments.

While the study goals state that the LSRWA was intended to examine the "loss of sediment and associated nutrient storage within the reservoirs of the lower Susquehanna River," the discussion and findings of the report (including sediment management strategies) focus almost exclusively on Conowingo Pond.

- As currently drafted, the report understates the significance of sediment and nutrient loading from sources upstream of Conowingo Pond. The main report specifically states that 70-80% of sediment that flows to the Bay during a major storm originates from the watershed upstream of Conowingo Pond; yet rather than focus on those sources, the main report instead focuses primarily on Conowingo Pond scour.
- Due to the focus primarily on Conowingo Pond and not all three Lower Susquehanna River reservoirs, the report gives the impression that only Conowingo Pond scour has a potential impact on Bay health, when in fact all three reservoirs are in dynamic equilibrium and susceptible to episodic scour. In order for this study to be a true Lower Susquehanna River assessment, all three reservoirs (Lake Clarke, Lake Aldred, and Conowingo Pond) should be examined and discussed proportionately.

While the general uncertainties associated with the various models and sub-models are discussed in the report and appendices, it is unclear how these uncertainties may propagate through the Chesapeake Bay Environmental Model Package (CBEMP) results.[2] Thus, the reader has no way of knowing how the results of the CBEMP model are affected by the uncertainties discussed in the report and appendices. In particular we are concerned that:

- The uncertainties within the HEC-RAS sediment load outputs (as noted by the author) may materially impact the AdH model results.
- The AdH results were associated with a separate list of assumptions and additional uncertainties.
- A sensitivity analysis or other assessment was not conducted to determine how these collective HEC-RAS and AdH uncertainties may ultimately impact CBEMP model results and the nonattainment percentages that are listed throughout the main report.

Although the individual modeling methods, assumptions, inputs, and outputs are well explained in their respective appendices, it would be helpful for the reader to have a single point of reference within the main report to explain all interactions between the various models.

- While Figure 1-5 in the main report explains the model interaction in a general sense, we envision an accompanying figure and narrative within the main report to more specifically define the

[2] According to the LSRWA Draft Report, the Chesapeake Bay Environmental Model Package or CBEMP uses a variety of sub-models, input parameters, modeling methods and assumptions to estimate the water quality impacts of selected watershed and land use conditions, reservoir bathymetries, and flows.

interactions. We have resubmitted Attachment 1 as an example of what we believe such a figure could look like.

- In addition to model interactions, it is difficult to track the model input conditions and assumptions, water quality analysis periods, and attainment results for each LSRWA modeling scenario. While the Appendices describe these parameters for some of the modeling runs, they do not describe all modeling runs nor is there a single, clear point of reference in the main report where this information can be found. We suggest the Corps consider developing a table to explain all of the LSRWA runs described in Appendix C, plus add a brief summary of any water quality nonattainment for each scenario. We have resubmitted Attachment 2 as an example of such a table.
- If the Corps does not include Attachment 1 and/or 2 in the next draft of the report, confirmation that the information contained in the attachments is correct and answers to the questions posed would be appreciated.
- We also recommend including the "stoplight plot" analysis results in Appendix D for all of the scenarios described in Table 3-1 of Appendix C.

Finally, the report identified a number of recommendations for follow through actions that will allow for a better understanding of sediment and nutrient transport dynamics in the Lower Susquehanna River and the potential effect they may have on Bay water quality. As such, Exelon has agreed to fund a $3.5 million, 2-year study to address a number of these recommendations and provide additional information to better understand the impact of sediment-bound nutrients on Bay water quality. Exelon looks forward to working with the Maryland Department of Natural Resources, the Maryland Department of the Environment, the U.S. Geological Survey, the U.S. Environmental Protection Agency Chesapeake Bay Office, and the University of Maryland Center for Environmental Science over the next 2 years while completing this study.

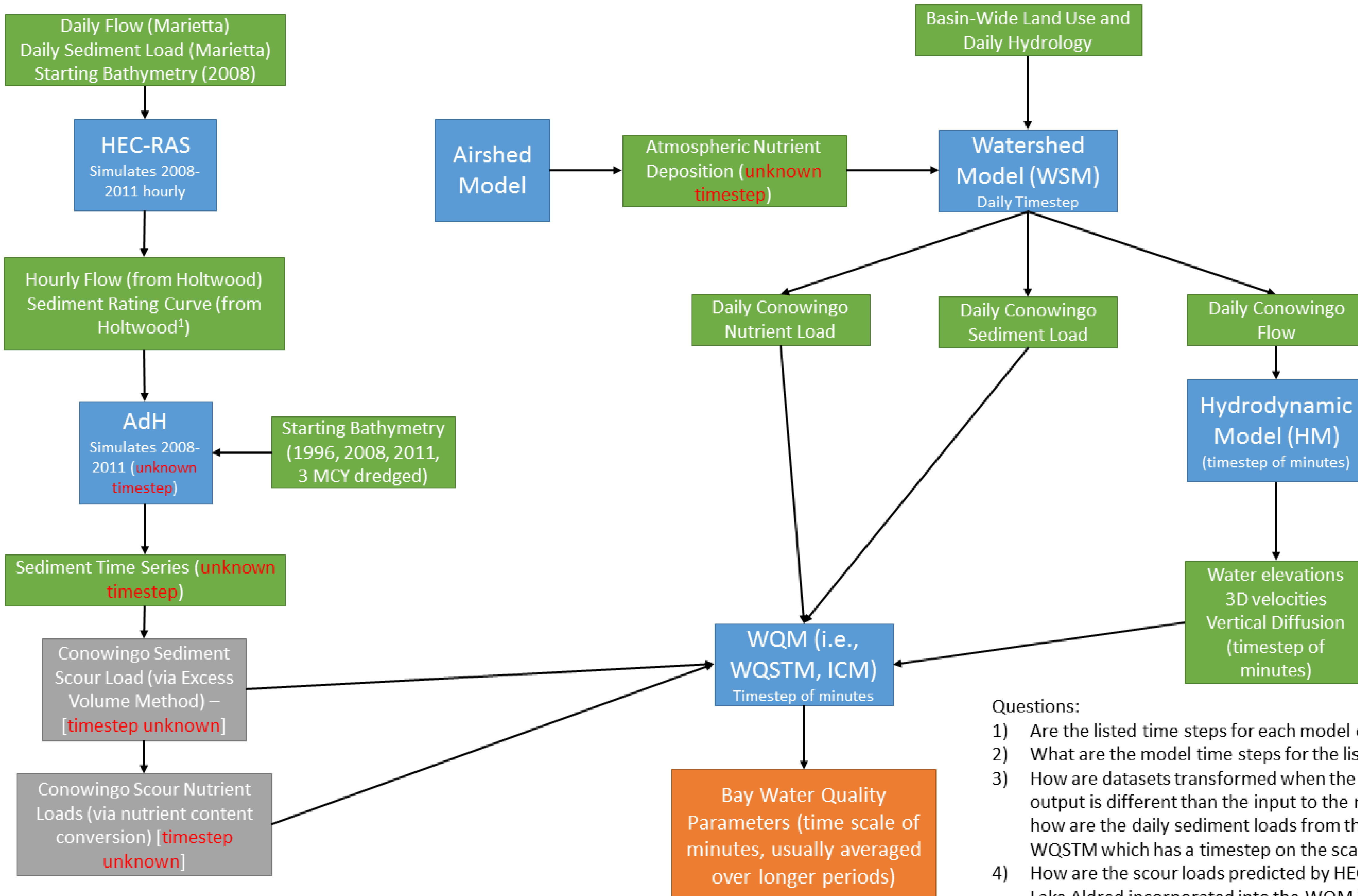
Detailed comments elaborating on the points discussed in this letter can be found in the accompanying tables as well as the letter and comments submitted on July 18, 2014. Exelon reserves the right to make additional comments in the future. We appreciate the opportunity to provide feedback and comments on the LSRWA Draft Report and look forward to continuing to work with project partners in the future. If you have any questions upon review of our comments, please feel free to contact me at (610) 765-6791 or colleen.hicks@exeloncorp.com or Tom Sullivan at (603) 428-4960 or tsullivan@gomezandsullivan.com.

Respectfully submitted,

Colleen E. Hicks

Colleen E. Hicks
Manager Regulatory and Licensing, Hydro
Exelon Power

Attachment 1: Description of WQSTM model interactions.



Questions:

1) Are the listed time steps for each model correct?
2) What are the model time steps for the listed unknowns (e.g., AdH)?
3) How are datasets transformed when the timestep of a model output is different than the input to the next model? For example, how are the daily sediment loads from the WSM translated into the WQSTM which has a timestep on the scale of minutes?
4) How are the scour loads predicted by HEC-RAS for Lake Clarke and Lake Aldred incorporated into the WQM inputs?

[1]The Holtwood sediment outflows were calculated from the HEC-RAS "scour" model, plus an additional 10% beyond the HEC-RAS predicted sediment load.

Attachment 2: Potential format for describing model inputs for each LSRWA scenario.
Footnotes are included to describe conditions common for all scenarios. Black text describes information taken from Appendix J-4. Blue text describes information taken from Appendix C.

Model Code	Description or Study Question	Models Used	Land Use (i.e., watershed sediment/nutrient loads)	HEC-RAS Model Run (scour or depositional)	Reservoir trapping efficiency	Reservoir Scour Load Method	Reservoir Sediment Nutrient Content	Time period analyzed for WQ Nonattainment	Deep Channel DO Nonattainment in CB4MH	Deep Channel DO Nonattainment in EASMH	Deep Channel DO Nonattainment in CHSMH
LSRWA-3	What is the system's condition when WIPS are in full effect and reservoirs have not all reached dynamic equilibrium?	CBEMP[1,2]	TMDL – WIPS in place	N/A	1991-2000 levels[3]	None	N/A	1993-1995	0%	0%	0%
LSRWA-4	What is the system's current (existing) condition?	CBEMP	2010 Land Use	N/A	1991-2000 levels	None	N/A	1993-1995	?	?	?
LSRWA-5	2010 land use with Conowingo reservoir removed from WSM. All sediments and nutrients pass through – no deposition or scour.	CBEMP	2010 Land Use	N/A	0%	N/A	N/A	Not analyzed?	?	?	?
LSRWA-6	TMDL land use with Conowingo reservoir removed from WSM. All sediments and nutrients pass through – no deposition or scour.	CBEMP	TMDL – WIPS in place	N/A	0%	N/A	N/A	Not analyzed?	?	?	?
LSRWA-20	2010 land use with sediment/nutrient from Conowingo scour added in.	HEC-RAS AdH CBEMP	2010 Land Use	?	Existing[4]	Excess volume method from AdH results (from 2011 bathymetry)	2011 Tropical Storm Lee	Not analyzed?	?	?	?
LSRWA-21	What is the system's condition when WIPS are in full effect, reservoirs have not all reached dynamic equilibrium and there is a winter scour event?	HEC-RAS[5] AdH[5] CBEMP	TMDL – WIPS in place	?	2011 levels	Excess volume method from AdH results (from 2011 bathymetry)	2011 Tropical Storm Lee	1996-1998	1%[6]	1%	1%
LSRWA-31	TMDL land use, sediment/nutrients from Conowingo scour added in.	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	1996 levels?	Excess volume method from AdH results (from 2011 bathymetry)	2011 Tropical Storm Lee	Not analyzed?	?	?	?
LSRWA-18	What is the system's condition when WIPS are not in effect, reservoirs have all reached dynamic equilibrium and there is a winter scour event?	HEC-RAS AdH CBEMP	2010 Land Use	?	"Conowingo Full" condition	Excess volume method from AdH results (from 2008 bathymetry)	2011 Tropical Storm Lee	1996-1998	?	?	?
LSRWA-30	What is the system's condition when WIPS are in full effect, the reservoirs have all reached dynamic equilibrium and there is a winter scour event?	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	"Conowingo Full" condition	Excess volume method from AdH results (from 2011 bathymetry)	2011 Tropical Storm Lee	1996-1998	?	?	?
LSRWA-22	TMDL land use, sediment/nutrients from Conowingo scour added in.	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	Existing	Excess volume method from AdH results (from 2008 bathymetry)	Jan 1996 flood event	Not analyzed?	?	?	?
LSRWA-23	TMDL land use, 1996 storm removed from hydrologic record and load record	? CBEMP	TMDL – WIPS in place	?	Existing	N/A?	N/A	Not analyzed?	?	?	?
LSRWA-24	What is the system's condition when WIPS are in full effect, reservoirs have not all reached dynamic equilibrium and there is a summer scour event?	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	2011 levels	Excess volume method from AdH results (from 2008 bathymetry)	2011 Tropical Storm Lee	1996-1998	?	?	?
LSRWA-25	What is the system's condition when WIPS are in full effect, reservoirs have not all reached dynamic equilibrium and there is a fall scour event?	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	2011 levels	Excess volume method from AdH results (from 2008 bathymetry)	2011 Tropical Storm Lee	1996-1998	?	?	?

Model Code	Description or Study Question	Models Used	Land Use (i.e., watershed sediment/nutrient loads)	HEC-RAS Model Run (scour or depositional)	Reservoir trapping efficiency	Reservoir Scour Load Method	Reservoir Sediment Nutrient Content	Time period analyzed for WQ Nonattainment	Deep Channel DO Nonattainment in CB4MH	Deep Channel DO Nonattainment in EASMH	Deep Channel DO Nonattainment in CHSMH
LSRWA-26	TMDL land use, January 1996 storm moved to June 1996	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	Existing	Excess volume method from AdH results (from 2008 bathymetry)	Jan 1996 flood event	Not analyzed?	?	?	?
LSRWA-27	TMDL land use, January 1996 storm moved to October 1996	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	Existing	Excess volume method from AdH results (from 2008 bathymetry)	Jan 1996 flood event	Not analyzed?	?	?	?
LSRWA-28	TMDL land use, sediment/nutrients from Conowingo scour added, 3 MCY dredged from Conowingo Pond.	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	Post dredging (3 MCY removed)	Excess volume method from AdH results (from 2008 bathymetry, dredged 3 MCY)	2011 Tropical Storm Lee	Not analyzed?	?	?	?
LSRWA-29	TMDL land use, sediment/nutrients from Conowingo scour added, 3 MCY removed from Conowingo Pond to represent bypassing, sediments/nutrients bypassed downstream from December-February every year.	HEC-RAS AdH CBEMP	TMDL – WIPS in place	?	Post dredging (3 MCY removed), bypassing during some months	Excess volume method from AdH results (from 2008 bathymetry, dredged 3 MCY)	2011 Tropical Storm Lee	Not analyzed?	?	?	?

