RESPONSIVENESS SUMMARY: CONOWINGO POND MASS BALANCE MODEL PEER REVIEW

Exelon Generation Company, LLC
300 Exelon Way
Kennett Square, Pennsylvania

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Responsiveness Summary: Conowingo Pond Mass Balance Model Peer Review

As part of the overall model development and application process, the hydrodynamic and sediment transport and nutrient transport components of the Conowingo Pond Mass Balance Model (CPMBM) were subject to peer review and critique by an external review panel. The peer review panel was comprised of the following expert panelists:

- Dr. Steve Scott (University of Mississippi), hydrodynamics and sediment transport
- Dr. Peter Wilcock (Utah State University) , hydrodynamics and sediment transport
- Dr. Damian Brady (), nutrient transport
- Dr. James L. Martin (Mississippi State University), nutrient transport

The panel was charged with addressing the following questions as part of their review and critique:

1. Is the modeling approach reasonable and credible to satisfy the goals defined in the Proposal for Lower Susquehanna River Reservoir System Model Enhancements in Support of the 2017 Chesapeake Bay TMDL Midpoint Assessment?
2. Does the Conowingo Pond Mass Balance Model (CPMBM) provide added value to the information available to the EPA Chesapeake Bay Program and the State of Maryland? Does it inform and advance the current science and understanding of the Lower Susquehanna River Reservoir System?
3. Given the data which were available to the modelers, evaluate the model results, input parameters, and modeling assumptions made to determine if the models perform reasonably.
4. Are the modeling outputs developed under this study appropriate to help inform or guide the suite of Chesapeake Bay Program models (i.e. the Watershed Model and Water Quality and Sediment Transport Model)?
5. While keeping the goals of the study in mind, could the models and outputs be improved? If possible, please identify specific areas of potential improvement (e.g., model input datasets/parameters, modeling assumptions, process description, other modeling systems or programs, etc.).

Panelist comments and questions, responses to them, and subsequent modifications to the CPMBM reports are tabulated in the responsiveness summary that follows.

ID	*Reviewer*	*Comment/Question*	*Response*	*Action/Revision*
1	S. Scott	I have a question about the simulated bed elevation change for the long term and short term simulations. I assume the long term simulations begin with the 1997 bathymetry and the short term simulations start with the 2008 bathymetry.	The bed elevation initial conditions for long-term and short-term simulations are always "measured" conditions, where "measured" means that we spatially interpolated discrete bathymetric measurements over the model grid. Thus, long-term model runs start with spatially interpolated elevations from the 1996 survey and short-term runs start with spatially interpolated elevations from the 2008 survey. The only differences between long-term and short-term model set-ups are: (1) the long-term starts in January 1997 with initial bed elevations defined from a spatial interpolation using 1996 bathymetric survey (which provides data for the area from approximately Muddy Creek to Conowingo Dam); and (2) the short-term model starts in January 2008 with initial elevations defined from a spatial interpolation using the 2008 bathymetric survey (which, relative to the 1996 survey, provides more data for the area from Muddy Creek to Conowingo Dam).	No further action required
2	S. Scott	Figures 63 and 67 detail results for the long term simulations for the 2011 year and 2008 to 2011 year. The net elevation change for these simulations is -3.43 and -1.03 respectively. I assume that the change in bathymetry for 2011 and between 2008 and 2011 is based on changes relating back to 1997. I assume the	Figure 63 is part of the sequence that shows cumulative and annual bed elevation for the long-term model. The simulated cumulative change is the model result at the end of 2011 minus the model condition at the start of the run in 1997.	No further action required

