



**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
National Ocean Service  
Office of Response and Restoration  
Assessment and Restoration Division  
290 Broadway, Rm 1831  
New York, New York 10007

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U.S. Environmental Protection Agency  
Region 2 ER RD  
290 Broadway  
New York, New York 10007

Dear EPA and the Phase 1 Peer Review Panel:

The National Oceanic and Atmospheric Administration's Office of Response and Restoration (NOAA OR&R) works on behalf of the Department of Commerce to protect and restore coastal resources from threats related to releases of hazardous substances and oil spills. NOAA has a long history of working on the Hudson River and supported a comprehensive cleanup of the contaminated sediments in the Upper Hudson River. NOAA has and continues to seek integration of remediation and restoration of the river through the remedial process. As part of our involvement at this site NOAA attended the February 17-18, 2010 Phase 1 peer review introductory sessions in Saratoga Springs. Subsequently, NOAA reviewed the March 2010 Hudson River PCBs Site EPA Phase 1 Evaluation Report (Louis Berger 2010) and General Electric's Phase 1 Evaluation Report Hudson River PCBs Superfund Site (Arcadis/Anchor QEA 2010). Overarching comments are offered by NOAA on EPA's and GE's reports for consideration by the Phase 1 Peer Review Panel. Comments specific to each report are provided in attachments to this letter. In addition, comments are being submitted to EPA by the Hudson River natural resource trustees (NOAA, Department of the Interior, New York State) for consideration by the peer review panel.

Phase 1 results emphasize the importance of developing a better estimation of DoC for use in the Phase 2 design, of using additional methods (estimation and verification) to ensure that initial dredging will target and remove the Phase 2 inventory, and of using post-dredging sampling protocols to effectively and promptly characterize remaining inventory and residuals.

NOAA continues to support a comprehensive cleanup of the Upper Hudson River and rejects GE's proposal to reduce the amount of dredging as a solution for meeting the Engineering Performance Standards. NOAA previously expressed the importance of the long-term benefits of a dredging remedy on the health of the Upper and Lower Hudson recognizing the potential for short term impacts. The remedy set forth in the 2002 ROD and the 2004 dispute determination required targeting of sediments for removal based on PCB inventory, surface concentration

(maximum in the top 12 inches), and other factors (bathymetry, sediment texture, depth at which PCBs are found).

During Phase 1 remediation, dredging was completed in 48.3 acres out of the approximately 90 acres targeted in the Thompson Island Pool (TIP). Approximately 31 acres were backfilled and another 17.3 acres were capped. Remedial design and Phase 1 remediation results demonstrate that PCB contamination was more widespread, concentrations were closer to the surface and higher, contamination was much deeper, and mass was greater than expected. Factors contributing to non-compliance with the Engineering Performance Standards (EPS) included

- underestimates of depth of contamination (DoC)
- poor spatial correlation of sediment PCBs on horizontal and vertical scale,
- incomplete SSAP cores (i.e., quantities and distribution),
- unanticipated wood debris (i.e., presence, distribution, amount) linked to inaccurate estimates of DoC and bucket non-closure,
- presence and inadequate control and capture of NAPL,
- reliance on interpolated median DoC combined with no adjustment for uncertainties built into cut lines,
- steep side slope construction,
- non-use of dredging overcuts,
- insufficient navigational/access depths,
- insufficient number and types of scows, and
- bottlenecks at the unloading wharf.

The presence of significant areas and volume of uncharacterized PCB inventory in Certification Units (CUs) that were remediated simultaneously and the impending closure of the navigation canal for the season, resulted in a decision to construct substantially more area of engineered caps than anticipated in the EPS (36% vs. 5%).

NOAA disagrees with GE's proposed changes to the Residual, Resuspension, and Productivity Standards. In Attachment 1 to this letter, NOAA provides detailed explanations why GE's proposed modifications would not meet the original Remedial Action Objectives (RAOs)<sup>1</sup> and would leave behind greater levels of PCBs and prolong recovery of the river. NOAA also provides additional recommendations and documentation in support of EPA's findings in their Phase I Evaluation Report and recommendations to improve Phase 2 design and compliance with Engineering Performance Standards (Attachment 2).

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<sup>1</sup> The ROD identified five RAOs. 1. Reduce the cancer risks and non-cancer health hazards for people eating fish from the Hudson River by reducing the concentration of PCBs in fish; 2. Reduce the risks to ecological receptors by reducing the concentration of PCBs in fish; 3. Reduce PCB levels in sediments in order to reduce PCB concentrations in river (surface) water that are above surface water ARARs; 4. Reduce the inventory (mass) of PCBs in sediments that are or may be bioavailable; and 5. Minimize the long-term downstream transport of PCBs in the river.

NOAA welcomes the opportunity to offer technical assistance on this site. Please contact me at (212) 637-3259 or [lisa.rosman@noaa.gov](mailto:lisa.rosman@noaa.gov) or [alyce.fritz@noaa.gov](mailto:alyce.fritz@noaa.gov) should you have any questions or would like further assistance.

cc: Ben Conetta, EPA/ERRD  
Mark Greenberg, ERT  
Amy Roe, USFWS  
John Davis, NYDOL

Wayne Richter, NYSDEC  
Larry Skinner, NYSDEC  
Robert Foley, USFWS  
Marguerite Matera, NOAA

## **Attachment 1. General Comments on GE's Report**

GE's Phase I Evaluation Report describes their experience implementing Phase 1 remediation and in particular, their ability to meet the three Engineering Performance Standards (EPS) related to resuspension, residuals, and productivity. GE concludes that the Phase 1 EPS could not be met simultaneously, that the EPS unmodified cannot be achieved in Phase 2, and they offer their conclusions and recommendations for Phase 2. The adjustments recommended by GE go well beyond the scope of the EPS. Their approach to addressing exceedances of the Residual and Resuspension Standards is to reduce the amount of mass removed and increase the amount of capping (backfill below 3 mg/kg Tri+ PCBs, cap above 3 mg/kg Tri+ PCBs). Their findings are bulleted below followed by NOAA's response.

### GE's Recommended Modifications to the Resuspension Standard

NOAA does not support GE's proposed modifications to the Resuspension Standard. GE's approach would determine a new load standard that is defined as a hard cap resulting in allocation of the load amongst dredge areas, specifically targeting the dredge areas where PCBs are, or may become bioavailable. EPA's dredging remedy for the Hudson River primarily targets both surface PCBs defined as the top 12 inches and sediment inventory. GE's proposal will target less surface sediment and PCB mass, remove smaller volumes of contaminated sediment and will increase the amount of capping envisioned under the ROD. GE's report recommendations and proposed changes to the EPS will result in a remedy that will be substantially less protective than required by the ROD.

In the 2002 ROD, EPA determined that "Placement of 18 inches (1.5 feet) of capping material over the existing surface, especially in shallower areas, could affect the hydraulics of the river, as well as actually move the shoreline toward the channel by as much as 25 to 50 feet in some areas. Therefore, in order to prevent changing the configuration of the river, 1.5 feet of sediment would be removed prior to the placement of the cap in shallow areas" (ROD pg. 59). The ROD (pg. 80-81) further states "The CAP-3/10/Select alternative is less reliable than the removal alternatives due to the potential for damage to the cap, thereby exposing PCBs. In addition, the CAP- 3/10/Select alternative is vulnerable to a catastrophic flow event, such as might be seen during a 500-year flood or a dam failure...the REM-3/10/Select and REM-0/0/3 [dredging] alternatives rank higher than the CAP-3/10/Select [capping] alternative due to the quantities of PCBs removed from the river and the permanence of such removal versus the long-term operation and maintenance required by capping PCB-contaminated sediments. EPA's analysis of residual risk for each alternative is consistent with the NRC report recommendation to consider options to reduce risk and to consider residual risks associated with material left behind." Subsequently in the EPS (V3, Page 42), EPA states: "The subaqueous cap is not comparable to the capping remedial option evaluated in the FS and ROD, because it is not to be used to isolate contaminated sediment inventory. The subaqueous cap is not a stand-alone remedial action alternative but rather part of the remedial action, and is only intended to isolate recalcitrant residuals."