[1]CBEMP is a suite of models used to assess Chesapeake Bay water quality conditions. Sub-models within CBEMP include the watershed model (WSM), a hydrodynamic model (HM) and a water quality/eutrophication model (WQM).

[2]CBEMP is always run for a hydrology period from 1991-2000.

[3]The specific trapping efficiency (e.g., 55%) used for the run should be listed in addition to the year range the trapping efficiency is associated with (e.g., 1991-2000).

[4]Appendix C lists "Existing" bathymetry for several runs, including LSRWA-3, LSRWA-4, LSRWA-20 and LSRWA-21). It is not clear if this is referring to trapping efficiencies or something else. Appendix J-4, pg. 1 lists LSRWA-4 and LSRWA-21 as having different trapping efficiencies, where LSRWA-4 has "1991-2000 levels", and LSRWA-21 has "2011 levels." It is not clear what 2011 levels means.

[5]AdH and HEC-RAS were always run using the four year 2008-2011 hydrology period (Jan 1, 2008 – Dec 31, 2011). The HEC-RAS outputs that were input into AdH were always the "scour" model results.

[6]We recommend that nonattainment calculations include one additional significant figure beyond the decimal point (e.g., 1.4% nonattainment instead of 1% nonattainment)

Questions/Comments:

1) Please verify that the data we have entered into this table are correct.
2) Please list specific trapping efficiencies (e.g., 55%) in addition to qualitative descriptors (e.g., 1991-2000 trapping levels).
3) What do "2011 levels" refer to as far as trapping efficiencies?
4) Please include an additional significant figure beyond the decimal point for nonattainment calculations (e.g., 1.4% nonattainment instead of 1% nonattainment)

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
1	General					Regarding citation of Study 3.17 – currently the LSRWA report cites the 2011 Initial report. The Final report should be cited as: URS Corporation and Gomez and Sullivan Engineers (GSE). 2012c. Downstream EAV/SAV study. (RSP 3.17). Kennett Square, PA: Exelon Generation, LLC.
2	General	Instead of presenting an equal focus on all three reservoirs, there are still points within the report that focus primarily on Conowingo. General sections of the report that present ideas or concepts not specific to Conowingo Pond by itself should reference the three reservoirs or reservoir complex.	Compton	Discussion in multiple sections about why Conowingo is emphasized. Also AdH modeling results are specific to Conowingo so data must be presented this way for accuracy. Mention of all three reservoirs and universal concepts are noted where appropriate.	No.	No further comment at this time
3	General	The "full" condition estimation should be more clearly explained. Pieces of the explanation are given throughout the report (Page 112, Appendix A-3), but there is not enough detail given in any one location (or even collectively throughout the report and appendices) to understand or follow how the estimation was derived.	Langland	The full condition is a term used to describe the storage capacity of a given reservoir. A reservoir is full when it can no longer effectively trap sediments and associated nutrients in the long term (decades). This language added to page 112. "Full" is better described as dynamic equilibrium which is described in detail on pages 109-110.) More detailed language has been added to Appendix A, Attachment A-3.	No.	Exelon is trying to more thoroughly understand what specific methods were used to estimate the 'full' bathymetry. It is not clear how this was done, or how the assumptions made as part of this process may ultimately influence the ADH model results.
4	General	The terminology "major scour event" is used throughout the report. Instead of referring to these events as major flood events, they are named major scour events. This predisposes the reader to assume major scouring is occurring when flows exceed 400,000 cfs, and while there is mass wasting occurring, that still doesn't mean the loads entering the bay are a higher percentage of scour than watershed-based sediments. For example, see page 81, paragraph 3.	Compton	Specific reference here was changed to "major flood event". In general throughout report, if discussion is on a storm event in the watershed "flood event" is stated if discussing impacts from the scour of reservoirs, then scour even, mass scour event is discussed, especially when differentiating impacts between watershed loads and scour loads.	Yes.	No further comment at this time
5	ES-2/paragraph 2	Paragraph focuses on sediments (no net trapping) with the potentially misleading implication that the same is necessarily true for nutrients. Nutrients, organic carbon, and other water quality aspects of sediments are reactive. If the residence times of nutrient-associated sediments are sufficient, labile materials may become refractory and non-reactive. Sediment transport is not necessarily equal to nutrient transport.	Cerco	We believe this paragraph is accurate and sufficient as written.	No.	No further comment at this time
6	ES-2/paragraph 3	Examples given are for sediment only. No information is given to determine if differences in flows are the cause of differences in sediment loads (W = Q C so if Q ↑, W ↑). No information is given to support the statement that reservoirs are trapping a smaller amount of nutrient loads from the upstream watersheds. No quantification of incoming or outgoing nutrient load.	Compton	Text altered to indicate that this conclusion is from a comparison of 1996 to 2011 bathymetry. Nutrients are discussed on ES-3. Also better quantification and reactivity of nutrients is identified as a recommendation of the study.	No.	The revised text states that bathymetric data were the basis for estimates of changing sediment loads; there is no quantification of incoming or outgoing nutrient loads. For example, if nutrients are preferentially present on the finest fraction of sediment particles (e.g., clays), then the relative change in trapping may be small (i.e., trapping of clays may never have been high). Thus, there is still a disconnect between trapping of sediment in general and trapping of sediment fractions that carry the most nutrients.

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
7	ES-2/paragraph 3	"…upon analyzing the hydrology of the lower Susquehanna River from 2008-2011, this study estimated that the decrease in reservoir sediment trapping capacity from 1996-2011 (from Conowingo) resulted in a 10-percent increase in total sediment load to the Bay…, a 67-percent increase in bed scour…, and a 33-percent decrease in reservoir sedimentation…" Using a four year hydrology period is too short and contains an inordinate frequency of storms.	Scott	These data were the result of a comparison of the bathymetries, not a comparison of the 15 years between 1996 and 2011. Language updated to clarify this point.	Yes.	No further comment at this time
8	ES-3/paragraph 2 (full)	Use of phrase "Conowingo Reservoir material" implies that the reservoir is the source of material rather than the reservoirs being a site where transient storage appears.	Compton	Text altered to indicate bed sediment stored behind Conowingo.	Yes.	The phrases "Conowingo Reservoir material" to "bed sediment stored behind Conowingo Dam" mean the same thing. The point of the comment is that the assessment is predisposed to assume that all "excess" sediment generated during high flow is coming from Conowingo Pond. However, the uncertainties involved preclude such a definitive statement.
9	ES-5/paragraph 1 (full)	Important context is missing: what is the fraction of nutrients delivered to the Bay that originate from the watershed ("washload") versus the fraction that is in transient storage within Susquehanna River bed sediments ("bed material load")? This process needs to be clarified in the report.	Cerco	The fraction of the nutrient load delivered from the watershed vs. the fraction from bed scour varies depending on the scour event and on the duration of the averaging period. The fraction from scour will be relatively high during the event but much less when a period of years is considered. There is no single number which is applicable. Some insight into this effect is provided in Table 6-1 of Appendix C. In any event, the subject paragraph does not need revision based upon this comment.	No.	No further comment at this time
10	Chapter 1 – page 8 – 1st paragraph					The 2nd sentence is new and the reference cited, Pazzaglia and Gardner 1993, is inappropriate. This reference examines the state of the lower Susquehanna River in recent geologic time (≈ 10,000 – 20 million years ago), not historic time. This new sentence seems to refer to historic time prior to construction of the dams. If referring to historic time, a different citation should be used. If Pazzaglia and Gardner 1993 reference meant to be cited, add that this publication explores geologic conditions, not historic.
11	Page 10 - paragraph 2					Is the reference given as Gomez & Sullivan (2012) (RSP 3.11) [twice in this paragraph] really meant to be URS and Gomez & Sullivan (2012b)?

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
12	CH. 1/P.11/Paragraph last(Sec 1.9) and Table 1-2	Assessment products include many overlapping, and not necessarily parsimonious, study elements. For example, the table states that HEC-RAS was used to compute sediment loads into Conowingo Pond. The Chesapeake Bay Watershed Model (CBWSM) also computes sediment loads to/though Conowingo Pond. How do they compare? SEDFLUME data were collected to determine erosion rates and erosion thresholds for sediment in Conowingo Pond. HEC-RAS, which was also used to calculate sediment transport, uses transport capacity relationships. How do the rates determined by the SEDFLUME work (and used in AdH) compared to calculations using HEC-RAS? Do they agree? The CBWSM also computes transport (because the reservoir is a node in the stream network) and uses an entirely different approach. How were differences handled? Which sediment load estimates were used to feed the CB water quality model (CE-QUAL-ICM) (Carl Cerco model)?	Langland/ Scott/ Cerco	HEC -RAS inputs of watershed loads compare well to CBWSM. USGS (HEC-RAS) annual average load for 1993 – 2012 is 1.5 million English tons/annum. This converts to 3.74 million kg/d. The WSM daily average load for 1991 – 2000 under 2010 Progress Run conditions is 3.06 million kg/d. The differences between the two estimates can be attributed to numerous factors including different summary intervals – 1993 – 2012 for USGS/HECRAS vs. 1991 – 2000 for the WSM. HECRAS also used some of the SEDflume data for estimation of several sediment model parameters.	No.	This comment is not meaningfully addressed without a change to the report to include this information and discuss the uncertainty. There are three different load estimates at Conowingo and each implies a different balance of transport processes: (1) Bay watershed model, (2) HEC-RAS, and (3) AdH. An attempt to identify or reconcile these differences in a quantitative way or recognize uncertainties does not appear to be made in the report. If AdH results differ from HEC-RAS results for Conowingo, is it appropriate to consider HEC-RAS results for upstream reservoirs to be reasonable?
13	CH. 1/P.17/Figure 1-5	Why is a sediment rating curve used as input to Conowingo reservoir instead of a time series output? HEC-RAS is capable of providing a time series, and appendix A says providing a sediment load time series was the modeling objective.	Langland	We tried both the rating curve and HEC-RAS model output. There were problems with the HEC-RAS model as you point out later in comment #75.	No.	No further comment at this time
14	CH. 1/P.18/Figure 1-6	Figure does not clarify which model feeds sediment estimates to CE-QUAL-ICM and how differences between estimates from models in the suite (CBWSM, HEC-RAS, and AdH) are handled.	Cerco/ Compton	The information on CE-QUAL-ICM loading is provided in Figure 1-5. The differences in the model suite are not the subject of these flow charts. This flow chart is meant to provide a simplified, broad picture of the analytical approach of the study tailored for a wide-audience.	No.	No further comment at this time. Please see comments in cover letter regarding Exelon's proposed Attachment 1 and 2.
15	CH.2/P.26/Paragraph 1 & 2	Table 5-6 of the main report is consistent with TMDL Appendix T in stating that the reservoir trapping capacity of Conowingo has been 55-60% from 1993-2012. Please elaborate on what trapping capacities were used in the various WSM model runs.	Linker/ Cerco	The LSRWA scenarios are fully described and characterized in Appendix D along with the estimated Conowingo bathymetries used in each scenario. That is the correct place for the scenario information and not page 75. Changes are unwarranted.	No.	We disagree that Appendix D adequately describes the input parameters for each run. It is important to understand the conditions of the scenario runs within the context of trapping capacity/efficiency as discussed in TMDL Appendix T.

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
16	CH. 3/P.32/Paragraph 5(continues to P.33), see Footnote #5	Footnote #3 indicates that HEC-RAS was used to simulate conditions in Conowingo Pond. HEC-RAS and AdH results for Conowingo Pond should be compared and contrasted. The simulated mass over Conowingo Dam in both models should be tabulated and compared. Any differences in outcomes reflect uncertainties in the assessment process that need to be identified and quantified. Also, given that HEC-RAS is used to drive the upstream boundary for the AdH model domain, it is reasonable to assume that similar sorts of differences would occur through each reservoir if AdH were used to simulate the upstream part of the system too. The upstream watershed (over Holtwood Dam) is the main source of sediment (and nutrients) entering Conowingo Pond. Uncertainties there propagate downstream.	Langland	It would be useful to show this comparison if the data existed. We gave Steve Scott (AdH modeler) the daily sediment load files which he used to help develop his sediment rating curve. I believe he found as we did that the HEC-RAS was not generating enough sediment to match measurements at Conowingo. It is unknown how HEC-RAS performed in the upper two reservoirs due to lack of calibration data, but chances are it also under predicted the load coming in to Conowingo. That is the reason Steve increased the sediment load for the 2008-2011 simulation period from 22 to 24 million tons. It also provided a range of conditions for Steve to make predictions.	No.	No further comment at this time
17	CH. 3/P.33/Paragraph last	Use of HEC-RAS to simulate sediments with cohesive characteristics is problematic. The SEDFLUME results for Conowingo Pond provide a means to check on just how cohesive bedded sediments in the Lower Susquehanna are. SEDFLUME tests give information regarding the critical shear stress for erosion and erosion rate. If the critical erosion thresholds experimentally determined using the SEDFLUME differs substantially from the constraints that drive transport equations used in HEC-RAS, then HEC-RAS cannot be reasonably applied and cannot provide appropriate boundary conditions to drive AdH. The presumed occurrence of “dynamic equilibrium” in upstream reservoirs does not justify the use of HEC-RAS. As noted by the LSRWA, dynamic equilibrium does not imply that the sediment mass entering or leaving a reach of the stream will be equal on a day-to-day or month-to-month timeframe. It is not clear how the authors concluded that HEC-RAS provided understanding of physical processes in upstream reservoir if it does not represent the underlying physics of sediment transport.	Langland	Tying into comment number 32, that is why a rating curve was developed for AdH in Conowingo and the inflowing sediment from HEC-RAS was used as a backup.	No.	No further comment at this time
18						A good test of the AdH model would have been to start with the 2008 bathy and perform a continuous run of the model thru the date of the 2011 bathy and see how well the model reproduces the observed 2011 bathy
19	CH. 3/P.38/Paragraph 4 (full paragraphs)	“One source of uncertainty is the exact composition and bioavailability of nutrients associated with sediments scoured from the reservoir [Conowingo] bottom.” Yet throughout the document nutrients are discussed in absolute terms using definitive statements.	Cerco	This paragraph acknowledges clearly and upfront the uncertainties in composition and bioavailability. There is no need to repeat this statement throughout the report.	No.	No further comment at this time

