Appendix G

Memorandum Regarding Evaluation of Model Input Differences

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MEMORANDUM

Discussion of Model Input Differences: EPA's Specific Comment #52 on GE's CMS Report

October 30, 2008

In its letter dated September 9, 2008, EPA provided comments on the Corrective Measures Study (CMS) Report submitted by GE in March 2008. One comment (Specific Comment #52) noted several differences between the simulation modeling performed by GE in the CMS and a parallel modeling effort conducted by EPA. In this comment, EPA stated that GE should propose a resolution to each of these differences for consideration prior to submittal of the CMS Report Supplement, and should include a discussion of these differences in model application, particularly as they relate to the evaluation of alternatives. This memorandum provides a discussion of each of these issues, and then discusses a potential resolution.

Summary of Differences and Discussion

The differences in simulation modeling assumptions noted by EPA (shown in italics below) are discussed in this memorandum, along with GE's assessment of how each may impact the evaluations conducted in the CMS. As discussed below, these differences all pertain to detailed aspects of how the inputs were specified for the hydrodynamic, sediment transport, and PCB fate model code (i.e., EFDC). The EFDC model inputs developed by GE during the CMS were reasonable and consistent with the methods described in the various documents leading up to the CMS (i.e., the EPA-approved CMS Proposal, EFDC Code Memorandum, Model Input Addendum, and Model Input Addendum Supplement) or in various discussions held with EPA and its consultants during development of the CMS. Indeed, this was confirmed by EPA at a meeting between GE and EPA on April 30, 2008, in which EPA representatives stated that they had no major comments on the EFDC modeling based on their review of GE's model inputs. Nonetheless, in accordance with EPA's comment, a brief evaluation of each difference is provided below.

1) *Remediation is assumed by GE to occur between Mar. 1st and Nov. 31st of each year, not continuously as assumed by EPA.*

    GE's simulation of remediation between March and November is consistent with the 9-month per year construction schedule that was used in all other CMS evaluations (and was discussed with EPA during development of the CMS Report at a meeting held on October 23, 2007). Further, GE believes that use of a 9-month construction schedule in the model is more realistic than a 12-month schedule, because it takes account of the problems with working during the winter.

    In any event, this difference would result in a relatively small change in timing of the model results during the period of remediation, especially water column PCB levels, but would likely have no appreciable impact on model projection endpoint concentrations. The remediation schedule has only a relatively short-term impact on model results during the time of simulated remediation. The impact of dredging over 12 months versus 9 months would be expected to be minimal because the total volume of sediment dredged per year would remain unchanged; EPA's use of a 12-month dredging period would simply spread the same amount of remediation over the full year. Moreover, the concentrations predicted by the model at the end of the 52-year simulations, which were used to evaluate what PCB levels are attained by each sediment alternative, are driven predominantly by the amount and type of remediation done within a particular reach (as well as upstream reaches) and the boundary conditions. That is, over the 30+ years that are simulated following remediation, the model reaches an approximate steady-state concentration that is determined by these factors.

Nevertheless, to confirm the impact (or lack of impact) of this difference in schedule, alternatives SED 3 through SED 8 would need to be re-run assuming a 12-month construction schedule.

2) *Backfill/capping is assumed to begin at 80% completion in a cell, but in an earlier presentation to EPA 73% was assumed.*

Following a January 2008 meeting with EPA, GE reconsidered the overlap between excavation and backfill operations in Reaches 5A and 5B and modified the schedule inputs to reflect backfill beginning when excavation was approximately 60% complete. The associated text in the CMS Report inadvertently stated this as 80%. However, the specific value assumed has no bearing on model inputs. Because the model simulates remediation of a computational grid cell by simulating instantaneous removal and application of backfill/capping according to the user-input schedule (as described in the May 2007 EFDC Code Memorandum), the only information of importance is the time at which each grid cell would be completed. Thus, the model schedules were specified so that the grid cells within a given reach were progressively remediated until that reach was completed within the number of years specified in the schedules that were used for all CMS evaluations (i.e., those shown in Tables 3-5 through 3-11 of the CMS Report).

In short, while the timing of backfill placement would affect the overall time for completion of a given alternative (with the use of 60% accelerating the time compared to 73%), it is independent of the model simulations (which are based on the specified schedules). As a result, GE believes there is no need for further action to resolve this issue.