The Phase 1 and 2 caps are not specially designed to withstand a 500-year flood or a dam failure. This is critical given the number of locks and dams in the Upper Hudson and GE's proposal to place a greater emphasis on capping. Breaching or loss of caps could result in remobilization of

residual and inventory PCBs, redistribution of the PCBs within the Hudson River ecosystem, and recontamination of remediated areas. Moreover, construction of more caps could destroy benthic habitat and existing mussel beds, wetlands and SAV, resulting potentially in permanent loss of valuable habitat

Step 11 of the dredge prism development approach allows for the modification of dredge prisms to avoid impacts to especially sensitive or unique habitats. This step does not reflect the opinions the federal natural resource trustees expressed to the National Remedy Review Board (NRRB) in their letter dated Oct 17, 2000 and at the November 2000 meeting. In particular, the Trustees affirmed that these highly productive Upper Hudson habitat areas are generally associated with high concentrations of PCBs and removal of PCBs was warranted. Modification of dredge prisms to meet a hard cap load allows for excessive capping above 3 ppm Tri+ PCBs and backfill below 3 ppm Tri+ further degrading especially sensitive or unique habitats of the Upper Hudson.

#### GE's Proposed Modifications to the Residual Standard

GE recommends changing the Residual Standard to 3 ppm Tri+ PCBs (~10 ppm Total PCBs) without addressing the primary issue of the underestimation of the DoC that was the direct result of inadequate characterization (incomplete cores, insufficient core density in areas of uncertainty), and a flawed interpolation approach. If DoC was accurately determined so only true residuals were left after the first dredging pass rather than inventory, the Residual Standard would function as designed, dredging efficiency would be improved, and resuspension could be significantly reduced.

GE's proposed changes to the Residual Standard are reactive and not proactive. Their modifications rely heavily on capping to sequester PCB-contaminated sediments and de-emphasize active removal by mechanical dredging. GE proposes dredging to the design prism and then sampling to determine the appropriate cap or backfill in high confidence areas and sampling to define a redredge prism in low confidence areas, redredging and then sampling to determine the appropriate cap or backfill.

This protocol allows inventory to remain in the river above the cleanup triggers due to poor site characterization and design. Moreover, GE's proposed modifications to the Resuspension Standard reduce the area targeted for dredging allowing for even more capping or backfill that is not explicitly articulated. The results of Phase 1 demonstrate that the 17-layer median interpolation approach used to characterize and design DoC were inadequate and underestimated DoC. The presence of significant amounts of wood debris and SSAP sampling methods contributed to an inaccurate estimate of DoC during Phase 1 design. NOAA recommends that the approach for setting the Phase 2 cut lines incorporate the lessons learned in Phase 1 rather than proceeding with the same approach GE used in Phase 1.

GE also proposes a modification to the existing dredge removal tolerances. They recommend that a certain percentage of compliance grid cells be allowed to exceed the existing tolerance on an acre basis following the dredge pass in an effort to minimize the amount of unproductive time

spent in grading sediment just above the dredge cutline tolerance limit. NOAA prefers better characterization of DoC and the incorporation of an overcut into the design as an alternative approach to fine grading of sediments with high PCB concentrations.

EPA, in its Phase 1 Evaluation report discusses a number of proactive measures to deal with the DoC underestimation and is committed to inventory removal. In contrast, GE's approach caps any missed inventory and allows placement of backfill, designed to withstand a 1 in 2 year flow event, to sequester sediments contaminated with  $\leq 3$  mg/kg Tri+ PCBs (~10 mg/kg total PCBs). NOAA doesn't support placement of backfill on top of sediments as high as 3 mg/kg Tri+ PCBs as this approach is neither permanent nor protective. This approach also appears inconsistent with GE's concern about addressing bioavailable PCBs (e.g., Pages ES-6, ES-8, ES-10). GE proposes capping of hard bottom areas when encountered. This recommendation should be modified to provide for capping of confirmed bedrock areas where encountered during remediation before the dredge cut lines are achieved but not pro forma and incorporated into the design. For example, "bedrock" was believed to be encountered in CU7 cores but it was later determined that woody debris more likely contributed to incomplete cores. Caution should be taken to avoid setting up a standard that contributes to inadvertent capping of areas containing missed inventory associated with debris field.

#### GE Proposed Modifications to the Productivity Standard

GE proposes a change in the productivity metric whereby tracking would be based on area remediated and PCB mass removed instead of sediment volume. The mass removal metric is designed to complement their proposed changes to the Resuspension and Residual Standards, thus allowing for inventory to remain in-place. The area remediated metric allows for capping in lieu of dredging. NOAA does not support either change. The PCB mass removal metric adds complexities to the Standard since EPA and GE do not agree on how to measure the mass of PCBs.

#### PCB Loads to the Lower Hudson River

NOAA will be submitting comments on the load after we have the opportunity to review the Addendum to the Phase 1 Evaluation Report that will address dredging-related losses to the Lower Hudson River.

#### Excessive PCBs Released into the Upper Hudson River Water Column

According to GE, nearly 25 times more PCBs were released into the Upper Hudson River water column than were anticipated by EPA. GE minimizes the importance of oil (NAPL) released into the river in spite of the frequent observations of oil droplets and sheens and the high variability in water column duplicate analysis. "Best management practices" employed in Phase 1 dredging did not effectively address the release of NAPL. NOAA believes that one of the most significant lessons learned for Phase 2 is to be better prepared for PCB oil release and to develop approaches to contain and capture NAPL before it is released to the river. Also, see comments under NAPL subheading.

GE does not believe that oil is a significant factor in PCB release (GE Report, Page 100). The fact that oil was rarely noted in the SSAP cores is not surprising, given that the SSAP cores missed a substantial amount of PCBs at depth where DNAPL likely would be found. For example high concentration deposits were located beneath wood layers not penetrated by cores. The lack of observations of oil during processing sediment for disposal does not address the frequent observations noted by the NY and EPA: "Oil droplets and sheens were routinely seen by field personnel downstream of dredging operations." (EPA Phase 1 Report, Page I-64)

GE notes that sheens were generated during the collection of only 39 of more than 8,000 SSAP sediment cores, primarily from CU-2 and CU-3 (GE Report, Page 100). It's not clear how these observations were collected, but the probe description notes sheens for individual cores from CUs 1, 2, 3, 8, and 18.

#### Exceedance of the Drinking Water Standard

According to GE, the federal drinking water standard of 500 parts per trillion was exceeded 10 times. While EPA and GE dispute the number of exceedances, the number of dredging stoppages is the same. NOAA supports EPA's provision of a non-Hudson River source of drinking water to affected communities to obviate this concern.

#### Mobilization of Buried PCBs

According to GE, dredging mobilized previously buried PCBs to downstream areas and deposited them on the sediment surface. Sediment traps were deployed immediately downstream of CU 10 and CU18, adjacent to CU11, and downstream of Phase 2 EGIA01B\_2, GI\_01\_KA and GI\_02\_KA dredge polygons. None of these areas were dredged in 2009 but highly contaminated sediments in the surface within these polygons could have been resuspended and captured within the traps by other events that normally occur during the year. Flows in 2009 were the third highest on record and the highest on record on the west side of Rogers Island due to construction of the rock dike in the east channel of Rogers Island. Figures 1 and 3 attached depict the PCB concentrations in the upper 2 inches in the vicinity of the traps. Figures 2 and 4 depict the locations of the sediment traps. Because adequate baseline data were not collected, GE's interpretation of the sediment trap data is questionable. The sediment trap study design cannot distinguish between sediment disturbed because of remedial activity or non-remedial events. Historic (1996) sediment traps were not placed in the same location as the Phase 1 sediment traps and therefore are not a suitable reference or point of comparison.

Moreover, the Phase 1 sediment trap data was only collected during remediation. Particle size distribution analysis documents sand comprising 38%-58% of the material in the traps deployed in July-August suggesting potential localized resuspension although infrequent high flows during this period also could have contributed to sediment redistribution unrelated to dredging. Also during part of this particular deployment period all dredging ceased for 5 days (August 7-11). No pre-dredging data from the same location is available. This is problematic due to the heterogeneity of sediment PCBs. Also, traps were not deployed to assess the natural movement of contaminated sediment under similar flow conditions. This is also a critical flaw given the observed changes in bathymetric surveys. In addition, cores were collected in 2009 for comparison to historic cores as part of the sediment trap study but only 7 out of 20 historic

coring locations (35%) were selected for re-sampling. Given the high surface sediment concentrations in the area of the traps and the high variability observed in co-located cores in the SSAP sampling, a more robust sampling design is necessary to evaluate changes in concentration. An analysis of the impact of a) deployment of the sediment traps, b) sediment disturbance and transport by boat traffic in the years prior to remedial dredging, c) uncontrolled releases of NAPL, and d) natural sediment movement within the system as documented by the changes in bathymetric surveys conducted between 2001 and 2009 do not appear to be accounted for.

#### Dredge-Related Increases in Fish PCBs Concentrations

According to GE, increases in PCB levels in fish were significant and widespread (Page ES-20). As a consequence, GE suggests that Upper Hudson River fish sampled in the fall of 2009 showed up to a 500% increase in PCB levels in the immediate area of dredging and increases of 40% to 60% were observed in fish collected around Albany/Troy area, 40 miles downstream of the 2009 dredging (Page ES-4).