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
20	CH. 3/P.40/Paragraph 2 & 3 (full paragraphs)	Why was the AdH model (unknown time step) output at 2 hours to then be computed in the WQSTM model at 15 min?	Scott/ Cerco	The ADH time step is short, on the order of seconds to minutes, compared to the daily loadings. ADH computations from each time step were summed into daily loads for use in the WQ model.	No.	No further comment at this time
21	CH. 3/P.41/Paragraph 1	How are the scoured sediment and nutrient loads from Lake Clarke and Lake Aldred accounted for? Is it similar to the process for which Conowingo-scoured sediments (and thus nutrients) are superimposed on the WSM nutrient loads input to the WQM?	Cerco	Sediment loads from Lake Clarke and Aldred are not specifically identified in the Chesapeake Bay loads. The Chesapeake Bay model only “sees” loads at the Conowingo outfall. Loads from Clarke and Aldred are combined with other loading sources at this outfall. The only material superimposed on the WSM loads is scour calculated in Conowingo Reservoir.	No.	No further comment at this time
22	CH. 3/P.41/Paragraph 1	The discord in the timeframes simulated by the model is noteworthy in that it likely affects model outcomes. The Bay WQ model period is 1991-2000. The HEC-RAS and AdH simulations were 2008-2010. Given the non-linearity of sediment transport and associated nutrient transport, it is unclear how results for one timeframe were “adjusted” to a different timeframe that may have different conditions (e.g., precipitation, different winds, different land uses, etc.).	Cerco	The only adjustment that was necessary was to adjust the amount of scour calculated for TS Lee downwards to a value appropriate for the January 1996 storm. This procedure is detailed in Appendix C and comparisons are provided of computed and observed solids concentration at the Conowingo outfall for January 1996.	No.	No further comment at this time
23	CH. 3/P.41/Paragraph 2	“Phase 5.3.2 of the CB WSM provided daily sediment and nutrient loads from the watershed for application in the LSRWA effort.” How does this compare to the AdH time step for scour loads? From Cerco The ADH time step is short, on the order of seconds to minutes, compared to the daily loadings. ADH computations from each time step were summed into daily loads for use in the WQ model.	Cerco/ Scott	The AdH time step ranged from 1000 seconds for low flow conditions to 100 seconds for storms.	No.	No further comment at this time
24	CH. 3/P.44/Paragraph 4	What were the nutrients used for the AdH scour calculations? This appears to be explained on Page 92, Paragraph 1 but is still unclear. What about scour from upper two reservoirs?	Scott	No, nutrients were not in the AdH model	No.	No further comment at this time
25	CH. 3/P.45/Paragraph last (onto P.46)	Were these nutrient contents compared to Marietta samples to get an idea of what the ‘watershed’ makeup may have looked like?	Cerco	We did not find Marietta samples that provided relevant information for comparison with observations at Conowingo.	No.	Relevant data may be available from the Susquehanna River Basin Commission’s Nutrient Assessment Program (SNAP)

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
26	CH. 3/P. 49-50	Based on the estimates of bioavailable nitrogen and phosphorus quoted here, which could potentially be resuspended and transported into Chesapeake Bay, there is a serious mismatch between the bioavailable fractions of TN and TP contained in the Conowingo Pond sediments and how they are incorporated in the CBEMP model wherein they are assumed to be approximately 85% bioavailable. Given this, it is likely that the CBEMP is over-estimating the release of Conowingo Pond nutrients from the sediment bed once they are deposited into the Bay sediments and therefore the model is over- estimating the change in non-attainment of the DO water quality standard	Cerco	The fractions assigned to G2 (slowly reactive) and G3 (inert) are based on long experience with the Bay model, as applied over the period 1985 – 2005. This interval includes multiple scour events so the assigned fractions are considered representative. Nevertheless, we acknowledge the reactivity of organic matter scoured from the reservoir bottom is an area of uncertainty. There are efforts underway to address this issue and this is a recommendation of the study.	No.	The comment was not meant to describe the G2 and G3 fractions in the SFM bed, but rather to point out that the current particulate organic matter coming in from the boundary is assumed to be all refractory. However, it may be possible that during a large scour event a major portion of the scoured particulate organic matter may be largely G3 and therefore putting this into the refractory pool (G2) may over-estimate the bioavailability of the combined watershed and scoured POM pool coming into the Bay. However, we acknowledge that a proposed study effort will be undertaken to address this issue.
27	CH. 4/P.59-60/Paragraph 3-4 (Sec. 4.2.1)	There is a shift in focus from transport in general for all three reservoirs (paragraph 3) to just transport within Conowingo Reservoir (paragraph 4). The same condition would be expected in all three reservoirs, not just Conowingo Pond.	Scott	There most certainly is scour in the upper two reservoirs that supply Conowingo. However, without field data to quantify it, it is very uncertain how much of the scour enters Conowingo. More field data measurements are needed below the dams.	No.	True, but still an important issue that warrants a statement in the report that is similar, if not the same, as Scott’s response.
28	CH. 4/P.106/ Paragraph 4 (full paragraphs)	What does “trace” erosion mean? Is it resuspended sediment that is moved within the pond and does not pass the dam? Is it erosion of the thin unconsolidated layer?	Scott	erosion of the mixing layer in the reservoir. Very unconsolidated that mobilizes at low shear rates (.004 psf)	No.	The qualitative term “trace erosion” is used several times in text. Since this response indicates it refers to a quantitative condition, the use of this term should be defined when used in the text. Ditto for the term “mass erosion.”
29	CH. 4/P.60-62/Paragraph USGS Scour Eqn	The basis for this is unclear. Its reliability is even more unclear particularly because the USGS equation is an empirical representation and simplification of an outcome that is itself uncertain because of uncertainties in upstream loads and processes. However you look at it, another problem is one of potential spurious self-correlation. Bed scour computed in AdH is related to discharge; so discharge occurs as a factor in both “independent” variables in the relationship.	Langland	Agree somewhat with your assessment. This is just a simple relation between MEASURED sediment loads from 2 sites, upstream and downstream of the reservoirs. The difference is most likely due to scour. You did note the error bars around each prediction to account for some of the uncertainty.	No.	No further comment at this time
30	CH. 4/P.65/Paragraph last (onto P.66)	This paragraph cites an ‘active layer’ depth of 2-3 feet. Specific study results that prove this statement should be provided or referenced. Appendix A of the LSRWA does not mention any ‘thin unconsolidated mixing layer’ as cited, and there is only a single reference to this in Appendix B which states that “[t]he top layer of Conowingo Reservoir sediments consists of a low density unconsolidated layer that may mobilize at lower flows.”	Scott	The depth of sediments available for scour was assumed to be 2 - 3 feet in the model. Bed properties were measured in the SEDflume up to one foot of depth. The remaining 2 feet were estimated. Appendix B is the source of this info. Sentence in main report was changed from "The active layer has a depth …" to "For modeling purposes, the active layer is estimated to have a depth…"	Yes.	We were not clear in our first comment – our primary concern was the evidence behind the statement of a ‘thin unconsolidated mixing layer’, which we cannot find a satisfactory description of within the main report. Our concern is that the main report appears to step beyond what is stated in Appendix B.

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
31	CH. 4/P.67/Table 4-4	The "full" condition bathymetry calculation is not well explained in the main report text. Upon investigation of Appendix A, it appears that the "full" estimation is based on assumption on how many acre-feet of sediment Conowingo Pond can store (146,000 acre-feet). The report does not provide any details regarding how this estimate of 146,000 acre-feet of sediment capacity was derived beyond general statements that recent bathymetry data were considered. Considering how frequently this "full" condition is cited throughout the report and Appendix A/B, more attention should be paid to how this value was arrived at, what assumptions were made and what methods were used to estimate this value.	Langland	The capacity of Conowingo is based upon original surveys from Conowingo Hydroelectric Company. The first estimation of the "full" capacity was made in Reed and Hoffman, 1996, USGS Report 96-4048. Some modifications have been made since that initial estimate based on more recent bathymetry. Additional details added to Appendix A. belong there. In response to comment #5, language was already added to para #1 on page 112.	Yes.	No further comment at this time
32	Page 66 (Nov report), end of last paragraph					Two new sentences were added to the bottom of Bathymetry Comparisons section explaining what "full" condition means – unfortunately they do not clarify the definition of dynamic equilibrium given elsewhere.
33	Page 69 (Nov report), end of last paragraph					The phrase "Hurricane Agnes in 1972" appears to have been inadvertently deleted from the last sentence after the word "excluding."
34	CH.4/P.73/Figure 4-5	The second panel in this figure indicates that silt deposition buried oyster beds. It's not clear if this is a proven impact, as earlier in the report (page 57), evidence was cited that disproved the 'sediment burial theory' following Tropical Storm Lee and indicated that oyster mortality was likely due to excessive fresh water and low salinities for an extended duration. This is reiterated again on page 138.	Spaur	Second figure shows extent of sediment plume, not extent of substantial sediment deposition. Change sentence "As a result, sediment runoff from Tropical Storm Lee was quite extensive compared to that of Hurricane Sandy, as depicted in Figure 5-6. " to "As a result, sediment runoff from Tropical Storm Lee was quite extensive compared to that of Hurricane Sandy and produced a large sediment plume in Bay waters, as depicted in Figure 5-6. Where sediment transported into the Bay would be deposited is controlled by waves and currents, thus mainstem Bay deep waters and protected headwater tributary settings would likely retain sediment from this storm, whereas higher energy shallow waters of the mainstem Bay would be expected to show negligible deposition (see Section 2.6.1)."	Yes.	Response appears to reference the second figure not the second panel (Tropical Storm Agnes June, 1972 – "silt deposition buried oyster beds.")

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
35	Chapter 4(pp. 74-75)					Langland's response to the Riverkeeper comment (# 41) in Appendix I (page 7) indicates both the average peak flow for the Jan 1996 storm (630,000 cfs) and the instantaneous peak flow (908,000 cfs) are to be added to the text to match what is now figure 4-7. However, the text only mentions the 908,000 cfs value and the figure illustrates a 630,000 cfs value (but it shows up more as a transposed 603,000 cfs). The mean daily flow for the 24-hr period centered on the 908,000 cfs peak is reported in Langland and Hainly (1997) as 530,000 cfs. These discrepancies should be resolved.
36	CH.4/P.74/Paragraph 1	It's not clear what "Average peak flow" means – is that the peak daily average flow (and if so at what location), or the average of the peak flows measured along the river? Also, the event says there was an ice dam breached "within the reservoir itself" but the specific reservoir (Clarke, Aldred, or Conowingo) was not described. It is our understanding that the ice jam breached in the Safe Harbor impoundment.	Langland	Correct, there is no average peak flow. Replaced "Average" with "The"; peak flow value changed to 908,000 cfs.	Yes.	The first portion of this comment was adequately addressed, however, clarification was not provided in regard to the specific reservoir where the ice jam breached.
37	CH.4/ P.75/Paragraph last (onto P. 76)	Again Conowingo is specifically called out separately, while loads from Safe Harbor and Holtwood are just considered part of the "watershed" loads.	Langland	The design of the study was to model Conowingo since it was believed it had remaining capacity, was largest reservoir, and may have the greatest impact on the upper Bay	No.	We would like to see a breakdown of the model results for each reservoir similar to what is shown for Conowingo Pond, recognizing that there are little to no measured data available to assess accuracy. Additional information should be added to the report.
38	CH.4/P.76/Table 4-7	Is there a reason that the AdH results were not used here instead?	Langland	The AdH model could not generate all the data included in Table 5-7.	No.	It is unclear why the AdH model could not be used to estimate scour loads at various sized flood events.
39	Page 78 (Nov), 5th Paragraph					In the first sentence, recommend changing "versus scour from the Conowingo Reservoir" to "versus scour of watershed sediments stored in the Conowingo Reservoir"
40	CH.4/ P.80/Table 4-9	It would be more useful to the reader to list the absolute amount of nonattainment for each scenario, rather than a differential from other scenarios. It is difficult to 'back-calculate' the absolute nonattainment numbers from the differentials presented because of a lack of significant figures and because the 'baseline' scenario is different for several of the scenarios.	Linker	The critical period of the Chesapeake TMDL is 1993-95, but the year of the Big Melt high flow event on the Susquehanna was 1996, so a 1996-98 3-year period was used to capture the main scour event simulated in the LSRWA report. With the new 1996-98 period, the high flow event is simulated, but the scenario findings of the 1993-95 period are now lost. It is not a worthwhile exercise to compare the TMDL WIP or the 2010 scenarios on the 1996-98 period that is now disconnected to the 1993-95 hydrology and loads that the Chesapeake TMDL was based on. For this reason differential results are used.	No.	Our original comment still stands. We disagree that this would not be a worthwhile exercise.
41	CH.4/P.91/Paragraph 2	Is this 'updated nutrient composition' from Tropical Storm Lee applied to all sediments (i.e., watershed sediments and bed scour sediments) or just bed sediments? If it is applied to just bed sediments, this same nutrient composition should be applied to the scour from Lake Clarke and Lake Aldred as well as Conowingo Pond.	Cerco	The TS Lee composition is applied only to scoured bed sediments. There is no need to apply any adjustment to lake Clarke and Aldred sediments. These loads are incorporated into the loading to Conowingo Reservoir.	No.	No further comment at this time

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
42	CH.4/P.97/Paragraph 3 (full paragraphs)	Paragraph focuses on AdH results for Conowingo Pond and purported loss of storage despite prior (and subsequent) text suggesting that changes in sediment transport are not expected to have a big impact on Bay water quality.	Scott	The reservoir is currently in a dynamic equilibrium for which deposition and scour continually occurs without a net change in storage. Sediments will deposit during low flows and scour during periodic storms. The loads from TS Lee did not demonstrate a long-term adverse impact to water quality. There was a short-term impact as would be expected.	No.	Given uncertainties in upstream loads to Conowingo reservoir and loads passing the Dam, what is the uncertainty associated with the mass estimates ascribed to erosion and deposition within Conowingo Pond?
43	CH. 5/P.100/ Paragraph 2	Goal of management not clearly stated. Stopping all sediment entering Bay is not possible or desirable.	Compton	Comment is vague. The referenced paragraph doesn't mention the word management or goal. There is no place the report that suggests stopping all sediment from entering the Bay. Goal/focus of the management strategies are adequately discussed in paragraphs 1 and 2.	No.	The nature of our comment is that the goal appears to be to reduce sediment loading to the Bay; however, this is not stated clearly in the report.
44	CH.5/P.102)Figure 5-2					Morris (1998) is not in the list references. This figure is not from Morris & Fan (1998). Believe the correct citation should be: Morris, G.L., (2014). Sediment management and sustainable use of reservoirs. In: Modern Water Resources Engineering (L.K. Wang and C.T. Yang, eds.). Humana Press. NY. Chapter 5. Pp. 279-338.
45	CH. 5/P.146-140	None of the evaluated dredging alternatives seem to consider sediment and nutrient (as well as other contaminant) releases during dredging. Such losses generally amount to several percent of all material handled	Compton/ Blama	Loss of sediment during mechanical dredging where material may fall from the bucket; regulations call this de minimis. When dredging is performed by hydraulic cutter head any contaminant attached to the sediment could be released due to the agitation of sediment. This can be calculated by running an elutriate test, however this test was not performed for the level analysis needed at the conceptual/watershed level. When dredging fines versus sand we lose more fines, so if we dredge more fines, we'd lose more material. Conversely, if we dredge more sand, we'd lose less. Language added to the report: When dredging is performed (hydraulically or mechanically) any contaminant attached to the sediment could be released during placement. To predict the release of contaminants elutriate tests can be performed. The standard elutriate test is used to predict the release of contaminants to the water column resulting from open water placement. The modified elutriate test is used to evaluate the release from a confined disposal facility. The results will vary depending on the grain size of the material being dredged. Since the LSRWA was a broad assessment of alternatives, elutriate tests were not performed on the potential dredged material. If specific dredging and placement sites are investigated in the future than it is recommended that	Yes.	No further comment at this time