3) *The spatial extent of the "deep hole" in Woods Pond used by GE is larger than used by EPA.*

As shown in the attached figure of Woods Pond, GE's selection of grid cells used to represent the "deep hole" was based on the EPA bathymetry contours. This figure demonstrates that the GE-selected grid cells reasonably represent the deep portion of the Pond. It is currently unclear how EPA opted to define the deep hole in the model, and how this definition differs from GE's. Nonetheless, GE expects that differences in the delineation of the deep hole would likely not have a material effect on model predictions, since all scenarios that include any remedial action (SEDs 3 through 8) specify remediation over the entire Pond. Although several of the CMS alternatives use different remedial technologies in shallow versus deep areas of the Pond, the Pond-wide average surface sediment concentration (immediately following completion of remediation) is not significantly affected by these differences. For example:

- Under SED 4 a thin-layer cap would be applied to the deep hole, while an engineered cap would be applied to this area under SED 5 (the shallow portion of the Pond would be subject to removal under both scenarios). Although the deep hole remediation technology differs between these two alternatives, the post-remediation surface sediment PCB concentration in Woods Pond is approximately 0.3 mg/kg for both alternatives. Further, the EPA model predicts that both the thin-layer cap and the engineered cap in the deep hole area would remain 100% stable during subsequent storm events.

- Similarly, while SED 7 and SED 8 would involve different remedial technologies in the deep portion of the pond (engineered capping under SED 7, removal under SED 8 – along with removal in the shallow portion under both alternatives), both alternatives result in about the same predicted average PCB concentration in Woods Pond (0.2 mg/kg) by the end of the projection period.

Both of these examples illustrate that small differences in the specific model grid cells used to define the deep hole area within Woods Pond would likely not materially impact the model results that were used in comparing the sediment alternatives. To confirm this, EPA would need to provide GE with a list of specific model grid cells it used to define the deep hole in Woods Pond, and the model would need to be re-run for alternatives SED 3 through SED 7.

4) *GE has simulated the remediation of more backwaters than those considered part of Reach 5D; EPA restricted the definition of backwaters to Reach 5D only. However it appears that those backwaters are represented in the model as floodplain cells.*

The backwaters considered in the CMS were consistent with those shown in Figure 2-3 of the EPA-approved CMS Proposal, and were not limited to the few large areas selected by EPA to define Reach 5D. Further, all alternatives in the CMS Proposal that included some amount of remediation in backwaters called for remediation in "Reach 5 backwaters," not Reach 5D as defined by EPA.

In selecting areas to be evaluated as backwaters in the CMS, GE conducted an assessment of all hydrographic features mapped within the system to determine which areas would be included in the floodplain soil assessments and which areas would be included in the sediment assessments, so as to avoid "double counting" of remediation. Hydrographic features included in the floodplain assessments included the vernal pools identified by EPA, as well as several other small ponds or low-lying (wet) areas, unless such areas were considered "boatable" by EPA in the Human Health Risk Assessment

(HHRA). Because “boatable” areas were excluded for calculation of floodplain exposure concentrations in the HHRA, such areas were assessed as backwaters in the CMS (unless they were classified by EPA as vernal pools). Thus, the backwaters evaluated in the model include the large areas traditionally mapped as backwaters, as well as the additional smaller “boatable” areas, which together include, but are not limited to, the areas that EPA designated as Reach 5D. Based on this, GE believes that its definition of backwaters provides a more complete accounting of the system’s hydrographic features for the purposes of the CMS evaluations.

Differences in which backwater areas are remediated will obviously affect the concentrations in such areas, and thus comparison to the amphibian IMPGs in those areas, which GE evaluated in the CMS (as directed by EPA). The more backwater areas that are remediated, the greater the attainment of the amphibian IMPGs in backwater areas. In order to quantify the impact of this difference on IMPG attainment, the model simulations including backwater remediation (i.e., SED 4 through SED 8) would need to be re-run using EPA’s definition.

5) *Wet removal techniques can differ in Reaches 5C, 5D, 6, 7 & 8 between EPA and GE simulations.*

GE assumes that this comment is referring to differences between GE’s and EPA’s assumed use of hydraulic dredging versus mechanical dredging in the wet. The GE model simulations are consistent with the wet removal techniques described for each alternative in Section 3.1.2 of the CMS Report. Differences in the use of mechanical versus hydraulic dredging will have a short-term impact on model results during the simulated remediation (due to subtle differences in resuspension rate and post-remediation concentrations between these two techniques). For the reasons noted above under issue 1, such short-term differences would likely have no appreciable impact on model endpoint concentrations and thus on the comparative evaluation of alternatives. However, to confirm the impact, differences in the use of mechanical versus hydraulic dredging in the wet would need to be discussed with EPA, followed by re-running model simulations of CMS alternatives that include removal in the wet (i.e., SED 4 though SED 8).