GE claims about the magnitude and geographical extent of the impact of dredging activity on 2009 concentrations in pumpkinseed and forage fish are overstated, based on selective data treatment, and mostly ignore inter-annual and spatial heterogeneity.

GE's statistical analysis relies on comparisons of September 2009 data with data from the last 2 years (2007-2008) of baseline monitoring rather than the full 5 years of data from the Baseline Monitoring Program from 2004-2008. This effectively ignores the inter-annual variability well documented in the long-term monitoring record. For example, the long-term monitoring location from TD5 (east of Griffin Island just below CU-18) shows only a very slow decline in pumpkinseed PCB concentrations over 12 years (see Figure 1 in EPA's Phase 1 Report Appendix I-C). Statistical comparisons of the 2009 data with data from the full baseline period that take into account lipid and fish length show significant increases in PCB concentration on a River Section basis for pumpkinseed and forage in the Thompson Island Pool and pumpkinseed in River Section 2 and no differences for either species in River Section 3 or below the Federal Dam (Albany/Troy) (EPA Phase 1 Report Appendix I-C, Table 7). GE's Figures 3.3-22ab and 3.3-23ab support EPA's conclusions for 2009 TIP pumpkinseed and forage fish from the TIP. Similarly GE's Figures 3.3-17 to 3.3-21 show several of the fish species had lower or similar concentrations during 2009 compared to the average for the five prior years.

GE's analysis does not take into account significant spatial variability within each river section. The largest increases in 2009 mean concentrations were observed from stations (TD1 and TD5) immediately downstream of active CUs. One station within the Thompson Island Pool (TD4) did not show any increase in 2009 for pumpkinseed. Regression analysis of temporal trends in pumpkinseed PCB concentrations for each monitoring location shows that only stations TD1 and TD5 are most of the sample results outside of the 95% prediction limits (EPA Phase 1 Report Appendix I-C, Figures 1, 6, 11, 16, and 17).

GE also attributes all apparent increases to dredging-induced resuspension. Statistical comparison of temporal changes should take into account other factors that contribute to variations in fish PCB concentrations. Average daily flow from May through November 2009

was the third highest (behind 1990 and 2006) on record and, as a consequence of the rock dike across the east channel of Rogers Island, flows in the west channel were the highest on record (EPA Phase 1 Report, Figure I-3-1b). Also of note, PCB concentrations from the Feeder Dam reference station for yellow perch and forage fish were higher in 2009 than the baseline data.

GE compares fish PCBs under a natural recovery scenario and a remedial scenario arguing that “the levels predicted for the remedy and natural recovery converge”. GE Report, Pages 177-178). The comparison of predicted concentrations in fish between the selected remedy and natural recovery is based on an estimate of natural recovery that has been demonstrated to be significantly overestimated by the models used to make those predictions. This is evident from PCB concentrations in the top 2 inches collected during remedial design that were 2-3 times higher than model predictions (Field et al 2009) and current loads are approximately 3 times the predicted load at Waterford (as shown by EPA 2010 Figure I-3-21).

### Significant Reduction in Target Areas Remediated

Approximately 45% of the targeted Phase 1 areas were not dredged primarily due to significant underestimates of DoC and sediment inventory removal in each CU due to incorrect cut lines. NOAA recommends a proactive response that decreases the probability of underestimating depth of contamination and increases the likelihood that CUs targeted for remediation in a given year will be implemented and completed before the end of the dredging/navigation season.

### Less PCB Mass Removed than Planned

Given the number of problems encountered during Phase 1, it is commendable that the volumetric goal of sediment removal was achieved. Still, GE's Figure 4.3-1 downplays the amount of inventory removed relative to the total volume dredged because they conflate the extra (i.e., non-designed inventory) with the actual residuals (approximately 8 percent of total volume according to EPA). Figure 4.3-2 demonstrates that the residual volume dredged was small relative to the total volume removed. GE's estimate of mass removal is lower than EPA's. GE appears to have used a combination of SSAP cores collected during remedial design and Phase 1 remediation cores. Their approach likely results in an underestimation in mass, since both complete and incomplete SSAP were shown to underestimate DoC. An underestimate of DoC would in all likelihood contribute to an underestimate of PCB mass removed. EPA's report (Section 3.2, Appendix II-J) provides analysis supporting this interpretation. NOAA believes that more mass removal would have been achieved if dredging passes 2 and higher had correctly targeted remaining sediment inventory.

### Bedrock and Clay

GE contends that the presence of bedrock and clay significantly contributed to exceedances of EPS. Yet only 5% of areas were capped due to presence of clay<sup>2</sup>. According to GE dredging of clay areas required 779 hours thereby comprising 4% of the available dredging hours. EPA does

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<sup>2</sup> Glacial Lake Albany clay is the only sediment type including other clays that currently corresponds to an uncontaminated sediment type

not provide estimates of areas capped due to hard bottom but indicated they were associated with 6% of dredging delays. In contrast, delays due to scow unavailability contributed the most to downtime, comprising 26% of the total hours available for dredging and 44% of the non-dredge hours (see EPA Fig. III-3-4). This suggests that the presence of bedrock and clay were less significant contributors to overall compliance with EPS than other issues.

### Woody Debris

NOAA agrees with GE that woody debris contributed to incomplete closure of buckets and loss of PCB-contaminated sediments and NAPL to the water column. Proactive efforts should be required to ensure that the locations where contaminated woody debris is likely to be encountered during Phase 2 operations are better known prior to dredging. In addition, equipment upgrades and engineering controls should be required to minimize PCB release to the environment. Contract specifications should be modified to specifically address proper procedures for dredging debris. Improvements to on-loading, off-loading and transportation of debris laden sediments should also be implemented to expedite the handling and manipulation time to maximize productivity, minimize resuspension, and minimize releases of PCBs to the air.

### Excessive and Unwarranted Capping of the River Bottom

Twenty-five percent of Phase 1 area closures required caps due to schedule constraints (Mugdan 2010)<sup>3</sup> compared to 10% of the areas receiving caps per the residual standard and 2% due to clay and bedrock. Hence, over 67% of the capped areas required cap construction because remaining dredging could not be accomplished due to incorrect design depths (i.e., greater depth of contamination than designed for) and the lateness in the season and pending closure of the navigation canal. Capping of these areas left significant inventory behind and did not follow the established procedures for addressing residuals (< 6 inches thickness remaining after inventory removed). Consequently, 100% of CU1, located within the Fort Edward turning basin require installation of a cap to isolate several feet of inventory not characterized during the design phase. According to EPA, "The option for capping is not meant to compensate for any deficiency in the dredging design." (EPS V1, Page 60). Consideration should be given to removing Phase 1 capped inventory, especially that remaining in CU1 because CU1 is the most upstream CU on the east side of Rogers Island. Uncharacterized inventory could be remobilized if the cap was breached contributing to recontamination downstream. Also, capping in the boat basin diminishes future local navigational options for the river.

### Dredge Prism Development Approach

GE employed a 17-layer approach for interpolating depth of contamination using Inverse Weighted Distance averaging or IDW. In EPA's July 2004 final determination on the Phase 1 Dredge Area Delineation Report (DAD) dispute, EPA determined that kriging is the appropriate method for vertically delineating depth of contamination. EPA stated that "Vertical delineation of the Phase 1 and Phase 2 dredge areas shall be conducted in accordance with resolution of GE Issue C.2." (EPA 2004, Attachment 1, Page 2) "For the revised Phase 1 DAD, GE shall

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<sup>3</sup> Special Hudson River Foundation Seminar March 15, 2010, PCB Remedial Dredging: Phase 1 Results and Relevance to New York/New Jersey Harbor Estuary. <http://www.hudsonriver.org/>

complete a semivariogram analysis of the vertical extent of contamination in the Phase 1 candidate areas, conservatively estimating the nugget for use in kriging and/or in estimating uncertainty in the depth of contamination.” (EPA 2004, Attachment 2, Page 19) “The EPA-approved Remedial Design Work Plan (which is part of the RD AOC) states that “[l]ocally-based geostatistical analysis [i.e., kriging] will be used where weight-of evidence is equivocal.” (EPA 2004, Attachment 2, Page 19).

NOAA believes that there is no technical justification for employing IDW over kriging since IDW does not perform any better than kriging and the 17-layer approach is much more complex than kriging. The IDW approach also requires post-processing of data to smooth out the troughs and peaks and does not have the same capability of quantifying uncertainty in the DoC estimate that kriging has. The general rule for statistically evaluating data is to use the simplest method that provides the best results. In addition Step 1 of this process appears to only consider the depth at which 1 mg/kg PCBs are found, which is contrary to EPA's dispute determination. Step 7A of the dredge prism development process permits alterations to dredge prisms based on engineering factors such as thin sediment layers, presence of rocks and cobbles, shallow water and in-river and shoreline structures. As a general rule, NOAA does not support eliminating areas characterized by thin sediment layer areas, rocks and cobbles, and or shallow water from remediation.