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		short term simulations begin with the 2008 bathymetry. Is this the 2008 survey bathymetry or the 2008 bathymetry taken from the long term simulation relating back to 1997?	The simulated annual change is the model result at the end of 2011 minus the model result at the start of 2011. The simulated annual bed elevation difference for 2011 was -3.43 cm. Please note that the bed area involved is the entire model domain. Figure 67 presents a comparison of the differences between spatial interpolations for two bathymetric surveys (left panel) and the difference between long-term model results for the corresponding timeframe (right panel). The long-term simulation began in 1997. The difference displayed on the right panel is the simulation result at the end of 2011 minus the simulation result at the start of 2008. The simulated difference over those 4 years is -1.03 cm. Please note that the bed area being involved is limited to the area surveyed (Muddy Creek to Conowingo Dam). [See discussion of Figures H-4 and J-1 below.]	
3	S. Scott	Figures H-4 and J-1 show the short term simulations for year 2011 and 2008-2011. The net bed elevation change for these simulations is -8.69 and -7.4 respectively. I do not understand why there is more scour for the short term simulation for 2011 than for the long term simulation of 2011. I assume all model parameters remain the same, why the difference? Also, the model bed area is smaller for the long term simulation than for the short term simulation. The only reason I can think of is that the 2008 bathymetry from the long term	With respect to Figures H-4 and J-1, the stated bed surface areas differ because two different types of comparisons are made. In Figure H-4, simulation results (in both panels) are shown for the entire model domain, with the left panel being the cumulative result and the right panel being the annual result. In Figure J-1, a comparison is made between differences in spatially interpolated bed elevations	No further action required

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		simulation indicated increased depth in the lower 3 miles of the reservoir (deposition rate lower in that area) thus lower shear stresses in 2011, and for the short term simulation the 2008 bathymetry from survey was used and the lower 3 miles had more deposition (shallower) and bed shear stresses were higher thus more erosion in 2011. Please clarify.	over time (left panel) and simulation results for the same timeframe (right panel). The type of comparison shown in Figure J-1 is necessarily limited to the area where bathymetric data were collected and interpolated. Please note that when bathymetric interpolations and model results are compared, the area upstream of Muddy Creek is shown as "white" because year-by-year bed surveys did not occur upstream of Muddy Creek. With respect to net bed elevation differences between the long-term and short-term models, there at several factors at play that include: • Long-term and short-term model parameterizations are identical other than for the difference in initial bed elevations. Thus, initial conditions for bed composition (the grain size distribution in each bed layer of each grid cell) and initial erosion resistance conditions are also identical. • The way SEDZLJS works, and given our customization so that tau critical is a function of clay content (as a surrogate for plasticity index), the erosion resistance of the bed can change over time. Those changes in erosion resistance include changes attributable due to the accumulation of sediment	

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			layers over the course of a simulation, differences in clay content that evolve over time (relative to the initial condition), and the shear stress exposure history of the bed. The shear stress exposure history is itself influenced by water depth and bed elevations. Each of these factors leads to a situation where the erosion resistance of each bed layer in each grid cell differs when you start from the same condition but let the bed evolve for 15 years (1997-2011) versus 4 years (2008-2011). The event in 2005 is a contributor to this difference. • These above factors affect evolution of bed elevations in the model and in turn influence hydrodynamic calculations, leading to differences in behavior during high flow events, most notably during TS Lee in 2011. Differences in bed elevations can affect flow velocities, shear stresses, erosion, deposition, and the shear stress exposure history of each grid cell. In addition, the 1996 bathymetric survey (which was the starting point for the long-term run) has more measurement uncertainty and less data density than other surveys. Interpolated bed elevations based on 1996 measurements have more interpolation/extrapolation error and appear to be unrepresentatively low in	