6) *Cap thickness in the case of an engineered cap without prior removal differs between the EPA and GE simulations.*

EPA notified GE in an email dated 10/8/08 that it was dropping this specific issue, and that no further evaluation or resolution was required.

7) *The 15-ppm criterion for Reach 5D in SED 5 is applied by GE as a area-weighted average for each backwater as opposed to a cell-by-cell basis assumed by EPA.*

GE’s approach was discussed verbally with EPA during development of the CMS Report. GE applied the 15 ppm criterion to each backwater on an area-weighted average basis in the CMS to be consistent with the method by which attainment of the amphibian IMPGs in the backwaters was evaluated – i.e., on an area-weighted average basis in each individual backwater.

This 15 ppm criterion affects the model simulation of backwaters in SED 4 and SED 5, and could have a small impact on model-predicted PCB concentrations in some backwater areas. However, in-river concentrations would likely be unaffected by this difference since the PCB exchange between backwaters and the main channel calculated by the model is relatively minor. Nonetheless, GE would need to re-run the simulations of SED 4 and SED 5, specifying remediation of only those individual grid cells with PCB concentrations greater than 15 ppm, to evaluate the impact of this difference on IMPG attainment in backwaters.

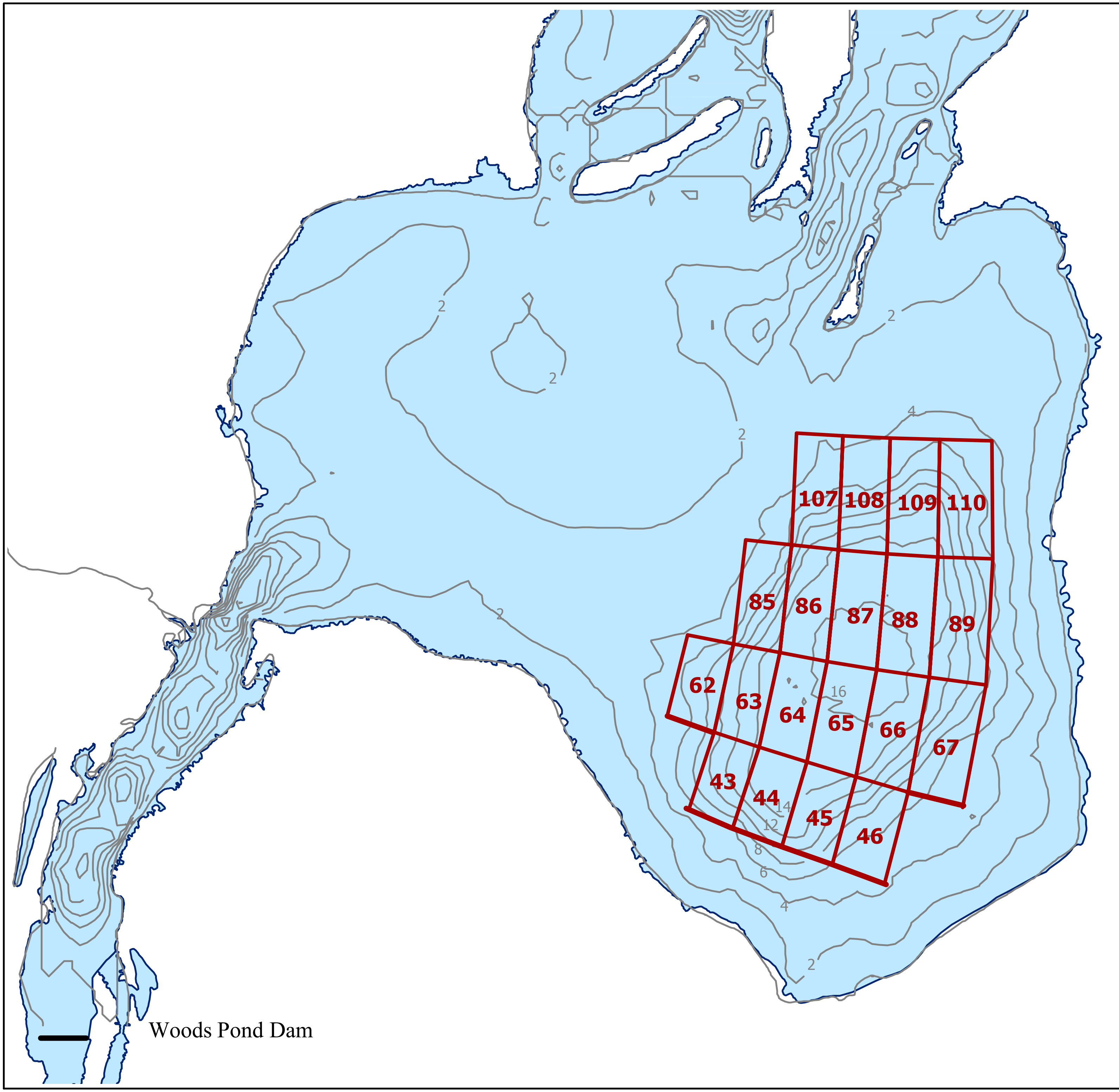
8) *In cases where the CMS Proposal (Revised Table 5-1) included removal followed by backfill/capping, GE assumed capping whereas EPA assumed backfill.*