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
46	General Comment	Pertaining to all alternatives – not addressed are the potential environmental impacts as related to: aesthetics, air quality and greenhouse gases, soils, water quality, wetlands, groundwater, surface water, wetlands, floodplains, biological resources, cultural resources, land use, socioeconomic resources, recreation and tourism, utility and transportation infrastructure, public health and safety, and noise. In many cases the environmental impacts associated with a specific alternative may cause more harm than good.	Spaur/ Compton	This paragraph was inserted after last paragraph on page E-4 (before section titled "Future Needs of the Watershed") and after first paragraph on page 182 (before paragraph starting "Table 6-10 is a matrix....). "It should be noted that the LSRWA effort was a watershed assessment and not a detailed investigation of a specific project alternative(s) proposed for implementation. That latter would likely require preparation of a NEPA document. The evaluation of sediment management strategies in the assessment focused on water quality impacts, with some consideration of impacts to SAV. Other environmental and social impacts were only minimally evaluated or not evaluated at all. A full investigation of environmental impacts would be performed in any future, project-specific NEPA effort."	Yes.	While a NEPA level review of potential environmental impacts is well beyond the scope of such as assessment, it is not unreasonable for a watershed assessment to discuss the relative environmental impact of alternatives and to list specific resources to be considered for future analysis.
47	CH. 7/P.148/ Paragraph 2	"If a more detailed evaluation of the upper two reservoirs is required in the future, AdH would be the more appropriate model to apply." Given that this is used as the input to AdH to determine Conowingo Pond scour it would seem imperative to do this.	Scott	Detailed analysis of reservoir sediment transport is best performed with a 2D model. Although there was significant uncertainty in this application, improvements in the model through further research at ERDC will provide more capability with less uncertainty.	No.	No further comment at this time
48	CH. 7/P.148/ Paragraph 1-5 (all)	Recommendations for future use of HEC-RAS and AdH are unclear. A new 2-D version of HEC-RAS is now available. However, it is unclear if new sediment transport functionality (if any) would address the most basic limitations of the framework for using HEC-RAS. AdH also has limitations, some of which are beyond the limitation of the present flocculation approach.	Langland/ Scott	More capability is needed in AdH. The ability to simulate dam operations, particle flocculation dynamics and transport, and better sediment bed definition. Chapter 8 is not about future use of the model; it's about ideas for enhancements to those models. The new 2D HEC-RAS model does not have any specific additional sediment transport capability.	No	No further comment at this time
49	CH. 7/P.149/ Paragraph 4	Models are run for incongruent periods and hydrologic/sediment transport conditions. The appropriateness of substituting loads from models other than the Bay watershed model (e.g., HEC-RAS and AdH) as inputs to the Bay WQ model needs to be established.	Cerco	The only substitution of loads is to augment the watershed model results with estimated scour during the January 1996 storm. The estimate employs scour calculations from ADH during 2011. Appendix C clearly establishes that the calculated sediment concentration during January 1996 is vastly improved by addition of the scour loads. The Appendix also discusses and describes the result of various estimates of sediment composition on watershed model computed nutrient loads.	No.	No further comment at this time
50	CH. 8/P.150-151/Finding #1	The important point is to know if the trapping capacity assumed in the TMDL is the same as considered now. Based on reading Langland trapping efficiency data in Appendix T and this LSRWA report they are the same.	Langland	Good news. Thanks	No.	To clarify the original comment, is the trapping capacity assumed in the TMDL the same as is considered now? It appears based on this report and Langland trapping efficiency data in TMDL Appendix T that they are. Please confirm.
51	CH. 8/P.151/ entire page	This test simply restates assertions made earlier in the report --> consequently, prior comments regarding the appropriateness of model use in the evaluation as well as underlying uncertainties need to be investigated and further considered before such definitive findings can be stated.	Compton	The team/has disclosed all sources of known uncertainties and recommendations to address these which are discussed in various places throughout report package. Findings/conclusions are made in this context and are valid.	No.	No further comment at this time

Comment #	Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change ?	Exelon Response/Additional Comment
52	CH. 8/P.152/ Paragraph 2	Couldn't the amount of time for sediments to settle out increase if there is an increase in velocity due to decrease in depth? The statement may be too strong a statement since the time to settle is a unique combination of gravitational and fluid forces."	Langland/ Scott	No, because water is traveling faster, therefore, potentially, less time spent in reservoir.	No.	Based on the response of this comment, recommend revising the paragraph in question as shown below in red: "As the lower Susquehanna River reservoirs have filled, water depths have decreased and water velocity has increased. This has led to increasing the bed shear (which can result in more scour) and to decreasing the amount of time ~~for~~ sediments spend in the reservoir ~~to settle out of the water column~~, which thereby, reduces sediment deposition within the reservoir (Appendix A)."
53	CH. 8/P.152/ Paragraph 4	More detail on this trace erosion should be presented in the report, and this statement should cite relevant sections or appendices. As stated in a previous comment, Appendix A did not mention any 'thin unconsolidated mixing layer', and there was only a single reference to this in Appendix B which stated "The top layer of Conowingo Reservoir sediments consists of a low density unconsolidated layer that may mobilize at lower flows."	Scott/ Langland	It occurs, but is not significant as compared to storm flows above 400,000 cfs and was not a focus of this assessment. Recommendations section outlines focus on understanding deposition and scour and flows below 400,000 cfs.	No.	No further comment at this time
54	CH. 8/P.154/ 2nd Full Paragraph					Recommended revision to wording at the end of Finding #2: "To achieve the required water quality conditions under the Chesapeake Bay TDML, full attainment of the states' Chesapeake Bay water quality standards, the extra nutrient loads associated with sediment scoured from the three reservoirs ~~Conowingo Reservoir~~ must be offset by equivalent nutrient load reductions."

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX A – SEDIMENT RESERVOIR TRANSPORT SIMULATION OF THREE RESERVOIRS IN THE LOWER SUSQUEHANNA RIVER BASIN, PENNSYLVANIA USING HEC-RAS, 2008-2011

	Original Exelon Comment	Langland Response	Exelon Response/Additional Comment
GENERAL APPENDIX COMMENTS	The model depends on how upstream boundary conditions (BCs), sediment bed properties, and transport processes are represented in order to "calibrate" the model to reproduce measured downstream BCs. With respect to the sediment BC, USGS used a function where upstream TSS = $0.007\ Q^{0.9996}$. For all practical purposes, this is a linear relationship between TSS and Q. Although there is a lot of spread in the data, the maximum concentration reported at any Q is 700 mg/L (with a more general trend around 300 mg/L). Extrapolating the upstream BC function to the high flow of interest leads to TSS = 835 mg/L when Q = 1.2e6 cfs. This extrapolated TSS concentration is just ~15% more than the maximum reported value (and less than 3x more than the general trend value of ~300 mg/L). [If the upstream reservoirs are believed to in dynamic equilibrium (and Holtwood reservoir is very shallow), the increase in TSS concentration is modest given the factor of 2 extrapolation of flow beyond the limit of measurements.] In contrast, the downstream BC was represented using a parabolic function where downstream TSS = $4\text{e-}09\ Q^2 - 0.0007\ Q + 34.313$. As before, there is a lot of scatter in the data but it is harder to see on the graph because the y-axis goes to such a high limit that typical values appear compressed. Nevertheless, typical values are on the order of 300 mg/L to ~1000 mg/L (at 600,000 cfs) with a maximum value of 3,000 mg/L (at 600,000 cfs). This may not be a reasonable representation of the downstream BC. Further, the form of this relationship presents a curious situation for several reasons: • the linear term, TSS = -0.0007 Q, is nearly identical in magnitude but opposite in direction to the upstream BC function • the quadratic term, TSS = $4\text{e-}09\ Q^2$, implies that concentration increase geometrically for a linear increase in flow • because the linear term is essentially equal to the upstream load (and opposite in sign), the mass represented quadratic term must be transported off the bed in the model in order for simulated TSS concentrations at the downstream boundary to equal measured values. When extrapolated, the relationship implies that TSS = ~5,000 mg/L when Q = 1.2e6 cfs. Not only is this concentration very high, it is 40% more than the maximum reported concentration of 3,000 mg/L (assuming that this 3,000 mg/L value is representative and not impacted by a sampling or measurement error), ~5x greater than other values measured at 600,000 cfs and ~10x higher than more typical values. There is no basis to determine if this downstream BC TSS relationship is reasonable or appropriate, particularly when extrapolated to 1.2e6 cfs. This situation is further exaggerated because the exponents in the sediment transport capacity/erosion relationships selected for HEC-RAS (1 for Parthenadies, 6/7 for Laursen) are much less than the value of 2 in the downstream BC relationship. This means that the model is forced to scour tremendous amounts of sediment from the reservoir bed to match downstream TSS levels. In short, with this downstream boundary, the model can only compute massive bed erosion and must be set-up so that erodible limits are sufficient to allow massive bed erosion.	Suspended-sediment concentration (SSC) was used not TSS, there is a bias difference in lab methods that generate an error when sand is present. The TSS method by using an aliquot taken at the middle of the sample potentially does not capture the heavier sands that have already settled. There are a lot of great discussion points here, linear vs quadratic relations, BC in and out of the reservoirs, maximum "measured" sediment concentrations, sediment recession, etc. It is important to note that the sediment concentrations shown in the sediment rating curves may NOT be the maximum concentrations. This is most likely the case at Marietta when the first (and highest at ~700 mg/L) measurement for the T.S. Lee event was 3 days after the peak. Most likely this was well after the sediment peak and on the recession side of the sediment hydrograph. This monitoring location is just upstream of the reservoirs. The downstream site reflects the cumulative effect of the Susquehanna River and 3 reservoirs and therefore the sediment rating curve might be expected to be different than a rating curve outside of a reservoir system. The quadratic form of the equation suggests a different source of sediment than the linear upstream. as you mention, scoured bed sediments. This is reflected in the" measured" data at the Conowingo site. I'm not sure how you define "massive bed erosion". The conclusion of the model simulation was the model "UNDER ESTIMATED" the amount of sediment when compared to "measured data" at Conowingo.	No revisions in the report appear to relate to this comment. Uncertainty bounds for both the upstream and downstream load estimates from measurements should be evaluated. There are no means to determine how much overlap may exist in these estimates. Understanding overlap in estimates is important because the difference between the downstream load and the sum of the upstream loads and tributary inputs empirically defines the amount of bed scour. All load estimates are extrapolated to high flow to represent high flow events. The functional form of load estimation equations can have a pronounced impact on inferences of bed scour. If 2 points in the downstream load estimate data set were treated as outliers (TSS = ~1,200 mg/L at Q = ~390,000 cfs; and TSS = ~3,000 mg/L at Q = 610,000 cfs), the implied curvature where TSS rapidly increases with Q at high flow in the downstream boundary load estimate would be reduced (or eliminated). Thus the quadratic term speaks more to a likely error in model boundary conditions rather than a different source of sediment. Moreover, correlation does not imply causation; cause cannot be inferred; particularly because the USGS analysis appears that it does not account for the time of travel between Marietta and Conowingo. The fact that the model was judged to underestimate the empirical TSS load passing Conowingo Dam speaks to errors in representing erosion and deposition processes in the reservoir. Table 2 (p. 12) of the revised report indicates a high clay fraction in the sediment bed. The inference is that the sediment is substantially cohesive. The transport formulations selected are not applicable to such sediment. The model is largely set to operate on a transport

N	Original Exelon Comment	Langland Response	Exelon Response/Additional Comment
			capacity limited basis (with infinite supply down to erodible limits). In contrast, reality may be more of a case where, due to sediment cohesion, the system is supply limited. Ultimately, the USGS' assessment that the model underestimates the TSS load leaving Conowingo is more a reflection of the method used to estimate upstream and downstream loads rather than an assessment of the model. Underestimation of loads at Conowingo could be the result of errors or uncertainties in any of the following: (1) (overestimating) the empirical load at Conowingo, (2) the upstream load, (3) watershed loads, and (4) scour from the bed. The report does not adequately deal with these issues and instead advances a priori conclusion that scour within Conowingo reservoir is the source of sediments.
	At a minimum, confidence intervals should be established for the upstream and downstream boundary conditions and alternative formulations should be explored for the functional relationships used for both BCs.	Selecting 2 different sediment transport functions for the model was the attempt to place some confidence interval in overall sediment transport from Conowingo.	Use of alternative sediment transport functions (which are themselves not applicable to the types of sediment being modeled) does not establish confidence intervals. This is a question of statistics; given the TSS and flow values used in the regressions shown in Figures 6 and 7, what are the confidence limits? Do the confidence limits of the upstream and downstream load estimates overlap? This is unrelated to sediment transport functions.
	There is a link with the SEDFLUME data too (and the AdH report) for cohesive transport. As noted in the AdH report (Section 6.1 of Appendix B), the sampling tube could not penetrate the substrate indicating highly consolidated sediments. The AdH report notes that most of the cores were less than 1 foot in length. However, erodible depths in the HEC-RAS model ranged from 0 feet just downstream of each dam where the bed is composed of gravels, boulders, and bed rock to 20 feet in the deepest sediment accumulation areas. This seems a bit inconsistent.	I did not collect the SEDFLUME data, but I am aware of some of the difficulties in the collection. Previous cores collected by USGS in 2000 and analyzed by University of Maryland, go down much deeper (average of 5 feet, deepest one 11.5 feet) and contain particle size information at incremental levels. In general, particle size becomes courser with depth, but there are many areas with erodible fines at depths greater than 5 feet. Just because the erodible depth is set to 20 feet, that does not mean the model is going to erode down that deep.	Did the HEC-RAS model show erosion depths greater than the depths to successful SEDflume collection? The maximum depth of erosion in the HEC-RAS model should be compared to the physical information implied by difficulty collecting SEDflume core deeper than 1 ft.
			Starting with the second sentence on page 4, in the citation for the URS and Gomez & Sullivan publication, "USR" is used in multiple locations.