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			some areas and perhaps too high in other areas. For example, the 3-6 meter differences in interpolated elevations that occur on a cell by cell basis between the 1996 and 2008 surveys may not be representative. Other factors also affect things but this is a place to start the discussion.	
4	P. Wilcock	p. 27: "Erosion thresholds were calibrated so that computed bed elevation changes over the course of the simulation were in rough agreement with spatial and temporal pattern and pond-wide average bed elevation change determined from interpolated bathymetric survey results." prw: More detail is needed here. Is this calibration for the entire model run or only for the initial time steps? What values of erosion threshold were selected in the end? Are these values different from those determined from Equations 2-16 and 3-1? In what cases?	The calibration of erosion thresholds represents the selection of values that the model uses as initial conditions for each cell and layer in the sediment bed (i.e., conditions at the start of a run). As noted in the report, the apparent erosion resistance of the bed exceeds values that were determined from site-specific SEDFLUME measurements or otherwise estimated from relationships to plasticity index. (Thus, the need for calibration.) Equation (2-16) is relevant to the behavior of individual grains and their potential transport from the bed under conditions where bed behavior is non-cohesive. Thus, it is not applicable to establishing initial conditions for erosion resistance, which is a function of how the overall matrix of particles in the bed behaves (which is generally cohesive). Similarly, Equation (3-1) is relevant to sediments that deposit to the bed during a simulation and which are considered to behave in a cohesive manner.	Text in Sections 2.2.2, 3.1.4.4, and 3.3.2.2 of the hydro/sedtran report was revised to provide more detail.

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5	P. Wilcock	p. 28: "Dimensionless diameters and critical shear stress values for each particle type were then determined based on effective diameter using Equations 2-15, 2-16, and 2-19." prw: I believe this should be Equations 2-16, 2-17, and 2-20. It is also not clear when 2-16 is used and when Equation 3-1 is used. Is it 2-16 always for in-situ material and 3-1 only for material deposited during the simulation?	Equation (2-16) is relevant to the behavior of individual grains and their potential transport from the bed under conditions where bed behavior is non-cohesive. Equation (3-1) is relevant to sediments that deposit to the bed during a simulation and which are considered to behave in a cohesive manner.	Equation numbers throughout the report text were updated as needed.
6	P. Wilcock	p. 33: "Consequently, erosion thresholds for initial bed layers at the start of simulations were adjusted during sediment transport model calibration." Is this applied only to the surface layer, or to the full bed? What were the adjusted values for erosion thresholds? Are they in a reasonable range?	The extent to which erosion thresholds required adjustment was based on comparisons to interpolated bed elevation differences as determined from spatially interpolated bathymetric surveys. Ultimately, the depth of net erosion for a grid cell is a function of erosion threshold, erosion rate, the duration of shear stresses in excess of the erosion threshold, and the total thickness of sediment (including any deposition) at any location. The duration of shear stresses in excess of the erosion threshold is a function of the hydrograph only and not subject to calibration. For simplicity, and broadly consistent with SEDFLUME measurements and subject to the constraint that fluxes were consistent with nutrient transport measurements, erosion rates were assumed to be 0.002 cm/s and were not otherwise subject to calibration. Thus, only initial erosion thresholds were varied during model calibration.	Figures displaying erosion thresholds, by bed layer, at the start of simulations were added to Attachment 1 (only available in electronic form).

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			The same erosion threshold was typically assigned through the entire thickness of the initial bed for each grid cell. Assigned thresholds were often in the range of 40-60 dynes/cm^2 (4-6 Pa). However, in a few locations where shear stresses are largest or where net erosion over time was limited regardless of shear stress, larger erosion thresholds (100-200 dynes/cm^2; (10-20 Pa)were required. From an empirical perspective, calibrated initial erosion thresholds are reasonable in that they simultaneously satisfy net bed elevation changes over time and nutrient constraints. [Demonstration of flux constraints for nutrients is detailed in the nutrient transport model report.]	
7	P. Wilcock	Equations 3-1 and 3-2. These relations are used to estimate τ_{ce}, at least in some cases. First, the relation between % clay and plasticity index is rather poor (Figure 7), as may be expected for cohesive sediments. Second, it is not clear when this relation is used to estimate τ_{ce}. Is it only for sediment that is deposited during the simulation? Is it also used when there is scour? Also, the reference for Jacobs et al. (2011) is not given.	Equations (3-1) and (3-2) are used within the code to assign τ_{ce} values for sediment layers that form by deposition during the course of a simulation at the time it deposits. Other logic in the SEDZLJS code (and assigned parameters) control how erosion resistance of deposited sediments evolves over time. Ultimately, (cohesive) deposited sediment layers will have time variable erosion thresholds bounded by the clay content/plasticity index relation expressed by Equations (3-1) and (3-2) as a lower bound and the initial bed condition and/or the maximum exerted shear stress as an upper bound.	Text in Sections 3.1.4.4, and 3.3.2.2 of the hydro/sedtran report was revised to provide more detail. The citation for Jacobs et al. (2011) was also added to list of references.