As part of the July 2004 dispute decision on the Phase 1 DAD, EPA stated that during dredge area delineation GE “must compare the data points to the MPA and surface sediment criteria when performing the delineation but cannot ignore the uncertainty in such data points in a weight-of-evidence approach to evaluating whether they fall above or below the criteria” and “requir[ed] GE to consider the uncertainty in the data when evaluating the weight of evidence as to whether an area should be included within a dredge boundary.” NOAA recommends reducing the uncertainty in Phase 2 DoC through recalculations and data collection during Phase 2 design followed up by post-dredging DoC determinations where the bottom two 6-inch segments are both <1 mg/kg Tri+ PCB. Recommendations from the panel on how to account for uncertainties in dredge prism development and setting cut lines would be helpful.

The panel also could recommend that GE the use of alternative dredging equipment including specialty dredges<sup>4</sup> in order to increase the probability that thin sediment layers, sediments in shallow water and mixed in with rocks and cobbles could be removed during Phase 2 remediation. Thin layers of sediment present an available exposure pathway to biota, contribute to the PCB loading, and require remediation. The interstices of rock and cobble areas targeted for remediation likely contain elevated PCB-contaminated sediments that are a continuing source of exposure to biota. Shallow water areas are a significant portion of the Upper Hudson targeted in Phase 1 and Phase 2, are highly productive, and in general are more contaminated than areas further from shore. This combination of factors highlights the importance of remediating these areas to remove PCBs from the environment, thereby increasing the likelihood that remedial goals are achieved.

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<sup>4</sup> “Specialized dredges and other specialized equipment will be needed to manage debris, in-river obstructions, vegetation, and shoreline stability prior to and during dredging. This issue will be addressed during the Phase 1 and Phase 2 Intermediate Design stages, along with the specific locations and depths of dredging established through the DAD process.” (GE Preliminary Design Report, Page 5-7)

## **Attachment 2. General Comments on EPA's Report**

EPA's Phase I Evaluation Report identifies problems encountered during Phase 1 remediation, analyzing data to resolve those problems, and offers recommendations to the Phase 2 design and Engineering Performance Standards. NOAA supports taking a EPA's proactive approach in addressing underestimation of DoC and offers additional recommendations to further delineate PCB contamination during design phase and to help improve remedial activities (meeting Performance Standards?) in Phase 2.

### **Summary of Recommendations**

NOAA's primary recommendation is that the Phase 2 River Section 1 Final Design be revised to incorporate lessons learned from Phase 1. The following specific steps or revisions should be implemented to support a revised and improved Phase 2 design:

- re-evaluation of SSAP cores and Phase 1 remediation data and field logs;
- implementation of additional sampling to confirm DoC including depth of "native" sediments, presence of NAPL, location and depth of wood debris beginning in year 1 and year 2 Phase 2 River Section 2 CUs;
- re-calculation of DoC (e.g., interpolate DoC, use actual DoC, apply correction factor);
- redraw dredge prisms and cut lines to refine horizontal and vertical extent of dredging consistent with surface sediment and MPA targets; and
- build uncertainty into the design<sup>5</sup>.

The proposed changes to EPS and remediation approaches are more likely to achieve the intended goals if the sediment characterization and design-development approach deemed insufficient by EPA in the Phase 1 Evaluation Report is strengthened prior to implementation of Phase 2. EPA's proposed adjustments for Phase 2 rely heavily on Phase 2 post-dredging core collection results and dredging overcuts to fill in the data gaps highlighted by Phase 1 results. NOAA's recommended revisions below further strengthen the Phase 2 design by providing the additional information needed (before dredging begins) to fill identified data gaps and effectively use lessons learned from Phase 1, as well as serve as a stronger foundation for the habitat reconstruction effort.

Specific recommendations on issues pertaining to the Resuspension, Residual and Productivity Standards are provided below.

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<sup>5</sup> EPA July 26, 2007 Final Decision Regarding General Electric Company's Disputes on Draft Phase 1 Dredge Area Delineation Report and Draft Phase 1 Target Area Identification Report The Phase 1 Dispute Resolution Determination, GE Dispute 4: Use of Uncertainty in Analytical Data: "GE shall consider uncertainty in the SSAP analytical data in applying a weight-of-evidence approach to dredge area delineation.... EPA is requiring GE to consider the uncertainty in the data when evaluating the weight of evidence as to whether an area should be included within a dredge boundary."; and GE Dispute 8: Collection of Co-Located Cores: "For Phase 2 dredge area delineation (including Phase 1 candidate areas that are not selected to be dredged during Phase 1...,GE shall collect co-located cores for the purposes of geostatistical analysis (i.e., kriging) of the areal and vertical extents of contamination... The density of co-located cores shall be sufficient to define covariance at separation distances of 10 to 40 feet from the associated core location, in order to quantify the uncertainty in the spatial correlation".

## **Resuspension Standard**

### Revisions to Horizontal and Vertical Scope of Dredge Prisms

Modifying the dredge cuts to account for debris fields and missed inventory will allow for the use of larger buckets thereby reducing resuspension associated with unwarranted fine grading of inventory mischaracterized as residuals

Resuspension could also be reduced by smoothing the horizontal boundary lines rather than trying to dredge along jagged lines. This modification should also increase dredging and backfilling efficiency and improve productivity.

### Access/Navigational Dredging

Access dredging outside the boundaries of the navigation channel and within the navigational dredging should be planned for and built into the Phase 2 design. This will reduce resuspension by increasing boat draft and reducing boat traffic since larger barges could be used to transport dredge sediment and backfill and capping materials. Additional navigational dredging should be considered that also addresses resuspension from pleasure and commercial boats as any further reduction in resuspension benefits the environment. EPA envisioned significant navigational dredging and explained in the Responsiveness Summary (ROD 2002 Part 2 Book 1, pg 8-32) that it would "provide an expanded and safer capacity for recreational and commercial use of the river, and would likely enhance the area's economy through increased tourism." Moreover, one of the stated benefits of the Hudson River remedy is to "resume navigational dredging and maintain navigation in the Champlain Canal, New York Harbor, and other areas" (ROD 2002 Part 2 Book 1, pg 11-16). EPA envisioned "improving navigation along the Hudson River/Champlain Canal between Locks 1 and 6... to enable project-related equipment to navigate the Champlain Canal system with minimal interference from in-river obstructions ...[and] to limit, as much as possible, interference between project generated river traffic and traffic otherwise occurring on the river.... [by] clear[ing] out shoal areas and thereby restore the navigation channel to its designated width." (EPA 2002 ROD Part 2 Book 1, pg 10-2)

### Engineering Controls for and Monitoring of NAPL

Approaches should be developed during the Phase 2 design to identify areas where NAPL is most likely to be found based on Phase 1 remedial design and remedial action data. This could include developing a relationship between Phase 1 sheen and PCB concentration and between wood debris and NAPL or other factors that could highlight areas with a greater potential for NAPL. Phase 1 results suggest that operating within multiple CUs simultaneously led to insufficient personnel and equipment (e.g., NAPL moving under or around unsecured booms while workers removing sorbent material in another portion of the CU). This would provide information for planning minimum and contingency resources for Phase 2. Contract specifications should include detailed protocols for responding to NAPL sheens and should specify that appropriate equipment and personnel be made available to maximize control and capture of NAPL. The planned and contingent use of a variety of engineering controls to control NAPL would serve to reduce exceedances of the Resuspension Standard.

Consideration should be given to the use of dual silt curtains, one set anchored from the top (floating curtain), the other from the bottom (baffle curtain) to minimize the amount of NAPL by-passing the curtain, especially in lower flow conditions where this type of design might be suitable. A similar silt curtain design was successfully employed at the Reynolds nearshore excavation area on the St. Lawrence River in 2009 where different size anchors were used to secure the curtains depending on the energy of the environment. An evaluation should be performed to determine whether silt curtains should be designed with absorbent materials as an additional means to control NAPL.

Installation of sheetpiling should be considered in areas of high NAPL contamination but pilings should be driven into the sediments outside the influence of NAPL to minimize loss of NAPL outside the enclosure. NAPL should be collected on a regular basis within the enclosure to reduce releases to the water column when the sheet piling is removed, reduce PCB volatilization, and minimize exceedances of the Quality of Life Standard for air.