Chapter / Section	Page	Paragraph	Original Exelon Comment	Langland Response	Exelon Response/Additional Comment
2.0 / Background	4	Bottom of middle one	Fall velocities do not change with water velocity, transport capacities and shear. Statement is incorrect.	Agree removed "due to"	The response to the original comment is satisfactory; however, the last two sentences of this paragraph are somewhat unclear: "The report implies increasing concentrations and loads are due to the loss of storage capacity from a decrease in the scour threshold. Reasons for this increase are not certain but likely involve changes in particle fall velocities, increased water velocity, transport capacities, and bed shear." Please provide further clarification.
2.0 / Background	5	Figure			This figure indicates that sediment transport by means of density currents is an important process in reservoirs. What evidence is there that this is occurring in Conowingo Pond?
4.1.2 / Sediment	11	Figure 6	Here and elsewhere (USGS regression equation) sediment transport curves are developed based on suspended sediment samples. Suspended samples do not capture bed load which is not estimated in the report. In addition there is always part of the water column on the bottom (usually with the highest concentrations) where the sampling device cannot collect data. I did not see any explanation of how the bed load or unmeasured loads were considered, if at all, in the analyses.	On page 24, under model limitations and uncertainty, this issue is addressed.	Other than "initial conditions or boundary conditions in a model may not be well known" (page 22) there appeared to be no discussion about the uncertainty in the inflowing load based on our review of the cited section. Not including bedload or unmeasured load at the upstream boundary does not appear to be addressed.
5.0 / Calibration	18	Top of page	Only flows from two tributaries were included – any estimate of flow percentage missing from ungaged tributaries? Should be able to estimate by comparing outflow from Conowingo with sum of inflows from Marietta and gaged tributaries.	This was an additional exercise completed and included in attachment 1	Is the reference to Attachment A-1 of the report or to a different one? Did not see anything about this in A-1.
6.0 / Model Uncertainty	24	4	Lots of problems were encountered with appropriate fall velocities for cohesive sediment. As recommended by HEC, the grain size distribution should reflect the flocs rather than discrete grains.	We did not have information about the floc size.	This should be identified as a limitation or uncertainty.
6.0 / Model Uncertainty	24	7	Statement is not exactly true. HEC-RAS solves sediment transport by size class.	With limited capacity	Original comment still stands. Item #7 is still incorrect in that sediment load is determined by size class using whatever transport formula was chosen (some are bed load only, some are total load) and the capacity limiters mentioned in the response.
6.0 / Model Uncertainty	24		Missing a paragraph #9 which would point out that the hydrograph is being simulated by a series of steady flow pulses, and sediment transport is assumed at equilibrium for each flow pulse. This is different from true unsteady flow (non-equilibrium transport) models.	May be a little too technical to explain without adding more information on the difference (advantage, disadvantage) between steady and unsteady models	Should be listed as a limitation. Can put something simple without further explanation required, e.g., "the model simulates flow hydrographs via a series of steady flow pulses."
7.0 / Results	25	1	Why is there poor agreement with bathymetry?	Model performance and added "the estimated change"	The report should have an explanation for the poor agreement.
7.0 / Results	25	Last			The Duan et al. reference is not very pertinent as her work on the Rillito Wash was for an ephemeral sand bed riverine system as opposed to a perennial silt dominated reservoir environment.

Chapter / Section	Page	Paragraph	Original Exelon Comment	Langland Response	Exelon Response/Additional Comment
7.0 / Results	25	Last	Model results are being compared to ESTIMATOR and scour equation results rather than directly to measured data. The model parameters were adjusted and a separate scour model with different parameters was created for the single Tropical Storm Lee event. This does not lend a lot of confidence to model results.	Agree, and one the important findings' of the study, that the HEC- RAS might not be the best choice of a model in this reservoir system	No further comment at this time
7.0 / Results	29	first			The first sentence that models were calibrated to samples is misleading in that there was no comparison of computed versus measured (based on concentration) sediment load but rather of percentages of sand/silt/clay
Appendix A-1	35	Table A1	It appears that the results were computed with Log-Pearson Type III distribution. The Appendix should note that this distribution is not always applicable for controlled systems.	I noted the difference might be due to flow regulation.	Noting that the difference between the in and out curves may be due to flow regulation is not the same as recognizing that the assumed distribution itself may not be appropriate for regulated systems.
Attachment A-1	38	2	It is not clear how the Gomez and Sullivan (2012) bathymetry data were used in computing estimated scour loads from the lower Susquehanna River reservoirs for three reasons: 1) the 2011 survey described in Gomez and Sullivan (2012) was limited to Conowingo Reservoir (no bathymetry was collected in Lake Clarke or Lake Aldred); 2) the Gomez and Sullivan (2012) study compared bathymetry data from three years apart (2008-2011) and did not make an assessment of the 2011 flood event's specific contribution; and 3) the Gomez and Sullivan (2012) study calculated that there was net deposition from over the three year period from 2008-2011, not net scour.	Good points. 1 and 2. The GSE bathymetry was not the only data used to develop the equation. As the discussion indicates, the prediction equation is a tool, that allows a "quick" estimate of scour from the reservoir system, not just Conowingo. Based on the regression diagnostics, error bounds are plotted on figure A4. 3. Correct the study did indicate net deposition during the 2008-2011 interval, however that does not imply no scour during the short term T.S. Lee event.	No further comment at this time
Appendix A-1	38-39	Figure A4	Not clear how scour loads were computed and curve developed, important as used for model calibration. Also based on suspended load measurements only (no bedload).	Scour loads are defined as sediment capable of being lifted from the bed become "SUSPENDED" and transported through the dam. The bed is always moving to some degree, however, this study (and most of Chesapeake Bay Program is concerned with what exits the dam, not necessary how movable is the bed.	The original question remains. How were scour loads computed and curves developed? Also, it appears the regression equation in the Figure has changed since the last draft even though the data appears to be the same. Not sure what happened here?
Attachment A-1	40	Table A2	Table A2 predicts the amount of scour exiting the Lower Susquehanna River reservoir system by using an equation fit to data from 1993-2011. Yet, 'scour' predictions are made for events as far back as 1936, when the reservoir system likely experienced much different sediment dynamics than it does in modern times. Additionally, it is not clear what criteria were used to estimate the scour load for these events, as the relationship between the two columns does not appear to fit a monotonic relationship.	Good point, I used the estimated trapping efficiency (table later in section) to estimate the scour load for storms previous to 1972.	No further comment at this time

Chapter / Section	Page	Paragraph	Original Exelon Comment	Langland Response	Exelon Response/Additional Comment
Attachment A-1	42	1	As velocity increases and bed shear increase, wouldn't the time for sediments to settle out also increase, not decrease?	NO, velocity increases, lessening the amount of time for sediment to settle out.	It seems the authors are referring to the time available to settle out in the reservoir and not the time it takes to settle. The text and author's response here are not clear. The sentence in question is: *"As the reservoir fills with sediment, the velocity increases, perhaps increasing the bed shear (can result in more scour) and decreasing the amount of time for sediments to settle out of the water column thereby reducing deposition."* Under the scenario of increased flow velocity and bottom shear, a particle in suspension will remain in suspension longer. That is, it will take longer to settle out of the water column. If the author means to communicate that there is less time available for the particle to settle out of the water column **in the reservoir** because it is being transported out of that system faster, this should be clearly stated.

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX B – SEDIMENT TRANSPORT CHARACTERISTICS OF CONOWINGO RESERVOIR

	Original Exelon Comment	Scott Response	Exelon Response/Additional Comment
GENERAL APPENDIX COMMENTS	Lots of discussion about erosion threshold and SEDflume data but not much about deposition shear stress threshold. Are these set equal in the model?	Because of uncertainty in flocculation dynamics, there was no minimum depositional shear stress (based on particle fall velocity of individual particles	Floccing is given importance and described on page 13, it is identified as one of three most critical model uncertainties on page 14, it is presented as a needed improvement to the AdH model on page 60, and it is identified as a source of uncertainty in the main report (2nd paragraph of page 38 in November version). However, I did not see this uncertainty described in Attachment B-1.
	The AdH model TSS upstream boundary condition is directly from the USGS HEC-RAS application. As noted in comments on Appendix A, USGS used a function where upstream TSS = 0.007 $Q^{0.9996}$. For all practical purposes, this is a linear relationship between TSS and Q. Although there is a lot of spread in the data, the maximum concentration reported at any Q is 700 mg/L (with a more general trend around 300 mg/L). It would be worth reviewing the basis and functional form for this upstream TSS BC. Uncertainty bounds and confidence limits for this relationship should also be established.	Agree. Perhaps the field data collection effort by Exelon and USGS can provide more data for such as effort.	This comment does not appear to have been addressed by a revision to the report.
	The AdH model TSS downstream boundary condition differs from the USGS HEC-RAS application. Whereas the USGS TSS downstream BC fit a parabolic function to the data and did not force the relationship to pass through the maximum point (TSS = 3,000 mg/L at Q = 600,000 cfs), the relationship used for AdH is forced through this maximum value. Consequently, at a flow of 600,000 cfs, AdH is calibrated to yield even more erosion than the USGS model. It would be worth reviewing the basis and functional form for this upstream TSS BC. Uncertainty bounds and confidence limits for this relationship should also be established.	The USGS did not use this linear function. They used actual data. The maximum value of their actual data set was more like 2700 mg/l. The AdH downstream output of TSS was based on both pass through sediment and bed scour contribution. The output of AdH was not forced through any curvefit. The actual measured values of concentration discharged through Conowingo were plotted as an exponential function that did pass through the maximum value.	AdH simulations attempt to approximate the load implied by the product of flow and concentration (Q times C) at Conowingo Dam. The load implied by the data reflects uncertainties in measurements and the timing of those measurements relative to flow conditions (i.e., rising limb, versus falling limb, etc.). The issue is whether the handful of high concentrations measured at Conowingo Dam, or not measured upstream, are accurate and reflective of the true load. The original comment was intended to express these concerns rather than to imply that AdH was curvefit. What effort was put into screening and evaluating the data?
	Boundary conditions should be reviewed to establish defensible ranges/relationships and quantify uncertainties.	Agree.	It is unclear if any action was taken based on this comment.
	SEDFLUME cores only penetrated to ~1 ft or less. In some cases the depth of scour identified in Figure 5 often exceeds 1 ft and can exceed 5-8 ft in several locations. Such model results are extrapolations beyond the range of measurements. Cores for the SEDFLUME could not penetrate sediment so it is likely that the erosion resistance of sediment at depth could be much more than at 1 ft below grade.	I agree. I increased the erosion threshold considerably for these deeper depths (greater than 1 ft) up to 5 – 6 pascals	This comment does not appear to have been addressed by a revision to the report.
			Appendix B-1 mentions transport by density currents several times as a process of sediment transport in reservoirs. What evidence is there that this is occurring in Conowingo Pond?

Chapter / Section	Page	Paragraph	Original Exelon Comment	Scott Response	Exelon Response/Additional Comment
Abstract **NEW**	ii	1			Recommend deleting the 1st paragraph of abstract. As currently written, it comes off largely as the opinion of others (i.e. USGS). Besides, it is not needed given content of rest of abstract.
1 / Introduction **NEW**	1-2	3 at bottom of p. 1 and on to top of pg. 2			How is enforcement of a TMDL standard related to perception of steady-state sedimentation in a reservoir?
1 / Introduction **NEW**	2	1			Statement that "[i]n the absence of large flow events, the majority of sediments that enter the two upstream reservoirs transport to the lowermost Conowingo Reservoir" has no clear basis. The AdH report only covers the Conowingo Reservoir; it does not extend to consider reservoirs upstream. This statement should either have a citation, reflecting the work/opinion of others, or it should be deleted.
2 / Background	4-5	Entire Section			This section seems as if it is a summary of work by others; however, there are relatively few direct citations. Recommend updating to include the appropriate citations.
2 / Background	5	Bottom	"HEC-6 model did better when included coarser sediments." By using only suspended samples you are missing out on coarser particles that might transport as bedload	Agree.	To state this as a question, is the potential lack of coarser material at the upstream boundary considered in the uncertainty analysis?
3 / Approach and Goals	8-9		Goals stated more clearly here than in main report. This description should be incorporated into the main report.	Main report will be updated.	This comment does not appear to have been addressed by a revision to the report.
4 / Description of Modeling Uncertainties	All		This section does a much better job of describing the uncertainties associated with the AdH results than the main report does. Specifically page 14, paragraph 2 which states that "Because of these uncertainties the AdH model may potentially over-predict to some degree transport of bed sediment through the dam." These points, for all models, need to be more clearly made and emphasized in the main report.	Main report will be updated.	This comment does not appear to have been addressed by a revision to the report.
5.1 / Susquehanna River Flows	15	2	While 2008-2011 did have a range of flows, the frequency of the flows is not comparable to the long-term record.	Agree. TS Lee was 13 year return event.	No further comment at this time
5.2 / HEC-RAS output rating	16	1	USGS model input taken from inflowing suspended load not considering bedload – missing coarser materials?	Agree. Bedload not sampled	See response 4 rows up.
5.2 / HEC-RAS Output Rating Curve	16	2	It is not clear what exactly was input into AdH from HEC-RAS – was it an hourly time series of suspended sediment load, or was the flow time series simply correlated to a sediment rating curve that was constructed from data output by HEC-RAS?	HECRAS produced sediment loads for mean daily flows for different size classes. AdH used this for the inflowing sediment rating curve into Conowingo	No further comment at this time
5.2 / HEC-RAS output rating	17	1	Conservatively high inflowing sediment load assumed and used for all other simulations. This does not appear to have been stressed or explained well in the main report.	The USGS used measured suspended sediment concentration data to create a sediment rating curve into the uppermost reservoir. The output to the AdH model was based on HECRAS output to Conowingo.	To confirm, we understand that the HEC-RAS sediment load was increased by 10% to account for the under prediction of sediment loads.