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8	P. Wilcock	p. 27: "The erosion rate used for simulations was assigned as 0.002 cm/s (0.236 feet/hour) …" p. 33: "Whenever the shear stress acting on the bed exceeded the critical shear stress for erosion, sediments were assumed to erode at a rate of 1.18 feet/hour (0.01 cm/s), which is within the range of USACE (2014) SEDFLUME results." These two sentences indicate two different values of erosion rate. Please reconcile.	The erosion rate of 0.002 cm/s is value of practical consequence. However, for completeness and clarity, it should be noted that the SEDZLJS framework requires inputs for cohesive and non-cohesive modes of erosion. The rate of 0.002 cm/s is the rate used for cohesive erosion. The rate of 0.01 cm/s is the rate that would be used for non-cohesive erosion. For the application to Conowingo Pond, the model was parameterized such that the 0.002 cm/s erosion rate would be used in nearly every case.	Text in Section 3.1.4.4 describing the erosion rate was moved to Section 3.3.2.2 of the hydro/sedtran report. The text was also modified to indicate both cohesive and non-cohesive erosion rates.
9	P. Wilcock	The behavior of the sediment bed under scour conditions remains poorly known. This is a problem with available input rather than the model, although this problem necessarily limits the possible fidelity of any model. In the long simulation (1997-2014), 18 of the model grid cells show scour greater than 30 cm (Figure 66), which exceeds the depth of any characterization of bed behavior. In the 2008 to 2014 comparison of surveyed and simulated elevation change (Figure 69), 25 of the cells in the simulation and 56 of the cells in the observed (about one-fifth of the cells) show scour greater than 30 cm.	As the reviewer noted, characterization of erosion rates and thresholds was limited to the USACE (2014) SEDFLUME effort. The depth of net bed elevation changes over time (as inferred from differences between interpolated bathymetric survey results) generally exceeds the depth to which bed erosion rates and thresholds have been characterized (~30 cm). However, other sediment sampling and characterization efforts have generated samples from a range of depth intervals, including approximately 300 cm below the sediment surface. The present hydrodynamic and sediment transport model development effort made extensive use of the full array of site data that have been generated to date. Thus, as	No further action required.

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			noted by the reviewer, the problem is largely a reflection of available input rather than the model (which necessarily impose limit on any model).	
10	P. Wilcock	**Estimating sediment entrainment.** There is a need to be clearer about how values of τ_{ce} were calculated and which value of erosion rate was used. Beyond that, there is a broader need to understand how model results may be sensitive to the choice of τ_{ce} and erosion rate. i. A report of values of τ_{ce} and erosion rate used in the final simulation is needed, including an assessment of whether all values used are reasonable and consistent. Were the values used and the rules applied consistent across the reservoir? Did they change with time? ii. Some estimate of the sensitivity of model results to the choice of τ_{ce} and erosion rate would be useful.	As described in responses to Comments 4-8, more detail regarding selection and evolution of erosion threshold and rate values has been provided. For all practical purposes, erosion rates were consistently 0.002 cm/s. Initial erosion threshold values were calibrated such that they conformed to empirical net bed elevation changes over time and nutrient cycling constraints. As the sediment bed evolves over time during a simulation, and layers are added to or removed from it, erosion thresholds can vary from a lower bound determined by the clay content-plasticity index relation and an upper bound limited by the initial condition and/or the maximum applied shear stress. Given the uncertainty associated with upstream/boundary loads and grain size distributions, bed sediment conditions (e.g., grain sizes, erosion thresholds and rates, etc.), the potential utility of model sensitivity analysis is of limited value at this time because model responses are influenced by more than factors controlling sediment entrainment.	No revisions were incorporated into the report. Sensitivity analyses are beyond the present scope of study objectives.