Other approaches for controlling NAPL should be evaluated. These include the use of bubble curtains in low flow conditions, multiple booms in a chevron configuration to direct the flow and NAPL to a collection site or away from a certain area, boom vanes in higher flow conditions, and other sorbent material.

Remedial monitoring should be modified to incorporate studies to assess releases of NAPL. NOAA tracks dispersed oil with fluorometers. This method is easy and the equipment is transportable providing an inexpensive qualitative approach for characterizing and tracking the spread of a 3-D plume. This method allows for the determination of the depth at which oil is found or identifies its presence when the sheen is no longer at the surface. NOAA uses the Turner design with special filters for hydrocarbons. Samples for quantitative analysis are collected once oil is qualitatively detected. This approach should be evaluated for monitoring the Phase 2 NAPL PCB plume. In addition, Phase 2 design, sampling should assess areas not targeted for remediation to determine whether NAPL released during Phase 1 remediation contaminated sediments above surface concentration or MPA ROD cleanup triggers. Likewise, post-construction monitoring should be conducted in unremediated areas to confirm they are below the cleanup triggers.

#### Water Column Monitoring and Exceedances of the 500 ng/l Standard

NOAA supports EPA recent announcement that water will be supplied to the Towns of Halfmoon and Waterford for the duration of Phase 2 dredging. NOAA recommends that the standard set to protect water supplies in the Upper Hudson be eliminated since provision of water supplies makes the standard obsolete. Revisions to the standard (e.g., location of and value of far-field exceedance that should trigger action) or provision of water should be considered to protect localities using the upper portion of the Lower Hudson as a water supply in later years of the dredging program.

## **Residual Standard**

### Vertical Extent of Contamination

EPA outlines different approaches for determining DOC in Phase 2 in the Phase 1 Evaluation Report. EPA describes a proactive approach that incorporates data gap sampling and modifications to the Phase 2 design based on Phase 1 findings (See e.g., Pages Intro-18, Page Intro-21, Page II-14, Page II-15, Page II-18, II-40, III-46, Appendix I-H). These steps include

- increasing the interpolated depth by 18 inches for incomplete cores;
- increasing the depth by at least 3 inches below the bottom of core segment below 1 ppm PCBs for complete cores;
- data gap sampling in areas with clusters of incomplete or abandoned cores including coring through wood debris;
- additional sediment sampling along CU boundaries immediately adjacent to shoreline areas to better define the DoC in these areas and fill in any data gaps (i.e., such as toe of slope of the shoreline bank);
- removal of woody debris to below wood horizon prior to analyzing sediments for PCBs; and
- use of overcuts.

Elsewhere in the report (e.g., Page II-32, Page II-69 to Page II-72), EPA outlines an approach that uses:

- post-dredging cores to characterize DoC by analyzing 2 feet length or shallower or to depth that demonstrates 1 foot (2 core segments) of sediment below 1 mg/kg total PCBs;
- full excavation of woody debris fields below established cut lines;
- the use of overcuts (9-18 inches for inventory sediment, and at least 3 inches for residual sediment) to compensate for DoC uncertainty; and
- minimize data gap sampling to avoid scheduling delays.

These approaches do not have to be mutually exclusive. However, stronger emphasis should be placed on minimizing the uncertainty in DoC during Phase 2 design to maximize inventory removal in the first dredging pass. NOAA recommends not using post-dredging cores and encounters with unexpected wood debris to guide sampling and removal below design cut lines during subsequent dredging passes. Development of a revised DoC for Phase 2 remediation should not use the same median interpolation of surface concentrations and mass per unit area (MPA) as these methods poorly described DoC during Phase 1 (see comments under subheading Dredge Prism Development).

Revision of DoC estimates should rely on better characterization, re-delineation, and re-interpolation of DoC and resetting of cut lines as part of the Phase 2 design. Revised DoC estimates would serve to

- minimize the number of dredge passes required to remove inventory;
- utilize the largest buckets for inventory dredging reducing resuspension tied to unnecessary fine grading of inventory sediments;
- minimize the down time required for collecting and analyzing post-dredging cores to determine DoC once dredging has commenced thereby increasing productivity; and
- maximize equipment selection and use for actual residual removal.

During development of the EPS, EPA assumed that re-dredging could require half of the total time spent on the initial dredging of inventory. During Phase 1, significantly more time was spent on characterizing and removing inventory below the design cut lines and fewer of the dredge passes focused on removing residuals (only about 8% of sediment volume removed was residual sediments).

Complete cores underestimated DoC by more than 6 inches 65% of the time while incomplete cores similarly underestimated DoC about 75% of the time. This suggests that an adjustment of 6 inches should be considered for the complete cores rather than the proposed 3 inches. Also EPA should clarify whether the adjustments to the complete cores is before or after interpolation. They should also provide their justification if the added depth is applied at a different stage of the dredge prism development process.

In addition, significant changes were documented between 2001 and 2005 and between 2005 and 2009 bathymetric surveys. Greater erosion and deposition was observed during the early period with the maximum erosion and deposition much larger than the accuracy of the survey. For the latter comparison, erosion was primarily observed in West Channel Rogers Island and East Griffin Island CUs. The potential for shifting bottom conditions adds to the uncertainty for Phase 2 because it is not known if the eroded sediment deposited outside areas targeted for Phase 2 remediation that might qualify for removal based the MPA criterion.

#### Horizontal Extent of Contamination

NOAA supports refinement of the lateral extent of remediation as part of the Phase 2 design process. The horizontal extent of Phase 1 and Phase 2 remediation was developed from an interpolation of surface concentrations and mass per unit area (MPA).

Phase 1 results suggest that MPA could be underestimated in incomplete cores with uncharacterized inventory at depth. Likewise, Phase 1 outcomes confirm the weak relationship in PCB concentrations for spatially related sediment cores, suggesting that the horizontal extent of contamination could be underestimated.

#### Capping

A goal of the Hudson River remedy is 95% to 98% PCB inventory removal (EPA 2004 EPS Vol. 3). Capping was envisioned as a secondary step to address residual PCBs primarily confined to isolated areas of river bottom that pose technical difficulties, e.g., outcrops of bedrock, boulder fields. According to the EPS (Vol. 1, page 60), “[t]he option for capping was not meant to compensate for any deficiency in the dredging design.” Nevertheless, caps were constructed in 9 of the 10 CUs for a total of 36% of the original Phase 1 dredge areas. These caps covered 18% to 100% of an individual CU (0.9 acres to 3.4 acres) and were in large part installed due to underestimation of DoC and that led to multiple dredging passes and CUs remaining open until end-of-the-year schedule constraints. Caps due to schedule constraints comprised 25% Phase 1 areas closed or about 67% of the area capped. Caps installed to address residual PCBs were used to close 10% of the remediation area or about 27% of the capped area. Most capping took place because of poor characterization of inventory, DoC and scheduling constraints (i.e., CUs 1, 2, 3, 4, 7, 8 and 18) and not because of inaccessible residual sediment contamination (i.e., CUs 5 and

6). NOAA encourages EPA to minimize capping of inventory and residual PCBs by expending greater effort upfront during design to determine location and thickness of wood debris, location of NAPL, depth of "native" uncontaminated sediment, better estimates of DoC (e.g., sampling, interpolations, use of correction factors, etc.) and applicability of specialty equipment employed for particular conditions (e.g., obstructions, bedrock). NOAA agrees with EPA that Phase 2 capping due to schedule constraints should be minimized through a better knowledge of the scale of inventory removal within each CU. NOAA also believes that seasonal constraints due to closure of the navigation canal should not be the impetus for unnecessary capping such as occurred during Phase 1. According to EPA, cap placement largely addressed residual sediment (< 6 inches thick) contamination and not inventory (> 6 inches thick) contaminated sediment (Intro-20). NOAA disagrees with this representation of the data. About 33% of the area capped isolated inventory<sup>6</sup> while about 27% of the caps covered residual sediments.<sup>7</sup>

At least 2 feet of backfill was placed on top of approximately 3.2 acres of caps in an effort to promote SAV recovery by returning the depth to the photic zone. Capping of residuals or inventory that could be removed through better site characterization and design, and improved or other removal methods, should not be transformed into an approach for reconstructing habitat destroyed or impaired through site remediation. Further, returning a dredged area to the photic zone may not return an area to pre-existing bathymetry or to optimum conditions for SAV re-establishment.

NOAA also recommends changing the proposed revisions to the Residual Standard to remove the allowance for capping sediment inventory with DoC greater than 6 inches after four dredging passes (See Table IV-3). Sediment inventory should be fully characterized and removed unless technically impracticable. EPA's Case D (Recalcitrant Residuals and Inventory Present) allows for the possibility that, with EPA approval, inventory could be capped after four dredging passes if the CU average is >1.5 mg/kg or DoC is >6 inches. NOAA does not support capping of inventory, especially if it has not been properly characterized. Our concern about excess capping of missed inventory could be addressed by revising Phase 2 based on Phase 1 findings and Phase 2 data gap sampling and re-interpolation of the dredge prisms.