Chapter / Section	Page	Paragraph	Original Exelon Comment	Scott Response	Exelon Response/Additional Comment
5.2 / HEC-RAS output rating	17	1	What is the basis for increasing the HEC-RAS load 10%?	I believe HECRAS underestimated scour load from the upper two reservoirs	No further comment at this time
6 / Model Validation **NEW**	22-32	Entire Section			In the absence of data that were considered sufficient for calibration, please explain how parameterizing AdH to reproduce results from USGS studies independently validates AdH results: 1. If USGS results are driven by empirical load estimates (or regression equations) that assume different functional relationships for upstream and downstream locations, and scour is imputed by the difference between downstream and upstream estimates, do AdH simulations parameterized to reproduce USGS results provide an independent confirmation of those results? 2. If AdH is constrained by SEDflume core measurements, what are upper and lower bound limits of AdH solids concentrations given upper and lower bound parameterizations based on SEDflume core data (without limiting the erodible depth of sediment as described to 1 ft)?
6 / Model Validation	22 & 23	2 & 2	One of the data sources used to validate the AdH model was the USGS data collected from the catwalks of Conowingo Dam. This data is not representative of the entire river cross-section. Moreover, if any of this data was collected during Tropical Storm Lee, the data may have been collected when the Station was shut down.	Agree	No further comment at this time
6 / Model Validation	23	3	"The properties of the lower two feet were either approximated from the SEDflume results or determined from literature values." It would be useful to have a table of these properties.	I estimated increases in shear stress from literature.	This comment does not appear to have been addressed by a revision to the report.
7.1 / General flow and bed shear distribution in Conowingo Reservoir	34	1	Middle of paragraph, sentence starting with "This channel was not included…" and next sentence should include a citation.	Agree.	This comment does not appear to have been addressed by a revision to the report
7.6 / Discussion	46	2	What inflow load scenario was used where the relative load from Conowingo (versus the overall watershed) was up to 30% of the incoming load?	Inflow scenario was 24 million tons over the four years, 10 million tons from TS Lee	No further comment at this time
7.6 / Discussion	46	2	Last sentence of paragraph is speculative and goes to the uncertainty of using the HEC-RAS model as the input to the AdH model	Agree	This comment does not appear to have been addressed by a revision to the report
9 / Impact of releases on flats	52+	General	The description of this downstream model has much less detail and is shorter than the sections dealing with the upstream model.	Agree	This comment does not appear to have been addressed by a revision to the report
9 / Impact of releases on flats	53-54	1, Fig. 34	What is the reference for the ratio of roughness with SAV?	The AdH user's manual	Add reference to Berger et al. to text and/or figure.
9.2 / Sediment results	55	1	No description is given of the upstream or downstream boundary conditions. Assuming that the U/S BC is the outflow from the U/S AdH model, but which run? Or were measured SSCs used?	The upstream boundary was an arbitrary flow, not Specific Conowingo outflow.	Does not answer the question of what was used in the modeling exercise that produced the figures and led to conclusions.
10.1 / Conclusions	57	1 & 3	Reinforces the importance of large less frequent events to sediment movement.	Agree	No further comment at this time

Chapter / Section	Page	Paragraph	Original Exelon Comment	Scott Response	Exelon Response/Additional Comment
11 / Recommendations to Improve Future Modeling Efforts	60	1	"…the model was not capable of passing sediment through the gates...this limitation impacted how sediment was spatially distributed in the lower reach of Conowingo Reservoir near the dam." How did it impact sediment? Further understanding on the exact impacts and uncertainty associated with this needs to be included in the Appendix and the main report.	Initially, we tried to input dam operations into the model (sequential opening and closing of gates as flood flows passed), however, the sediment transport component of the gate operation did not become operational during the conduct of the study. Opening the gates will affect the distribution of sediment from the powerhouse to the center of the channel, thus impacting sedimentation on the Eastern side of the dam (just upstream).	No further comment at this time
B-1, 6.0 Discussion & Conclusions	B-1		Using the provided graphs, the 86,000 cfs limit where all flows pass through the powerhouse accounts for about 30% of the annual sediment load. This should be mentioned.	Doesn't that depend on storm frequency? Not sure about that. Maybe "average" annual sediment load.	Original comment was based on Figure 5. Maybe the ordinate (y-axis) should be labeled average annual load? It is notable that 70% of the average annual load does NOT go through the powerhouse (usually due to larger events).

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX C – APPLICATION OF THE CBEMP TO EXAMINE THE IMPACTS OF SEDIMENT SCOUR IN CONOWINGO RESERVOIR ON WATER QUALITY IN THE CHESAPEAKE BAY

GENERAL APPENDIX COMMENTS	Original Exelon Comment	Cerco Response	Exelon Response/Additional Comment
	The use of metric units when everything else is in English unnecessarily confuses the issue.		

Chapter / Section	Page	Paragraph	Original Exelon Comment	Cerco Response	Exelon Response/Additional Comment
Chapter 3	18	3	Although period examined has a range of flows, how representative is the flood frequency during this period with the long-term flood frequency?	The report indicates two erosion events (flow > 11,000 $m^3 s^{-1}$) occurred during the ten-year simulation period. These events were in April 1993 and January 1996. Langland's report indicates flows in excess of 400,000 $ft^3 s^{-1}$ (11,000 $m^3 s^{-1}$) have a recurrence interval of five years. Two events in ten years correspond well with the expected recurrence.	Does the use of the 1996 storm event combined with the high nutrients observed in 2011 make for either a worst case, or at least very conservative, estimate of Bay impacts?
Chapter 3	19	3	How was the Conowingo Pond equilibrium condition determined?	The equilibrium bathymetry was determined by the team that modeled Conowingo Reservoir (Mike Langland, Steve Scott, and associates). This question must be answered by that team.	Original comment still stands. Please address as appropriate following the next round of LSRWA comment review.
Chapter 4	23	Entire Chapter	How are the scoured sediment and nutrient loads from Lake Clarke and Lake Aldred accounted for? Is it similar to the process for which Conowingo-scoured sediments (and thus nutrients) are superimposed on the WSM nutrient loads input to the WQM as described in Chapter 4 of Appendix C?	Sediment loads from Lake Clarke and Aldred are not specifically identified in the Chesapeake Bay loads. The Chesapeake Bay model only "sees" loads at the Conowingo outfall. Loads from Clarke and Aldred are combined with other loading sources at this outfall. The only material superimposed on the WSM loads is scour calculated in Conowingo Reservoir.	While author's response is correct, it still does not address the upper reservoir issue directly.
Chapter 4	23	1	"The loads at the head of the reservoir system are supplemented by inputs from the local watersheds immediately adjacent to the reservoirs." It would be useful if there were a figure depicting this either in the main report of this Appendix (or both).	A figure such as this one might be included in the main report. This doesn't appear to be a critical deficiency.	It would be useful to the reader to have such a figure.
Chapter 4	26	3	Bullet 5 – "For key scenarios, an alternate set of nutrient loads was constructed based on 1996 observed nutrient fraction." These should be included and discussed in the main report.	The results from these scenarios are reported in the appendix to this report.	Given the uncertainty of the exact composition of the nutrients, the main report should include discussion about the results from the scenarios which used the alternate nutrient loads.
Chapter 4	32	Figure 4-1	Assuming that the Calculated eroded particulate nitrogen and phosphorus referenced are from AdH? Please confirm.	No, ADH does not calculate nutrients. The calculated eroded nutrients are based on ADH calculations of eroded sediment and on observed fractions of nutrients associated with sediments.	No further comment at this time
Chapter 6	48	last	How does this statement impact the LSRWA conclusions? Does it result in a greater modeled impact to the Bay from scour when applying the CBEMP? "The predominant role of net scour loads, reported here, is in contrast to the companion reports to this one (Scott and Sharp, 2013; Langland, 2013) in which scour is assigned a lesser fraction of the total storm loads."	This report emphasizes the marginal impact of a scour event on Bay water quality. The marginal impact of a scour event depends on the magnitude of the scour event. The magnitudes of the scour events in 1996 and in TS Lee were similar. The ADH computation of scour during TS Lee is 2.64 million metric tons. The scour calculated for 1996 is 2.37 million metric tons. The marginal impact of the scour load is not affected by the watershed load.	No further comment at this time

Chapter / Section	Page	Paragraph	Original Exelon Comment	Cerco Response	Exelon Response/Additional Comment
Chapter 6	53	1	The last sentence may also be interpreted as a quantification of the benefit of Conowingo Dam to the Bay when depositional.	During depositional periods, the retention of nutrients in Conowingo Reservoir is apparently of benefit to the Bay.	No further comment at this time
Chapter 6	**NEW**				Last paragraph at bottom of page 53 in public draft report, makes a strong case that the Conowingo Dam is still providing WQ benefits. Similar argument at bottom of page 55 in public draft report.
Chapter7	119	1	"Model results can be reported with extensive precision, consistent with the precision of the computers on which the models are executed. Despite the precision, model results are inherently uncertain for a host of reasons including uncertain inputs, variance in model parameters, and approximations in model representations of prototype processes." This statement and the rest of this section do a much better job of clearly stating the uncertainties associated with models and model results than the main report does. While the main report does generally acknowledge some model limitations/uncertainties it does not do as good of a job as the Appendices in stating how uncertain some of these results may be.	The potential to alter the main report to reflect this section of Appendix C is left to the authors of the main report.	The main report should state as clearly as the Appendix does how uncertain some of these results may be.
Chapter 7	120	2	While uncertainty due to bioavailability of the nutrients is acknowledged and while the "scoured" refractory nutrients are handled in the same fashion as the other boundary nutrients could an estimate be made of how the scoured nutrients might be different than the current assumption of 86% of refractory PON going to G2 and 14% of refractory PON going to G3 (based on Cerco and Noel, 2004)? We believe that SFM computed G2 and G3 is likely to be the other way around with G3 > G2 for organic matter that has been in the sediment bed for several years, as would be the case between scour events in Conowingo Pond.	The material on the bottom of Conowingo Reservoir has not all been there for several years. Material is deposited continuously, including fresh organic matter from phytoplankton in the reservoir. The fractions assigned to G2 and G3 are based on long experience with the Bay model, as applied over the period 1985 – 2005. This interval includes multiple scour events so the assigned fractions are considered representative. Nevertheless, we acknowledge the reactivity of organic matter scoured from the reservoir bottom is an area of uncertainty. Our understanding is that experiments are planned to address this issue.	No further comment at this time
Chapter 7	**NEW**	119-120			The new report should acknowledge that another area of uncertainty is how much of the nutrient load coming from the three reservoir system is due to the Conowingo Pond alone versus a combination of all three reservoirs, since they are all likely to be in some form of dynamic equilibrium. Needs to be addressed with a more refined model of the three reservoirs.
Chapter 7	120	3	It is stated that the SEDflume studies reported in Appendix B "indicate erosion does not occur below 9,300 m^3s^{-1} (330,000 cfs)." Please clarify if the author is referring to the beginning of "mass bed erosion" as defined in Appendix B. If so, shouldn't the value be 400,000 cfs?	The commonly accepted threshold for mass erosion is 400,000 cfs. The text will be revised.	No further comment at this time

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX D – ESTIMATED INFLUENCE OF CONOWINGO INFILL ON THE CHESAPEAKE BAY TMDL

Chapter / Section	Page	Paragraph	Original Exelon Comment	Linker Response	Exelon Response/Additional Comment
Introduction	3	3	The last portion of this paragraph starting with "During the 2017 Midpoint Assessment…" discusses decisions being made regarding any necessary adjustments to the CB TMDL. It should be clearly noted here that Appendix T of the TMDL discusses actions that will be taken in the event that the status of Conowingo Pond changes from previously understood conditions. The language used should be that contained in TMDL Appendix T.	Appendix T is correctly cited, referenced, and characterized in Appendix D. It's clear from the text what's directly quoted and what's paraphrased. The citation and attribution is entirely correct and changes are unwarranted.	To clarify, Appendix T of the TMDL already takes into consideration actions that should be taken if it is found that Conowingo Pond has reached dynamic equilibrium. The TMDL specifically states, "…if future monitoring shows the trapping capacity of the dam is reduced, then EPA would consider adjusting Pennsylvania, Maryland, and New York 2-year milestones loads based on the new delivered loads."
Results	21	Figure 5	While the differential values are useful, it is helpful for the reader to also list absolute nonattainment values rather than just relative values.	Listing the absolute values for Scenario LSRWA-21 and LSRWA-3 (and explaining why the 1996-1998 period is different from the 1993-1995 period and the reason they're different , etc., etc. would add confusion, not clarity. Adding absolute nonattainment values is unwarranted.	We disagree; having absolute nonattainment values is the only way to compare various loading scenarios and time periods. We understand the goal of reducing confusion and improving clarity, but we feel these data need to be provided somewhere for the public to digest. We cannot fully evaluate the modeling scenarios without this critical piece.
Results / LSRWA Results: Non-Management Scenarios	22-23	3 & 4	Why were the points of comparison changed for the June and October events from the comparisons made earlier in the section?	In the seasonal scenarios the comparison is being made among the January, June, and October seasons (or months) and the No Storm Scenario of LSRWA-23 allowed the comparison of the three seasons to be made. In this case we're looking at the relative difference among the different seasons and the use of LSRWA-23 is appropriate.	No further comment at this time
Results / LSRWA Results: Non-Management Scenarios	22-23	June/Oct	It would be helpful if the stop-light tables 2a and 2b could be expanded to include the results from the various LSRWA scenarios. It is not clear at all as to whether the scenarios that are run with the nutrients collected with the 1996 scour event are significantly different that those using the 2011 water quality data. For example, for the June event, it is surprising that the non-attainment was reduced from 4% to 2% (a 50% reduction) for the Deep-Channel Attainment for Bay segment CB4MH comparing LSRWA26 vs. LSRWA-24, while no other changes in attainment were found.	Different simulation years (93-95) in table 2a and 2b from 1996-1998 period which contains the January 1996 Big Melt event.	No further comment at this time, but this comment highlights the importance of developing a summary table similar to the one included in the attachment to our cover letter.