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11	P. Wilcock	**Grain Size.** The model uses four grain sizes (clay, silt, sand, gravel) as well as a nominal grain size for coal. It would be useful to compare simulated vs. observed grain size of the sediment load at Conowingo Dam. This provides a separate basis for evaluating model performance. Similarly, it would be useful to compare the beginning and ending grain size of the reservoir bed. If the transport of different grain sizes is off, progressive sorting of the bed should show that effect clearly.	The value of efforts to evaluate bed composition changes was discussed by project team over the course of model development. Although evaluations of bed composition over time have some appeal and merit, we concluded that the relative benefit of such evaluations is more limited than might be recognized. They are unlikely to provide insight into processes that control sediment transport within Conowingo Pond because: • Model conditions that evolve over a simulation are a response to uncertain boundary loads and setting velocities for each size class, erosion thresholds, etc. • Initial grain size distributions for each grid cell in each layer of the bed, as estimated from sparse data that were interpolated in vertical and horizontal, are very uncertain (e.g., large Root Mean Square Error of interpolation). • Further, data from a roughly 25-year period were used to establish initial bed conditions. Given such uncertainties, the departure from, or conformance to, any initial bed composition over time would not be dispositive of whether erosion and deposition processes (and corresponding sediment sorting) are appropriately	No revisions were incorporated into the report. Analyses of bed composition are beyond the present scope of study objectives.

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			parameterized. For example, the relative increase or decrease in any size class within the bed could be the result of error in loads and/or settling velocities and/or erosion characteristics and/or the initial bed composition and/or any combination of the these factors. As an outgrowth of these data limitations, model development was guided by empirical constraints arising from net bed elevation changes over time as inferred from successive bathymetric surveys and erosion and deposition flux constraints imposed by measured nutrient fluxes (including sediment oxygen demand). It should be noted that the constraints imposed by nutrient fluxes are surrogates for differential transport and sorting of grain sizes in the sediment bed. Nutrients are more closely associated with clay- and silt-sized particles. Thus, the generally close correspondence between the model and inferred bed elevation changes and the subsequent successful simulation of the suite of nutrients was judged to be more indicative of model performance than uncertain comparisons to bed composition changes.	
12	P. Wilcock	**Uncertainty.** The report notes that "uncertainties in flows at Holtwood contribute to uncertainties in sediment load estimates" and the "Uncertainties in SSC	It is unclear how, or even if, USEPA would be able to incorporate this sort of information into to its TMDL assessment	No revisions were incorporated into the report. Uncertainty

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		estimates contribute to uncertainties in sediment load estimates". It would be useful to explore how uncertainties in the upstream boundary condition, as well as uncertainties in the bottom boundary condition for sediment erosion, may contribute to uncertainties in the simulated loads at Conowingo Dam. It would be informative to propagate uncertainty in the upstream and bottom boundary conditions into uncertainty in the CPMBM predictions.	efforts. Also, the level of effort required to establish uncertainty limits or perform statistical evaluations of uncertainty bounds is relatively high. Consequently, efforts to evaluate uncertainty were not pursued.	analyses are beyond the present scope of study objectives.
13	D. Brady	Dr. Brady provided a list of potential improvements to the water quality portion of the CPMBM. These included: 1. Modeling the water column with a process based RCA-like model 2. Empirical study of the relationship between flow and resuspension in this system 3. More in depth modeling of sediment transport to homogenize organic content of the sediment to determine if the current spatial gradient is ameliorating loads to the bay by having resuspended material with high organic content far from the dam. 4. Revisiting some of the ratios and assumptions regarding the relationship between water quality parameters within the assumptions of the model.	The available time and budget do not permit these improvements to be performed at this time. The USEPA has moved forward with the 2017 Re-assessment of the Chesapeake Bay nutrient TMDL and would not accept any new findings that might arise from such analysis. However, we will provide additional thoughts on the recommendations for improvement. 1. There are very limited in-situ Conowingo Pond data with which to perform calibration of a process-based RCA-like water quality model. Most of the available data are measured by the USGS downstream of Conowingo Dam 2. Empirical studies of flow and resuspension have been performed by the USGS and were reviewed as part of the sediment transport modeling effort 3. If additional sediment transport modeling were to be conducted that effort should focus on modifying the settling rates used for silts and clays such that	No revisions were made to the report.