Capping within the navigational channel should allow for at least 14 feet water depth to avoid damage to the cap during future navigational maintenance dredging. This may require additional dredging to not exceed the depth allowance. The navigational channel is maintained at 12 feet and navigational dredging assumes a cut to 12 feet plus a 2 foot overcut. Also placement of caps in the navigational canal that don't have an upper armor layer may be more difficult to distinguish during navigational maintenance dredging. Consideration should be given to re-opening CU's where caps were installed in water depths of 14 feet as they risk being damaged during future maintenance dredging.

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<sup>6</sup> Based on EPA Phase 1 Evaluation Report, Page Intro-20, Bullet 3: "Excluding CU-1 [about 3.4 acres] only 16 of the capped nodes (representing about 2.3 acres) had contamination extending deeper than 6 inches.

<sup>7</sup> Based on percentages in Mugdan (2010), slide 56.

### Nearshore Remediation

In addition to altering grid size and grid shape, NOAA recommends that EPA reconsider Step 9 of the dredge prism development process that allowed the incomplete removal of PCBs in the nearshore environment. Only the top 2 feet of PCBs in nearshore areas is dredged regardless of depth of contamination unless concentrations exceed 50 mg/kg at deeper depths. This approach permits incomplete removal of PCBs in important habitat areas of the river and degrades habitat through cap construction. EPA envisioned the removal of more than 2 feet of sediment in the nearshore environment.<sup>8</sup> Moreover, the placement of a cap was not intended as a substitute for dredging inventory except in special cases. Its primary purpose was to address residuals. The example provided in the EPS where capping of inventory might be necessary was rocky areas, not nearshore areas.

During Phase 1 remediation, partial or full engineered caps were installed in five of nine CUs. It was demonstrated during the Reassessment that nearshore sediments pump PCBs into the water column providing an exposure route to receptors. EPA concurs that the Phase 1 approach should be refined but is limiting its recommendations to an alteration to grid shape and size. Tapering into the shoreline is an approach that would maximize contaminant removal, minimize hardening and allow for reconstruction of the shoreline topography and habitat.

### Revision of Residual Standard

NOAA supports retaining a trigger of 1 mg/kg Tri+ PCBs for meeting the Residual Standard and allowing backfill where appropriate. NOAA also supports the requirement to dredge remaining inventory even if four passes have been completed. EPA is proposing the "Standards Met" category to allow backfilling in CUs where average Tri+ PCB is <1.5 mg/kg rather than  $\leq 1$  mg/kg. EPA is proposing a Case B, the "Widespread Residuals Present" category. This shifts the requirements to Case D, the "Recalcitrant Residuals or Inventory Present" category after 2 dredging attempts. Case D allows for either re-dredging or capping (through petition to EPA) of recalcitrant residuals or inventory where CU average Tri+ PCB is >1.5 mg/kg, and/or DoC > 6 inches and at least 4 dredge passes have been completed. This required action should not be used to unnecessarily cap uncharacterized inventory. It is not clear why it is described as a treatment for residual PCBs if the DoC is greater than 6 inches.

### Backfill Testing

EPA's original Residual Standard required backfill testing under the 20-acre joint evaluation process scenario. Specifically there was a requirement that "backfill surface concentrations

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<sup>8</sup> "Where shoreline disturbance will exceed three feet of sediment removal, the stabilization will include log or wood crib revetment in addition to the vegetative mattress.... Based on the area determined to require remediation, the length of shoreline restoration is currently estimated to be approximately 17 miles. For the selected remedy it is anticipated that approximately 20 percent of the shoreline stabilization will consist of hydro-seeding, 50 percent include the placement of vegetative mattress, and the remaining 30 percent would require a log or wood crib revetment in addition to the vegetative mattress. In very limited areas where significant erosion has been observed, structural measures such as rip-rap may be required to prevent further degradation of the shoreline." (ROD Part 3, Page 10-23)

remain below 0.25 mg/kg Tri+ PCBs” and “backfill must be dredged, replaced, and retested or remedied via another method with input from EPA” if concentrations exceed this criterion (Vol 1, pg. 65). EPA’s revised Residual Standard eliminates backfill testing completely. Verification sampling should be conducted on placed backfill under all of the scenarios presented in the Revised Residuals Standard table (Table IV-3) and on non-armored cap material to confirm that post-construction concentrations meet the 0.25 mg/kg criteria. For example, EPA expected that isolation cap material would “remain physically stable and that concentration of Tri+ PCBs in the upper 6 inches will remain at concentrations less than or equal to 0.25 mg/kg (EPS V3, Page 61). NOAA is concerned that sediment and NAPL plumes generated during Phase 2 remediation similar to those observed during Phase 1 could contribute to recontamination of backfill and cap material. NOAA’s preference is to require random but representative confirmatory testing of backfill post-placement to document that the backfill surface achieves the desired reduction in PCBs and to confirm that significant recontamination of the backfill is not occurring.

### Dry Excavation of Some Areas

Consideration should be given to remediating some areas in the dry as a way to reduce resuspension, for example, backwater areas such as West Channel Griffin Island, Hot Spot 13, and Hot Spot 35. In past years, some pool elevations have been lowered for dam and lock maintenance during the dredging season. GE could take advantage of these opportunities to excavate in the dry excavation<sup>9</sup>, thereby significantly reducing releases of PCBs including NAPL to the river.

## **Productivity Standard**

### Sequencing of Dredges

Sequencing should occur from upstream to downstream to avoid recontamination of remediated areas. Still, eddy formation and reverse transport (from downstream to upstream) was observed during Phase 1. Engineering controls should be implemented to control releases and potential for recontamination should be built into scheduling decisions. Remediating multiple CUs simultaneously yet not operating simultaneously in areas with high silt and clay contents is likely to pose logistical and contaminant transport issues and affect productivity.

### Wood Debris and NAPL

EPA proposes excavation woody debris that is encountered during dredging. NOAA supports further characterization of the Phase 2 areas for wood debris and NAPL during Phase 2 design and then complete removal of contaminated debris during Phase 2 remediation. If woody debris is encountered where contamination is unknown and is buried under sediment, it should be tested to determine whether the debris and sediment below the debris is below clean up triggers. Also

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<sup>9</sup> “Excavation “in the dry” is typically accomplished by isolating the area of sediment to be excavated using methods such as earthen embankments, sheetpile wall systems, or portable dams.... Given these concerns, application of this sediment removal technique is limited to select portions of the Upper Hudson River that lend themselves to hydraulic isolation (e.g., shallow backwater areas and shallow near shore areas).” (PDR, Page 5-15)

excavation of sediment below contaminated woody debris should be tested to confirm that it meets the Residual Standard or whether additional removal is required.

Some of the Phase 2 design assessment can be based on existing information, but additional field sampling is appropriate for confirmatory purposes. GE's Hudson River database and/or field records likely contain summaries of field and laboratory observations of wood debris in cores, oil sheens when coring, and presence of oil or oil smell in core when processing. The SSAP core and Phase 1 remedial action sample information should be revisited to glean information about the presence of wood debris and NAPL. The relationship between findings reported in design notes, field logs, database and remedial observations should be determined to evaluate how reliable the existing data is in anticipating conditions in Phase 2 and in particular in each river pool. NOAA also recommends additional sampling in Phase 2 areas to determine or confirm revised depths of contamination and verify presence of wood debris and NAPL. This should first be performed in Phase 2 River Section 1 areas and results used to guide data gap needs for River Sections 2 and 3. More of an emphasis might be placed on areas with incomplete and abandoned cores but sampling should also occur in areas of complete cores to verify estimated DoC as DoC was underestimated for all core types (see e.g., EPA Report Intro-21, Bullet 4).

Significant problems were encountered during dredging due to the presence of excessive quantities of unanticipated wood debris and NAPL. Contract specifications should be revised requiring appropriate type and quantity of personnel and equipment to efficiently and effectively remove wood debris and collect, contain and control NAPL. Monitoring focused on NAPL releases and containment should be incorporated in the OMM Plan.

### Overcut

EPA in estimated inventory removal included an overcut (ROD (2002), Part 2, Book 2, Page Post-Dredging PCBs-1). This approach was not employed during the development of Phase 1 dredge prism and contract specifications. In the subject document, EPA recommends that uncertainty in Phase 2 DoC be identified during design and incorporated into the dredging (EPA Report, Page II-15). EPA recommends a 9 inch inventory overcut for DoC based on complete cores, an 18 inch inventory overcut for DoC based on incomplete cores (e.g., EPA Report, Page II-69, Page II-70) and at least a 3 inch residual overcut (Page II-71 to Page II-72, Page II-75)). Elsewhere the report suggests lowering the dredging design cut line by approximately 9 inches (EPA Report Page III-46). NOAA assumes EPA is referring to the incorporation of a 9 inch uncertainty cut line into the design rather than adjusting the design cut line with an additional overcut allowance.