Chapter / Section	Page	Paragraph	Original Exelon Comment	Linker Response	Exelon Response/Additional Comment
Results / LSRWA Results: Non-Management Scenarios	25	Table 3	1) It would be useful to add a row for each of these columns specifically indicating which years are being analyzed for WQ attainment. 2) The nonattainment's should be listed with more significant figures (e.g., 1.4% nonattainment instead of 1% nonattainment) 3) The absolute nonattainment values (e.g., LSRWA-21 had 19% deep channel DO nonattainment in segment CBMH4) should be listed in addition to the relative nonattainment numbers (e.g., an increase of 1% nonattainment over the Base TMDL Scenario (LSRWA-3))	1) The text on (example page 18 paragraphs 2 and 3) provides sufficient information on when the 1996-1998 simulation period is used in order to simulate the January 1996 storm. 2) A single significant figure is sufficient and is consistent with the level of significance typically reported in the Chesapeake TMDL. 3) Listing both the absolute value and the base value along with the difference between the base scenario is from the base as suggested would be redundant, confusing, and unwieldy.	Please see our previous comment (2nd comment, page D-1). We believe it is crucial that absolute nonattainment values are provided somewhere in order for the reader to comprehensively evaluate the model results.
Results / LSRWA Results: Non-Management Scenarios	25-26	Tables 3-5	Why aren't LSRWA-22, 26, 27 discussed in these tables?	LSRWA-22, 26, and 27 are discussed in the text.	Important to note that only the worst case scenarios are presented in the tables.
Conclusions	29	1	It is stated that the TMDL simulation period of 1991-2000 "was a condition prior to the current dynamic equilibrium state of sediment infill of the Conowingo Reservoir." However, an agreed timing of the onset of dynamic equilibrium is not clear in this report; nor is the relationship with changes in trapping efficiency. For example, Table 5-6 has the trapping efficiency of Conowingo Reservoir remaining at 55-60% for the time period 1993-2012. But Table 1-1 says dynamic equilibrium was first reached in the mid-2000s. Is this a contradiction?	The exact date of the onset of dynamic equilibrium in the Conowingo Reservoir is unknown. But a definitive statement from the LSRWA report is that the Conowingo Reservoir is <u>now</u> in dynamic equilibrium. At some time prior to 2000 it was not. There is no contradiction.	No further comment at this time
Conclusions	31	1	"During episodic high flow scour events, large nutrient loads are delivered to Chesapeake Bay." The term "scour events" lead the reader to believe that the scour is responsible for all nutrient loads going to the Bay when in fact the vast majority of the loads originate from watershed sources upstream of Conowingo Pond and the Lower Susquehanna Reservoirs. This comment is true of any reference to "scour events" throughout the main report and appendices.	The scenarios referred to in the conclusion section separated the loads from the watershed and the scoured loads from the Conowingo by the difference between scenarios as described in the results section. The increase in nonattainment in Deep Water and Deep Channel DO (described in the results and discussed in the conclusions) were specifically because of the scoured nutrients from the Conowingo Reservoir.	As stated in the updated text and pointed out by STAC in their review, DO water quality standards are greatly affected by seasonality; that is, the summer hypoxic period is the season of concern and "a small difference in DO during this period makes a big difference to living resources…" As stated in the Appendix, deep-water and deep-channel DO water quality standards are on a "knife-edge of attainment". STAC went on to say that, "it strikes the reviewers that changes in chlorophyll and dissolved oxygen associated with "normal" inter-annual variability in climate and nutrient loading are much higher than those associated with additional Conowingo Dam-derived nutrients as simulated here."
Conclusions	31	3	The last sentence of this paragraph discusses how the TMDL will account for changes in the trapping capacity of Conowingo Pond as per TMDL Appendix T. When discussing the TMDL and changes in Conowingo Pond trapping capacity throughout this Appendix, and the main report, it is important to always use consistent language from Appendix T in regard to how this will be handled.	Appendix T is correctly cited, referenced, and characterized in Appendix D. It's clear from the text what's directly quoted and what's paraphrased. The citation and attribution is entirely correct and changes are unwarranted.	See first response at beginning of table

Chapter / Section	Page	Paragraph	Original Exelon Comment	Linker Response	Exelon Response/Additional Comment
LSRWA uncertainty			The CBEMP assumes that refractory organic nitrogen coming into the system and depositing to the sediment is 84% G2 and 16% G3 (Cerco and Noel, 2004). However, it is likely that scoured sediments from Conowingo Pond would have the reverse distribution G2 > G3. A model scenario should be constructed to evaluate this condition.	Agreed that the research now underway into the proportions of refectory and labile organics in Conowingo Reservoir sediments is needed in order to be definitive regarding the G2 and G3 fractions in the Conowingo bed.	No further comment at this time

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX E – MGS SUSQUEHANNA FLATS SAMPLING RESULTS

Page	Original Exelon Comment	Ortt Response	Exelon Response/Additional Comment
General	The bathymetric map does not indicate the elevation datum for the contours.	Contour info added.	The location map of the first draft (Figure 1) has been replaced with a NOAA bathymetric map. Contours, however, are not legible.
Page 2; paragraph 1			The Susquehanna River drainage does not include six states; it includes three states.
Page 2; paragraph 1			What is meant by 'increasing' in the sentence: "In addition to an increasing amount of sediments being deposited behind Conowingo Dam in the Conowingo Reservoir, there is an increasing quantity of sediment that is delivered to the Chesapeake Bay by bypassing the dam."? Increasing relative to what?
Page 2; paragraph 4			Where were samples #1 and #2 to be located in the Susquehanna River?
Page 4; paragraph 3			Please indicate that the Bennett and Lambert method provides wet bulk density values.
Page 4; paragraph 4			Remove comma after Kerhin and others.
Page 5; paragraph 1 Captions of figures 2 and 3			Correct citations are Shepard (1954) and Folk (1974), not Shepard's (1954) or Folk's (1974). Remove apostrophe.
Page 6; last paragraph			Insert period at end of sentence.
Page 7; figure 2			Caption should indicate that the classification is based on percent of sediment size classes in sample. Otherwise the numbers on the tertiary diagram are not explained.
Page 7; figure 3			The sediment type codes in the tertiary diagram should be explained, as per Table 7.
Page 8; table 3			The columns labeled #alive and #dead appear to refer to clams. Please note this on table. The footers (#6, #12, #17) are not lined up nor are they clear as to meaning. Please clarify.
Page 9; table 4			Please note that color notations (e.g., 5 YR 3/4) are in accordance with the Munsell color system. "Asian" for sample 7 should be capitalized.

Page	Original Exelon Comment	Ortt Response	Exelon Response/Additional Comment
Page 11; figure 4			This is a very important graph. It may show up better if printed in landscape view. To help the reader understand this graph, interpretive footnotes may be useful, e.g., the steeper the slope the better the sorting; the 50% mark is the median grain size; etc.
Page 14; table 7			Please note that bulk density is wet bulk density.

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX F – U.S. GEOLOGICAL SURVEY CONOWINGO OUTFLOW SUSPENDED SEDIMENT DATA REPORT

	Original Exelon Comment	Blomquist Response	Exelon Response/Additional Comment
GENERAL APPENDIX COMMENTS	Cover letter states "samples were collected along a representative cross-section from the catwalk on Conowingo Dam…" Conowingo Dam catwalk sampling is not representative of the channel cross-section at the dam.	The data transmittal letter dated February 10, 2012, represents an accurate assessment of the relation between catwalk and cross- sectional variability, given the analysis of available historical USGS quality control data.	The reader of this letter may take the originally commented upon statement as meaning the data collected are representative of the river at the dam. In a published document prepared by USGS it is noted these data are only representative of the river in front of the turbines. That is, in the USGS Quality-Assurance Project Plan (QAPP) for the Maryland River Input Monitoring Program and Nontidal Network Stations for the period July 1, 2013 to June 30, 2014 (Updated July 2013) available at: http://www.chesapeakebay.net/documents/MD_RIM_QAPP_2013_2014.pdf it is written: "Previous testing at Conowingo Dam has shown that this approach provides a representative sample for flows confined to the turbines. However, sampling from the turbines can be unrepresentative of spillway discharges since the flows originate from different locations in the reservoir's vertical profile." The Introduction of this Appendix should include the same language.
	A brief report to accompany the data would be useful (in addition to the cover letter provided). The report could highlight the sampling methods used, field conditions, hydrograph, sampling comments/notes, etc. In its current form, the Appendix does not provide the reader with very many details about the sampling event(s).	The data were collected using standard methods for the site as outlined in the QAPP on file with EPA CBPO. Streamflow records for the periods represented by these samples as well as the analytical results themselves are publically available at http://waterdata.usgs.gov. Limited time and funds availability precluded the preparation of a separate report detailing these data.	While it is understood that a brief report goes beyond the time and funding constraints of this effort, a more detailed Introduction providing a general overview of the sampling methods, field conditions, hydrograph, sampling notes/comments, etc. would be helpful to the reader to put the data collected into context.
			The sampling does not appear to take into account the travel time of the water and sediment through the reservoir system during a storm event. It would be useful if the author could provide comment on what effects this may have on the use of the data and any subsequent results/conclusions.

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX G – 2011 EXELON CONOWINGO BATHYMETRY SURVEYS

GENERAL APPENDIX COMMENTS	Original Exelon Comment
	No Comments

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX H – LITERATURE SEARCH FINDINGS REPORT

	Original Exelon Comment
GENERAL APPENDIX COMMENTS	No comments

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX I – STAKEHOLDER INVOLVEMENT

Section	Page	Exelon Comment
I-7 / LSRWA Response to STAC Review	General	In response to STAC comments pertaining to the AdH model, there are multiple references to "Response under development by ERDC AdH modeler" yet no response is actually provided. Please provide a response for each of these instances.
I-7/LSRWA Response to STAC Review	17	The graph in Appendix A (Figure 7) does not appear to have been updated as indicated.
I-7/LSRWA Response to STAC Review	28	The notes to Figure 1-6 (Main Report) do not appear to have been changed as indicated.
I-7/LSRWA Response to STAC Review	29	The definition of saprolite does not appear to have been added as indicated.
I-7/LSRWA Response to STAC Review	29	The deletion of 'river' does not appear to have been made as indicated (now in Appendix K).

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX J – PLAN FORMULATION

Chapter / Section	Page	Paragraph	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Exelon Response/Additional Comment
Attachment J-1	2	2	The implication that sediment plumes as represented by TS Lee in Figure 3 are due to scour from Conowingo Reservoir is incorrect. As noted in the main report, these plumes are predominantly comprised of sediment from the watershed upstream of Conowingo Reservoir.	Michael	Page 2, paragraph 2 – change the last sentence to "The massive plume of sediment that occurred following Tropical Storm Lee extended from the Conowingo Dam past the mouth of the Patuxent River (Figure 3) and originated both from the watershed and from scour behind the dam.", with the majority of the sediment coming from the watershed.	Please make "dam" plural. That is, change to: "…from scour behind the dams."
Attachment J-2	3 tables		Pertaining to all alternatives – not addressed are the potential environmental impacts associated with each alternative. Environmental resources that could be impacted could include: aesthetics, air quality and greenhouse gases, soils, water quality, wetlands, groundwater, surface water, wetlands, floodplains, biological resources, cultural resources, land use, socioeconomic resources, recreation and tourism, utility and transportation infrastructure, public health and safety, and noise.	Compton	LSRWA effort was a watershed assessment and not a detailed investigation of a specific project alternative(s) proposed for implementation. That latter would require preparation of a NEPA document. The evaluation of sediment management strategies in the assessment focused on water quality impacts, with some consideration of impacts to SAV. Other environmental and social impacts were only minimally evaluated or not evaluated at all. A full investigation of environmental impacts would be performed in any future, project-specific NEPA effort.	No further comment at this time
Attachment J-4	1	Table	It is not clear what reservoir bathymetry/trapping efficiency means. If it is simply referring to trapping efficiency, then it should be stated as such. The actual trapping efficiencies should be listed as well (e.g., 55%) rather than just a level associated with a time period.	Compton	For scenarios 2-6 the input parameter is actual reservoir bathymetry per AdH. The exception is Scenario 1, which did not use AdH but was the TMDL/WSM only run which considered trapping rates/efficiency of the 1990s (which was around 55%). What is most important is what era is represented in the simulation which is depicted.	It would be useful to the reader to have the trapping efficiency explicitly listed for each scenario. Please see our example matrix provided as an attachment to our cover letter.
Attachment J-4	1,7	Table	It's not clear how nonattainment differentials are be compared between LSRWA-30 and LSRWA-3 (on page 7), since page 1 of this report says that the nonattainment's were calculated for different time periods for the two runs (1993-1995 for LSRWA-3, 1996-1998 for LSRWA-30). Similar comment for LSRWA-4 and LSRWA-18.	Compton	The CBEMP utilizes the 1991-2000 hydrologic period. For the criteria assessment procedure, a 3-year critical period (1993-95) was used as the period for assessing attainment of the water quality standards for several LSRWA model scenarios. The 1993–1995 critical period was chosen based on key environmental factors, principally rainfall and streamflow, which influenced attainment of the DO water quality standards for the deep-water and deep-channel habitats (USEPA, 2010a). Since the January 1996 high flow event was outside the 1993-95 critical period, the 1996-98 hydrologic period was used as the assessment period for LSRWA modeling scenarios that included an evaluation of a storm event.	No further comment at this time
Attachment J-4	1,7,8	Table	The DO nonattainment's should be listed by segment (similar to pieces from the stoplight plots), and must be listed as absolute numbers as opposed to differentials from other runs, as it becomes confusing for the reader to follow which runs are being compared to other runs. Also, the nonattainment's should carry an additional significant figure (e.g., 1.4% instead of 1%).	Compton/ Linker	Organizing nonattainment by segment does not work in the format of the table. As comment states Appendix D stoplight plots organizes by segment if reader wants to view it this way. Listing the absolute nonattainment values is unwarranted. Significant figures will remain as we received comments earlier on that that amount of precision was not conducive.	As noted in some Appendix D comments, we believe listing absolute nonattainment values by segment would be useful. We also understand that providing the data in this report may be difficult. We are interested in the absolute nonattainment values if there is another way for them to be provided.