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			settling of suspended solids would be more widely deposited along the length of the reservoir 4. The sediment cores do in fact contain coal and this, therefore, makes the determination of the organic carbon content of the sediments virtually impossible to determine; hence our simplifying assumption. This recommendation would need to be discussed with the USEPA/USACE developers of the watershed and Bay water quality models, as HDR was instructed to utilize the recipe developed by the USEPA and the USACE.	
14	D. Brady	Introduction. "has begun implementation"	Agree with suggested wording change	Report has been revised
15	D. Brady	Introduction. "However, the estimated dissolved oxygen"	Agree with suggested wording change	Report has been revised
16	D. Brady	Introduction. "has been asked"	Agree with recommendation to change wording	Report has been revised
17	D. Brady	Introduction. "This assumption appeared"	The wording in the report is clear that the assumption refers to the original SFM	No revision was made to the report.
18	D. Brady	Methods. Comment on definition of the sediment bed layers	Agree with the recommendation for clarification	Report has been revised.
19	D. Brady	Methods. Why no diagenesis in the deep bed?	Certainly there would be no G1 or G2 material expected to be found at this depth, i.e., greater than 1.5 meters in depth. It is also likely that there may be additional G-classes which have even less reactive organic matter than assumed for G3. However, it was beyond the scope of this study to add additional state-	The report has been revised to clarify the rationale for not including diagenesis at depth.

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			variables to SFM to represent additional G-classes. We were concerned that if we allowed G3 to react in the deep bed, the model would produce unrealistically low values of sediment POM at depth.	
20	D. Brady	Methods. Still not clear how the model gets deposition … one suggestion is to fit ammonia data and compare to Boynton	HDR believes that the report is clear on how deposition and erosion occurs in the water quality portion of CPMBM and it is driven by information provided by the sediment transport model, ECOMSED, portion of the CPMBM. Sediment ammonia data are only available for a period of one year and would be insufficient to specify deposition for the 18-year calibration period.	A minor revision was made to the report.
21	D. Brady	Methods. CPBMB uses a mass balance approach using the difference between the loadings in WSM to assume the rest is deposited	Dr. Brady is incorrect. The "difference" approach to estimating deposition was only used for the stand-alone version of the SFM, not the CPMBM. In the CPMBM model, loadings from the WSM model served as inputs and deposition was determined based on settling rates, bottom shear stresses and tau critical for deposition and erosion as provided by ECOMSED	No revision was made to the report.
22	D. Brady	Data Sources and Analysis. Figure 3 is missing.	During the conversion process from Microsoft Word to PDF, figure 3 was lost	HDR will use a different PDF conversion tool and ensure that Figure 3 is contained in the report
23	D. Brady	Data Sources and Analysis. Missing parenthesis		Report text was corrected