NOAA supports a minimum of 12 to 15 inches overcut for design and post-dredging inventory where DoC development is driven by complete cores since about 65% of the 27 collocated Phase 1 Level 1A cores differed by 12 inches or more. NOAA also supports up to a 6 inch overcut (e.g. double the residual sediment thickness) for residual dredging, especially if the vertical extent of Phase 2 dredging is not reformulated during design and the accuracy of the bathymetric surveys is  $\pm 6$  inches. During Phase 1, the dredging depth exceeded design depth by an average of 1.5 feet and as much as 13 feet (~3.8 times design depth) in CU-1 with 1 to 3 feet of contamination remaining prior to installation of an engineered cap. A maximum of 7 feet additional depth was removed in other CUs. The final removal volume was 1.9 times the

dredging volume accounting for corrections for setbacks around obstructions and corrections in bathymetry. The final adjusted (for setback/bathymetry) mass of PCBs removed was 1.8 times greater than the adjusted design mass. The net increase in volume dredged during Phase 1 was 82,100 CY over an area of 44.86 acres, or an additional 1.13 feet of dredging depth over the area (estimates exclude CU-1).

#### Smoothing the Horizontal Boundary

Lateral boundaries of the Phase 1 CUs were extremely irregular creating undulating or sharp edged borders. The Phase 2 CUs have similarly jagged or scalloped borders. Smoothing of the horizontal boundary lines should increase dredging and backfilling efficiency and improve productivity.

#### Dredging Simultaneously in Multiple CUs to Maximize Productivity

During Phase 1 remediation, design specifications limited dredging to two CUs. GE petitioned and EPA subsequently authorized GE to dredge three CUs simultaneously when inventory dredging targeted by the design was completed in the first CU. This resulted in up to nine CUs being dredged concurrently and approximately 36% of the opened CUs being capped to address inventory not built into the design due to seasonal constraints. In the Phase 1 Evaluation Report, EPA concludes that Phase 2 dredging should be allowed in multiple contiguous CUs. The only limitations EPA sets are related to navigation and logistics and the stipulation that closure should occur sequentially from upstream to downstream. NOAA recommends additional limitations and stipulations on conducting remedial operations in an unlimited number of CUs. Problems similar to those observed during Phase 1 could result in underestimation of design depth and volume, which could create the potential for lack of appropriate number and type of personnel and equipment.

In the proposed modification to the Residual Standard, EPA allows remediation of a CU to occur in more than one dredging season in part to reduce the amount of inventory capping. NOAA is highly supportive of this approach since it will reduce unnecessary capping but recommends that EPA balance the number of opened CUs with attainment of the Residual and Resuspension Standard. Many of the problems encountered during Phase 1 derive from providing equal emphasis on achieving the three Engineering Performance Standards.

NOAA recommends that the Productivity Standard be subordinate to the Resuspension and Residual Standards where all three standards cannot be met simultaneously. EPA should also minimize the number of opened, incompletely remediated CUs at the end of the each remedial construction season by managing the number of simultaneous operations throughout the dredging season and maximizing complete removal within the entire CU or discrete portion of the CU to minimize recontamination prior to the subsequent remediation season. \\

#### Backfill and Cap Material Tolerances

EPA reports that backfill and capping material was placed to within the tolerances specified in the design without undue difficulty. NOAA recommends reconsideration of the backfill and cap tolerances to ensure adequate placement of backfill for habitat reconstruction (unconsolidated

river bottom (UCB), aquatic vegetation beds (SAV), riverine fringing wetlands (RFW)), to return dredged areas to original bathymetry in nearshore areas, and for sequestration of PCBs under the cap. Tolerances for nearshore and RFW backfill were  $\pm 6$  inches, and  $\pm 12$  inches for 15% additional backfill. An average of 12 inches was set for the 1 foot residual backfill with a minimum thickness of 9 inches for 100 sq ft. NOAA recommends that a tolerance of  $\pm 0.25$  feet should be set for nearshore backfill as its placement is designed to return predetermined elevation controls (e.g., 117.5 feet to 119 feet elevations in River Section 1) to original bathymetry. A tolerance of a -0.25 feet to +1 foot should be set for SAV bed reconstruction. Placement of backfill for SAV bed reconstruction should not reduce water depths to less than 2 feet; excess backfill should require removal. RFW elevations should be created as designed  $\pm 0.1$  foot. Wetland plants have strict zonation requirements for growth and survival and changes in a few inches of elevation can make the difference between successful and unsuccessful plant establishment.

Maximum tolerances for Type A and B Isolation Caps were twice the design thickness. Minimum average thickness for 12-inch thick design Type A and Type B Isolation Caps Isolation Caps was 12 inches in 25 sq ft. Minimum average thickness for 15-inch thick design Type B Isolation Caps Isolation Caps was 15 inches in 25 sq ft. Minimum average thickness for the 9-inch isolation layer within the 15-inch thick design Type B Isolation Caps Isolation Caps was 9 inches for 100 sq ft. NOAA recommends that the tolerance for Isolation Caps should be a minimum thickness of 12 inches for the Type A Isolation caps and the Type B Isolation low velocity caps and 15 inches for the medium and high velocity Type B Isolation caps. Minimum and maximum tolerances should be set for each of the layers within the cap such that the final cap meets the minimum design thickness and does not exceed twice the design thickness. Additional precautions should be included to avoid converting open water to upland in nearshore areas or interfering with navigational maintenance dredging.

#### Backfilling: 3:1 Side Slopes

EPA observed higher PCBs in post-dredging sediment cores at lower elevations than at the equivalent elevation in the adjacent cores collected after previously completed dredge passes and attributed this finding to the heterogeneity of the contaminated sediments. Sloughing/slumping of contaminated sediments from adjacent non-targeted sediments including sediments cut on a 3:1 side slope could also contribute to the higher concentrations in later dredge pass verification samples. Some of these adjacent areas may have exceeded the MPA trigger if complete cores were recovered or alternative procedures were employed for determining the horizontal and vertical dredge boundaries. Improving the design to minimize the amount of uncharacterized inventory could reduce potential recontamination issues. Increasing the shallowness of the slope could reduce the potential for resuspension and redistribution of unstable side slope sediment.

Instead of achieving a presumed stable slope of 3:1, a slope of 4.5:1 or 6:1 was achieved backfilling CU-17 with Type 1 backfill. In response, EPA agreed to the use of Type 2 backfill as the base and Type 1 graded over it. For Phase 2, EPA proposes that the gradation and utility of Type 1 backfill be reviewed and appropriate changes be made in the Phase 2 design. NOAA recommends that EPA consult with its fluvial geomorphologist about slope stability issues and re-evaluate the stability of a 3:1 slope, especially in areas that would not impact the navigation channel. NOAA also requests that EPA reconsider the grade of the side slope and in particular

consider a shallower grade in the design, as an alternative to substituting different backfill or changing the gradation of Type 1. The natural resource agencies negotiated changes to the backfill gradations to improve their quality so as to better serve the objectives of the habitat reconstruction efforts, and would prefer not to modify or eliminate Type 1 backfill thereby compromising the growing medium for plants if other solutions are available to address slumping.

Backfilling: 15% Additional Backfill for SAV Habitat Reconstruction

EPA proposes a review of the adequacy of the 15 percent backfill allotment and overall approach to achieving design elevations once Phase 2 SAV planting beds are identified. NOAA supports EPA's finding that the 15% additional backfill allotment provided insufficient volume for reconstructing Phase 1 SAV beds. NOAA also supports EPA's proposal to reconsider the approach for reconstructing Phase 2 SAV beds but offers an alternative approach for when and how to design and reconstruct the SAV beds. NOAA prefers that the overall approach be based on providing adequate backfill for optimal re-establishment of SAVs removed during Phase 2 remediation and that the constraints set by the 15% backfill allotment and the guiding principles linked to those limitations be eliminated. Appropriate elevations (preferably a return to original bathymetry) should be provided through backfill placement for all SAV beds destroyed during remediation whether they are being reconstructed through active planting or natural recolonization methods. The review of the adequacy of the 15 percent backfill allotment and the overall approach to supporting submerged aquatic vegetation planting bed elevations should be developed in advance of identifying Phase 2 SAV planted and unplanted bed reconstruction areas. Two-thirds of the SAV beds targeted for Phase 2 reconstruction are achieved through natural recolonization; EPA's proposal focuses on the planted beds only. Further, both the approved Phase 1 and Phase 2 design documents place 15% additional backfill in former SAV beds without regard to reconstruction method (planting vs. natural recolonization). EPA should reconsider the benefits of reusing clean dredge spoil material to meet Phase 2 backfill placement volume needs.