LSRWA APPENDIX COMMENTS – JANUARY 2015

APPENDIX K – EXISTING CONDITIONS OF THE WATERSHED

Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change?	Exelon Response/Additional Comment
P. 1, Paragraph 1	While the last portion of this paragraph describes why the discussion is focused on Conowingo it does not explain why there is no focus on the two upstream reservoirs. Why are these reservoirs not discussed at the same level of detail as Conowingo?	Spaur	Modify sentence "As such, it has potentially a large influence on the Chesapeake Bay during storm events due to scouring of nutrients and sediments stored behind this dam." to "Holtwood and Safe Harbor Dams were known to be at equilibrium at the start of this assessment. Because Conowingo was not believed to be in dynamic equilibrium and it reaching that condition could have a potentially large effect on the Bay, more attention is focused on Conowingo Dam than Holtwood or Safe Harbor Dams in this section."	Yes.	To be consistent, the report should acknowledge that Holtwood and Safe Harbor are in "dynamic equilibrium" The revised text still does not quantify or adequately describe how much more important Conowingo Pond loads are to Susquehanna River sediment loads versus loads from Lake Clarke or Lake Aldred. In general, throughout the report and appendices a satisfactory reason has not been given as to why so much more importance has been placed on Conowingo Pond scour as opposed to scour from Lake Clarke and Lake Aldred.
P. 1, Paragraph 1	This paragraph, and the third paragraph in particular, attempt to explain why Conowingo Pond is of particular importance; however, they do not quantify or adequately describe how much more important it is to Susquehanna River sediment loads versus Lake Clarke and Lake Aldred.	Spaur	Dealt with by response to #35.	Yes.	It is hard to follow why believing Lake Clarke and Lake Aldred are in dynamic equilibrium means that they are not capable of having an equally important impact on Bay health. We understand that the initial focus was on Conowingo because it appeared to be fundamentally different (larger in size, trapping more) than the other two reservoirs, but now that we understand that all three reservoirs have reached dynamic equilibrium, we feel that future efforts should be more evenhanded between all three impoundments.
P. 5, Paragraph 4 (last part of Section K.2)	The report identifies that climate change has resulted in recent years being wetter. In general, wetter years would mean increased watershed sediment delivery and transport through the reservoirs. This potentially conflicts with the conclusion that loads are increasing as a consequence of reduced trapping/dynamic equilibrium. It is unclear how earlier statements regarding decreases in trapping can be evaluated without first establishing how hydrologic (and land use) changes impact the watershed the river system.	Spaur	Added sentence to paragraph 2 on page 97, before "All of the Table 4-1 scenarios…" "However, there were no modeling runs formulated for forecasted climate change conditions; a general discussion of global climate change impacts can be found in Section 5.1.4. "	Yes.	The original comment is still valid. The revision does not address the fact that conclusions are made that focus on sediment transport within Conowingo Reservoir without also noting that watershed changes and responses to climate also contribute to changes in sediment and nutrient delivery to the Bay.
P. 11, Paragraph 3	The Exelon study cited (RSP 3.12) does not mention contributions to vertical circulation in the reservoir.	Spaur	Citation corrected to "(Normandeau Associates and GSE, 2011)" -- see comment response #48 for citation details.	Yes.	The corrected citation should be for the final report which is 2012, not 2011. A similar citation change was made at the end of the 2nd preceding paragraph (page 11). That change was incorrect. At the end of the first paragraph on page 11 of Appendix K the citation should be URS and Gomez & Sullivan (2012a).

Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change?	Exelon Response/Additional Comment
P. 16, Paragraph 4	Statement that nutrients released from bottom sediments provide a substantial portion of the nutrients required by phytoplankton is perhaps a little simplified. First, as noted, vertical stratification limits the vertical exchange of dissolved oxygen between the surface and bottom waters (as pointed out on page 34 paragraph 4) and, therefore, the vertical exchange of bottom water nutrients to surface waters is also limited. In addition, as pointed out in paragraph 3 of page 33, nutrients are recycled and reused many times over as they move downstream in rivers towards the Bay. They are also recycled and re-used in the Bay as well. Bottom nutrients are likely to contribute to the production of surface phytoplankton, but it is not clear what the balance between surface recycling of nutrients and bottom release of nutrients is in determining algal productivity.	Spaur	Concur that complicated topic, so will further simplify/generalize. Change "Nutrients contained in Bay bottom sediments are re-released into the water column seasonally, and these regenerated nutrients provide a substantial portion of the nutrients required by phytoplankton in summer, particularly in the middle Bay. " to "Nutrients contained in Bay bottom sediments are re-released into the water column seasonally, and these regenerated nutrients provide a substantial portion of the nutrients required by phytoplankton, particularly in the middle Bay. "	Yes.	Suggest adding “could” as shown in red “ Nutrients contained in Bay bottom sediments are re-released into the water column seasonally, and these regenerated nutrients could provide a substantial portion of the nutrients required by phytoplankton, particularly in the middle Bay. "
P. 18, Paragraph 3	“Monitoring of nutrients in the Susquehanna River has shown that the flow-adjusted annual concentrations of total nitrogen, total phosphorus, and suspended sediment delivered to the dams have been generally decreasing since the mid-1980s.” It is unclear how much of any trends are due to increasing data density over time and reduced uncertainty. There may be some apples and oranges comparisons beneath everything. As stated in the Zhang et al. (2013) paper, there is interpolation and extrapolation in load estimates. The next statements that “This decrease is attributed to the success of environmental management measures. However, total nitrogen, total phosphorus, and suspended sediment loads from Conowingo Reservoir itself to the Chesapeake Bay have shown an increasing trend since the mid-1990s, indicating decreasing reservoir trapping capacity (Zhang et al., 2013)” need further evaluation. Changes in sediment export from the River could also include changing sediment delivery from the watershed. It is unclear how the data analysis on which these statements rely was performed	Spaur	Change middle sentence from "This decrease is attributed to the success of environmental management measures." to "Environmental management measures in the watershed contributed to this decrease." to be less precise over relative importance of management measures versus other causes.	Yes.	Original comment is still valid.

Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change?	Exelon Response/Additional Comment
P. 18, Paragraph 3	Zhang et al (2013) refers specifically to the reservoir system (reservoirs plural) and loads from the Conowingo Dam outlet. To quote from their conclusions: "Flow-normalized loads of SS, PP, and PN at the outlet of the Conowingo Reservoir have been generally rising since the mid-1990s. The reservoirs' capacity to trap these materials has been diminishing, and the Conowingo Reservoir has neared its sediment storage capacity."	Spaur	Change last sentence in paragraph (already recently revised as per above) from "One study has indicated that loads of total nitrogen, total phosphorus, and suspended sediment from Conowingo Reservoir to the Chesapeake Bay are increasing and attributes this to decreasing reservoir trapping capacity (Zhang et al., 2013)." to "One study has indicated that loads of total nitrogen, total phosphorus, and suspended sediment from the reservoir system of the lower dams to the Chesapeake Bay are increasing and attributes this to decreasing trapping capacity of Conowingo Reservoir (Zhang et al., 2013)."	Yes.	The revised statement still does not reflect the cited Zhang et al 2013 appropriately. Suggested edits are shown in red (page 18 of Appendix K): "One study has indicated that loads of ~~total~~ particulate nitrogen, ~~total~~ particulate phosphorus, and suspended sediment from the reservoir system of the lower dams to the Chesapeake Bay are increasing and attributes this, in part, to decreasing trapping capacity of Conowingo Reservoir (Zhang et al., 2013)." Furthermore, the actual statement from Zhang is "Flow-normalized loads of SS, PP, and PN at the outlet of the Conowingo Reservoir have been generally rising since the mid-1990s. The reservoirs' capacity to trap these materials has been diminishing, and the Conowingo Reservoir has neared its sediment storage capacity." Zhang says reservoirs (plural).
P. 22, Paragraph 4	The citation to Exelon (2011) regarding DO in the reservoir is not the 2011 report in the References section. The 2011 Exelon study RSP 3.1 should be cited for this statement.	Spaur	Changed citation to (Normandeau Associates and GSE, 2011). Added reference but used the format that Exelon requested in comment #1. New reference = Normandeau Associates, Inc., and Gomez and Sullivan Engineers. 2011. *Seasonal and Diurnal Water Quality in Conowingo Pond and below Conowingo Dam* (RSP 3.1). Kennett Square, PA: Exelon Generation, LLC.	Yes.	Please cite the final report which is 2012, not 2011.
P. 26, Paragraph 1	The report cites Hartwell and Hameedi (2007) for the proposition that "[t]idal portions of the Anacostia River, Baltimore Harbor, and the Elizabeth River are hotspot areas of contaminants." However, Hartwell and Hameedi (2007) does not mention the Anacostia River, and the figure with the sites of greatest contamination does not include the Anacostia.	Spaur	Change reference to instead be "CBP, 2013" (That these are the three "hottest" contaminated regions of Bay is widely reported and not dependent upon an individual report.)	Yes.	Hartwell and Hameedi (2007) needs to be removed from the reference section in the main report.
P. 29, Paragraph 3	"TP probably does not show a pattern of decrease with depth into the sediment." Personal communication with Langland is cited here but what is Langland's basis for this comment?	Spaur	Add clause "Because the phosphorus adsorbed to bottom sediments is minimally bioavailable and not being utilized by organisms nor reacting chemically," prior to beginning of sentence "TP probably does not show a pattern of decrease with depth into the sediment (Michael Langland, Hydrologist, U.S. Geological Survey, personal communication, 2014). Comment based on years of collected data observations.	Yes.	No further comment at this time

Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change?	Exelon Response/Additional Comment
P. 29, Paragraph 2	Based on the estimates of bioavailable nitrogen and phosphorus quoted here, which could potentially be resuspended and transported into Chesapeake Bay, there is a serious mismatch between the bioavailable fractions of TN (96% typically of limited bioavailability) and TP (0.6-3.5% plant available) contained in the Conowingo Pond sediments and how they are incorporated in the CBEMP model, wherein they are assumed to be approximately 85% bioavailable, once they enter into the bay and are deposited back to the sediment bed in the Bay. Therefore, it is likely that the CBEMP is over- estimating the release of Conowingo nutrients from the sediment bed once they are deposited into the Bay sediments, and therefore the model is over-estimating the change in non-attainment of the DO water quality standard.	Spaur	The context here is IMMEDIATE bioavailability. Immediate added before bioavailability in this paragraph and this statement added: "The nutrients stored behind the dam that are not in immediately bioavailable forms might, however upon burial in the Bay bottom might be expected to gradually become bioavailable from microbial processes in the sediment (Michael Langland, Hydrologist, U.S. Geological Survey, personal communication, 2014). "	Yes.	No further comment at this time
P. 29, Paragraph 4	The paragraph starting with "the sediment retained behind Conowingo Dam…" seems odd in that the focus is exclusively on Conowingo. Even if the measurements are from Conowingo Pond, it seems like the description would be applicable to all three reservoirs given that the sediments (and nutrients) are derived from the watershed. How do these measurements compare to the assumptions for labile and refractory carbon and nutrient distributions used to drive the Bay WQ model? Is/was this information used to update the bay WQ model?	Spaur	Statement at beginning of Section 2 informs reader why we focus on Conowingo. However, concur with need to provide additional information on sediments and nutrients of upper two dams. Please insert the following new paragraph covering this topic after paragraph 2 (p. 44, June 23 version): "TN and TP in bottom sediment samples collected in Lake Clarke considered vulnerable to scour ranged from 3.3 to 5.3 g/kg and 0.8 to 1.2 g/kg, respectively. TN and TP in bottom sediment samples collected in Lake Aldred considered vulnerable to scour ranged from 1.2 to 5.7 g/kg and 0.3 to 0.5 g/kg, respectively. Lake Clarke had higher clay content than Lake Aldred at these locations, likely accounting for greater TP content. Clay content of bottom sediments in downstream Lake Clarke remained consistent in comparison of findings of studies conducted in 1990 versus 1996. Conversely, clay content in bottom sediments in downstream portions of Lake Aldred decreased from 1990 to 1996 (Langland and Hainly, 1997)."	Yes.	No further comment at this time

Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change?	Exelon Response/Additional Comment
P. 29, Paragraph 7	The report does not appear to discuss the potential impacts that the particulate coal may have on collected data or model predictions, nor whether it is uncommon to have an 11-percent coal content.	Spaur	Unlikely that additional future coal to be transported into Bay from sediment behind the dams would have much effect on the Bay. The upper Bay already contains substantial coal as was stated in Section 2.6, and has for probably more than a century. Evaluating effects of additional coal input is one of many specific topics that were not evaluated in this assessment. An environmental impact statement covering any proposed project would be the appropriate place to specifically address this. However, we should change existing sentence on p. 38, 2nd paragraph in "Bay Bottom Materials and Processes" subsection from "Abundant coal occurs in Susquehanna Flats sediments (Robertson, 1998)." To "Abundant coal occurs in Susquehanna Flats sediments transported into the Bay from coal mining in the Susquehanna Basin (Robertson, 1998)." This would better clarify source and timing of coal deliveries to the Bay (coal mining having begun in earnest in Basin by early 1800s). (On side note, I skimmed MGS [1988] and Robertson [1998], but neither of these provides specific information on how much coal occurs in Bay's flats sediments, other than to state that it's abundant in certain strata near the surface.)	Yes.	The importance of coal content is not the effect of future transport to the Bay, but how its presence may influence chemical measurements of sediments.
P. 29-30, Paragraph 7 & 1	Focus is only on Conowingo: what about the other reservoirs?	Spaur	See Comment #35.	No.	See Exelon comment to first two rows of this table on page 1
P. 35, Paragraph 2	There appear to be many other substantial declines in total SAV acres that are not explained by storm events (figure 2-16 and figure 2-17). There is no narrative around this, leaving the reader with the impression that storm events are the primary reason for SAV abundance declining even though a close inspection of the graph doesn't necessarily prove this connection. In fact, Kemp et al (1983) examined potential reasons for the decline bay-wide and at the Flats from the mid-60s to 1983 and concluded that storms played a secondary role.	Spaur	Topic of SAV trends related to storms, eutrophication, and other stressors is covered adequately in last paragraph on bottom of p. 48. No change needed.	No.	No further comment at this time

Page Number/ Section	Original Exelon Comment	LSRWA Lead	LSRWA Lead Response	Report Change?	Exelon Response/Additional Comment
P. 38, Paragraph 1	The first sentence states that "no SAV beds were mapped immediately below Conowingo Dam in the non-tidal and tidal Susquehanna River over the period 1997-2012." Exelon RSP 3.17 mapped SAV at the mouth of Octoraro Creek and at the island complex at near the mouth of Deer Creek (Robert, Wood, and Spencer Islands) and at Steel Island along the opposite bank in 2010 surveys.	Spaur	Change paragraph "No SAV beds were mapped immediately below the Conowingo Dam in the non-tidal and tidal Susquehanna River over the period 1997-2012. However, SAV was frequently mapped in the non-tidal and tidal river downstream to the river mouth from the 1990s through 2010 (VIMS, 2013)." to "VIMS mapped no SAV beds immediately below the Conowingo Dam in the non- tidal and tidal Susquehanna River over the period 1997-2012. However, VIMS frequently mapped SAV in the non-tidal and tidal river downstream to the river mouth from the 1990s through 2010 (VIMS, 2013). SAV was found to occur in 2010 downstream of Conowingo Dam at creek mouths and islands between the dam and Port Deposit in shallow areas with fine-grained sediment and low water velocities (URS and GSE , 2011).	Yes.	SAV was found to occur in 2010 downstream of Conowingo Dam at creek mouths and islands between the dam and Port Deposit in shallow areas with coarser-grained sediment (sand and cobble) near sources of sediment supply and reduced flow velocities (tributary mouths and a protected island complex) (URS and GSE , 2012c). Study 3.17 should be cited with the final report year (2012). Thus, in the references section it should become 2012c.