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24	D. Brady	Data Sources and Analysis. Is it possible that there was significant vertical structure in individual cores?	There does not appear to any structure of N or P going down core. Figure 6 did not show other core data in the figure. This has been corrected.	Figure 6 has been revised.
25	D. Brady	Data Sources and Analysis. Profiles not shown for NH4, SRP and Fe.	NH4 and SRP data were not available for the 2000 SRBC data. Fe data (not shown) do not show vertical structure either.	No revision was made to the report.
26	D. Brady	Data Sources and Analysis. Long cores – what did vertical profiles of pore water show?	Pore water NH4, SRP and Fe was only analyzed for the August 26-Sept2 long core. Generally, NH4 increased down core, but the patterns were irregular. SRP pore water concentrations were generally low (1-5 umol/L) with slight, but irregular, increases in concentration going down core. Fe tended to be very irregular going down core.	No revision was made to the report.
27	D. Brady	Data Sources and Analysis. Question raised concerning negative regression slopes for carbon	At this time HDR does not have any hypotheses for the negative slopes. This may more a question for Dr. Cornwell (UMCES), who performed the diagenesis experiments.	No revision was made to the report.
28	D. Brady	Data Sources and Analysis. Page 7 – units missing for CO2 and NH4 and misspelling of nitrogen	Report revised to add units and correct spelling.	Report revised to add units and correct spelling.
29	D. Brady	Data Sources and Analysis, Page 7 – is there a reason to discount the two data points for nitrogen and go with 7.0E-5 umol/g-day	HDR dropped to points for carbon not nitrogen. The reason for dropping them is that the rates were greater than or equal ot the G2 diagenesis rate.	No revision was made to the report.
30	D. Brady	Data Sources and Analysis, Page 8. Be clear that the TN is multiplied by 8 (to get TC) due to Redfield.	Dr. Brady is incorrect to assume that the ratio of 8 was chosen due to Redfield. Rather it is tied to the "recipe" developed by the USEPA and USACE for estimating watershed loading information.	No revision was made to the report.

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31	D. Brady	Data Sources and Analysis, Figures 10 and 11 are mis-referenced. Were the parameters constrained in any way?	The original figures 10 and 11 were left out of the report. The parameters were not constrained.	Figures 10 and 11 have been added to the report and the remaining text and figures have been re-numbered appropriately.
32	D. Brady	Data Sources and Analysis, The text between pages 8 and 9 could be more clear.	HDR agrees with the recommendation.	The report has been revised appropriately.
33	D. Brady	2.3 Application of the Stand-alone SFM. Page 10 change multiply to multiplying		The report has been revised appropriately.
34	D. Brady	2.3 Application of the Stand-alone SFM. Page 10 provide references	The report cites information provided by Carl Cerco (pers.comm.) – no further reference is required.	No revision was made to the report.
35	D. Brady	2.3 Application of the Stand-alone SFM. Boyton's estimates of deposition are assumed to include resuspension	Dr. Boynton deployed sediment traps, which captured particles are two or three depths in the water column. Dr. Brady is correct that the bottom most sediment trap appears to capture some resuspended material. In our analysis, HDR excluded data from the bottom most trap and, therefore, feel comfortable that the estimates only reflect deposition.	No revision was made to the report.
36	D. Brady	2.3 Application of the Stand-alone SFM. Climatology approach. Use of actual 2015 temperature data.	HDR modeled 1997-2014. We are not sure how using 2015 data would apply in this instance. It is also outside of HDR's original scope.	No revision was made to the report.
37	D. Brady	2.3 Application of the Stand-alone SFM. POP percentages are mentioned twice.	They are mentioned twice – one reference in relationship to the comparison to POP data and the second reference to describe the percentage POP relative to the total P	No revision was made to the report.
38	D. Brady	2.3 Application of the Stand-alone SFM. Page 14. Explanation of the excess inorganic P being attributed to	HDR has some questions concerning nutrient estimates provided by the	A minor revision to the report was made