This comment appears to be limited to the Reach 5 backwaters under SEDs 6 and 7 and to the Reach 7 impoundments and Reach 8 (Rising Pond) under SED 7, since these are the only alternatives and reaches where "capping/backfill" was specified in Revised Table 5-1 (submitted on May 31, 2007 as an addendum to the CMS Proposal Supplement); the use of capping versus backfill was explicitly defined for all other reaches and alternatives in Revised Table 5-1. Since these differences relate only to backwaters and impounded portions of the river, the overall difference in model results from simulating capping versus backfill would likely be small since these areas are not highly erosional. However, the use of capping versus backfill could result in some differences in concentration in a few of the Reach 7 impoundments under SED 7, as indicated by the fact that when backfill was simulated in those areas under SED 8, it was predicted to experience some limited erosion, as discussed in Section 4.8.3 of the CMS Report. Therefore, GE's use of caps in these areas under SED 7 would be more conservative than use of backfill since it prevents such erosion and any potential re-exposure of contaminated sediments in the model simulation. To evaluate the magnitude of the differences resulting from the use of backfill versus capping, GE would need to re-run the model assuming backfill placement in the above-referenced reaches under alternatives SED 6 and SED 7.

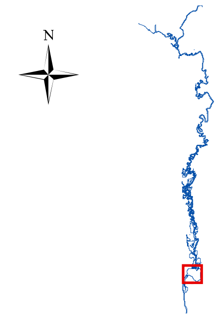
Potential Resolution

The preliminary evaluation discussed above indicates that several of the differences noted by EPA could have a small or short-term impact on the model results, but would likely not materially affect the individual or comparative evaluations of the sediment alternatives – with the possible exception that differences in the extent of backwater remediation (as discussed under issue 4) could affect the extent of attainment of the amphibian IMPGs in the backwaters. Further, the differences in model results stemming from the differences in inputs noted by EPA may be within the uncertainty of the model predictions – a factor EPA has noted in General Comment 26 on the CMS Report.

However, the cumulative effect of these differences on model results cannot be accurately quantified without re-running the simulations. Specifically, in order to fully evaluate and reconcile these differences in a definitive and quantitative way (with the exception of issues 2 and 6 above), it would be necessary to re-run the CMS model simulations of alternatives SED 3 through SED 8, and then to assess the results by comparing them to those documented in the CMS Report. This would require a significant level of effort, including meeting with EPA to discuss the differences, running the model simulations with the new inputs, and post-processing the results. Then, depending on how the results compare with those from the original simulations, the vast number of graphics and output metrics used throughout the CMS Report may need to be re-generated so that all pertinent information could be incorporated into the CMS Report Supplement.



LOCATOR MAP



SCALE

200 100 0 200 Feet

LEGEND

- Water Depth (2-ft; CR Environmental)
- Dams
- Housatonic River
- "Deep Hole" Grid Cells Simulated in Model

Note:
Values shown in the center of each grid cell represent L values in EFDC.

EFDC model grid cells used to define "deep hole".

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GENcms

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