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		deposition of PIP.	USEPA watershed model and the "recipe" for doing the nutrient splits provided by the USACE. However, the problem may also be related to the stand-alone SFM as well.	to clarify the rationale for attributing the problem to the deposition of PIP.
39	D. Brady	2.3 Application of the Stand-alone SFM. Page 14. High variability in observed P fluxes.	HDR does not have a reason for the high variability in the P fluxes. They do not seem to be driven by DO as per discussions with Dr. Cornwell	No revision was made to the report.
40	D. Brady	2.4 CPMBM Setup. Questions concerning flows	Details of the procedure that HDR used to calculate flows is provided in the CPMBM sediment transport report.	No revision was made to the report.
41	D. Brady	2.4 CPMBM Setup. Question concerning exclusion of photosynthesis (P)/respiration (R) problematic.	It is difficult to confidentially answer this question without additional data and without model revisions, which was outside the initial scope of this analysis. However, the average residence time within Conowingo Pond, as estimated from the CPMBM hydrodynamic/ sediment transport model is about 4 days. Therefore P-R may not be that important.	No revision was made to the report.
42	D. Brady	2.4 CPMBM Setup. Nutrient concentration was taken from USEPA, not loading?	HDR back-estimated nutrient concentrations based on load and flow and then used the HDR flow estimates and back-calculated nutrient concentrations to generate loadings.	No revision was made to the report.
43	D. Brady	3.1 Calibration. If inflow concentration is a problem, does this only happen at high flows?	The answer to the question depends on the water quality parameter of interest. For example, DON appears to be under-estimated at low flows,	No revision was made to the report.
44	D. Brady	3.1 Calibration. Ultimately, the relationship between flow and concentrations is a linear positive one according to the model and not in the data. This	Dr. Brady's statement certainly appears true for dissolved P forms, but this is largely driven by information provided	No revision was made to the report.

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		contributes to the mismatch in phosphorus loading. But can we trust that the data is adequate to conclude that there is no relationship between flow and concentration?	by the watershed model. It is less clear for particulate P. Model and data suggest that as flows increase, so does particulate P.	
45	D. Brady	3.2 Calibration to Storm Event Data. Page 19, change the use of the word "recipe"	The report will be changed	The word recipe has been changed to methodology throughout the report
46	D. Brady	3.3 Sediment Composition Calibration. Page 20. change "will focus" to "focused"		The report was modified to read "focused"
47	D. Brady	3.3 Sediment Composition Calibration. Page 21. Label the section where discussion will follow.	Discussion follows in Section 4. Report will be modified.	The report has been revised as appropriate.
48	D. Brady	4. Results. Page 22. Figure 50 - it is not clear if this is data or a model. If it is a model, then the resuspension under flow is a function of a parameter, correct?	Due to the addition of figures 10 and 11 to the report, Figure 50 to which Dr. Brady refers should be Figure 52. The results presented are model computations and resuspension is determined by computations provided by the CPMBM hydrodynamic/sediment transport model and are determined by the critical shear stress for erosion model parameter.	The report has been modified to more clearly state that Figure 52 is based on model computations.
49	D. Brady	5. Management Scenarios. Page 23. How were management scenarios chosen?	Management scenarios were based on information provided by the USEPA.	The report has been modified to clarify where the choice of scenarios came from.
50	D. Brady	5. Management Scenarios. Page 24. are the figure references correct here?	No the figure references were incorrect and the report was modified to correct the error.	The report has been revised appropriately.
51	J. Martin	Page 10. One improvement of the sediment flux model that could be considered would be the inclusion of iron as a state variable, along with iron speciation in order to	In order to fully implement this recommendation, which is outside of the initial scope of this study, it would be	No revision was made to the report.

ID	*Reviewer*	*Comment/Question*	*Response*	*Action/Revision*
		more realistically capture the impacts of phosphorus sequestration in iron rich sediments.	necessary to have estimates of iron loadings to Conowingo Pond, which is not included in the USEPA WSM. HDR believes that increasing the P partitioning coefficients well above those used in the USEPA Chesapeake Bay model and arrived at via the calibration of SFM to Chesapeake Bay data and that are reflective of the higher levels of Fe contained in Conowingo Pond sediments is a reasonable approach.	