The deficit in backfill for SAV bed reconstruction required modifications to the design such that the distribution of the 15% backfill allotment differed dramatically from the design. Approximately 21,105 CY, or 93 percent<sup>10</sup> of the allotted 22,748 CY of 15% additional backfill, were placed in CUs 3 through 8 and none was placed in CUs 2, 17 or 18. This left only 7% of the total allocation available for reconstructing SAV beds in CU-9 to CU-16 that should have been dredged in 2009 as part of Phase 1 remediation compared to the 23% design estimate (5187 cy). Phase 1 results demonstrate that 15% additional backfill allotment for reconstruction of SAV beds provided inadequate backfill volume to return to SAV bed design elevations, in large part due to greater than anticipated depths of sediment contamination. The allotment process provides for a further deficit of backfill volume to return the SAV beds to original elevation.

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<sup>10</sup> Upon disassembly, rock from the East Rogers Island rock dike was used in some of the West Channel Rogers Island CU's to reduce the amount of 15% additional backfill required to reconstruct SAV beds.

### Access/Navigational Dredging

Access dredging outside the boundaries of the navigation channel and within the navigational dredging should be planned for and built into the Phase 2 design. This will increase productivity by increasing access of larger vessels thereby reducing the amount of down time the dredge operators waited for empty scows to return to the dredge areas.

### Dry Excavation of Some Areas

Consideration should be given to remediating some areas in the dry as a way to increase productivity, for example, backwater areas such as West Channel Griffin Island, Hot Spot 13, and Hot Spot 35. Efforts could also be made to coordinate potential draw downs in pool elevations for dam and lock maintenance during the dredging season with dry excavation of other areas that would temporarily be above water.

### **Specific Comments**

Page Intro-16, Bottom to Intro-17, Top: *"It is concluded from the Phase 1 data that the Residuals Standard can be appropriately implemented and readily achieved during Phase 2 if the DoC is better characterized and appropriate overcut intervals are added to address uncertainties in the design cut lines."*, Intro-17, Bottom, *"The SSAP core information should be revisited in light of the Phase 1 results to better estimate DoC for Phase 2 (including CUs planned but not completed in Phase 1)."*, Page II-1, Para 2, *"It is concluded from the Phase 1 data that the Residuals Standard can be appropriately implemented and readily achieved during Phase 2 if the depth of contamination (DoC) is better characterized and appropriate overcut intervals are added to address uncertainties in the design cut lines."* Chapter 2 conclusions differs, suggesting that post-dredging sampling and overcuts should be the primary method for detecting and achieving efficient removal of inventory not captured by the current design.

Page Intro-20, *"Cap placement largely addressed residual sediment contamination (less than 6 inches thick), and not inventory (greater than 6 inches of contaminated sediment). Excluding CU-1, only 16 percent of the capped nodes (representing about 2.3 acres) had contamination extending deeper than 6 inches."*, and Page II-61, Bottom, to Page II-62, Top, *"In six of the eight CUs that were capped, the average Tri+ PCB concentrations of the capped nodes exceeded 27 mg/kg and more than 1 node contained Tri+ PCB concentrations greater than 15 mg/kg. For 3 CUs (i.e., 1, 2, and 8), a cap was placed after the last dredging pass even though the average Tri+ PCB concentration in the CU was greater than 6 mg/kg. The decision to place a cap in CUs 1, 4, and 8 was approved by EPA because further dredging could not be implemented due to impending closure of the navigation season."*: These statements may not be internally inconsistent statements but they send different messages. The latter statement, related to seasonal constraints, better explains the need for the significant area of capping during Phase 1 remediation. See slide 56 EPA March 2010 presentation to the public.

Page II-18, Top. *"Alternate sediment core collection methods that can penetrate wood debris should be considered for Phase 2, as the data gaps associated with the large number of*

*incomplete cores were likely a contributing factor to the underestimated design cut lines.”* Proactive core sampling and test pits should be conducted during design and cut lines reset.

Page II-32, Para 3, *“For Phase 2, better estimation of DoC and better assurance that initial dredging will remove the targeted inventory are needed. To reduce the amount of additional dredging required after the initial dredging pass, the complete sediment column, to the depth of uncontaminated sediment, should be analyzed immediately after collection for every post-dredging core; and at a minimum, every core must have two contiguous segments below 1.0 mg/kg to establish the DoC”*: This process relies heavily on post-dredging rather than pre-dredging characterization and is likely to present a false sense of efficiency and reliability and could contribute to slower than anticipated productivity. NOAA supports revisions to the Phase 2 design. See comments above on Vertical Extent of Contamination.

Page II-38, Last Para, *“The post-dredging elevations were within 3 inches of the design elevations for only 18 percent of the cores, indicating that for majority of the SSAP cores re-dredging was required.”* This finding suggests the importance of additional Phase 2 design sampling, revisiting of dredge prism development, and setting of cut lines.

Page II-42, *“Before collecting a grab sample or abandoning a location the location should be moved within a 20-ft radius around the assigned sampling location multiple times, or according to field judgment to account for significant variability in bottom conditions”*.”: Since post-dredge sampling is conducted on nodes placed no more than 80 ft apart, a 25-ft radius circle around the assigned sampling location should be used to increase the probability of collecting sediment without overlapping areas from adjacent node sampling.

Page II-52, Last Para., *“This process is repeated, substituting 0.024 mg/kg for the highest remaining value and working down the list of ranked values, until the mean of the modified set of results drops to 1 mg/kg Tri+ PCB rounded to a whole number (effectively 1.49 mg/kg).”* and Page II-74, Para 2, *“The new implementation will also target a concentration of 1.0 mg/kg Tri+PCB and only permit a mean of 1.49 after the last pass”*: A value of 1.49 should be rounded to 1.5 mg/kg for compliance with the Residual Standard.

Page II-54, Top, *“For locations where a compliant node is surrounded by noncompliant nodes, the area associated with the compliant node should be dredged to the average depth of the surrounding non-compliant nodes.”* Please clarify that this dredging is to the average depth of non-compliant nodes plus the overcut. NOAA's recommendation would be to use the maximum rather than the average depth of non-compliant nodes. Our proposed approach is more likely to capture the missed inventory and increase productivity. Phase 1 results documented the lack of confidence in identifying compliant nodes as subsequent sampling rounds recorded compliant nodes as non-compliant. Also, even in CUs 17 and 18 where all SSAP cores were complete, DoC was significantly underestimated.

Page II-69, Para above item 1, *“EPA considers the extensive increase in remediation volume during Phase 1 and the high degree of variability in the DoC to be the major concerns requiring redress in the Residuals Standard for Phase 2. Both of these issues can be best addressed by adjustments to the core collection process and the addition of overcutting (a design change),*

*which are described below*”: This statement appears to conflict with the proactive approach described in the Introduction.

Page II-69, Bottom to Page II-70, Top: “*While some additional coring may be needed prior to or during Phase 2, an extensive preHudson dredge sampling to obtain additional cores is unlikely to greatly refine these estimates.*”: NOAA believes that EPA’s approach could still significantly underestimate DoC and lead to problems of achieving compliance with EPS.

Page II-70, “*It may be necessary to reevaluate the DoC in some areas with a low fraction of complete cores by an alternative sampling method, such as split spoons or Shelby tubes, that can penetrate the full thickness of contaminated sediment in areas where vibracoring met refusal (e.g., areas containing wood debris). This coring does not need to be completed prior to the initiation of Phase 2, so long as sampling procedures and a robust method for interpolation of the data and incorporation of overcuts, to arrive at Phase 2 design cut lines, are in place.*” See comments about Vertical Extent of Contamination.

Page II-71, Item 2, “*terms “residuals core” and “inventory core” should be abandoned in favor of “post-dredging” core.*”: NOAA is concerned that if the distinction between residuals and inventory is dropped for Phase 2, this will provide a disincentive for distinguishing between sediment inventory and sediment residuals.

Page II-71, Item 3, “*The design depth of cut should be adjusted to include an overcut of 9 inches when sediment inventory is targeted (and 18 inches where the DoC is based on incomplete cores). For residual sediment contamination of 6 inches or less, at least 3 inches of overcut*” and; Page III – 48, Section 5.5 Para 1, “*Based on the experience gained in Phase 1, the Phase 2 design should require dredging at least to the projected 1 mg/kg Total PCB horizon and an overcut of up to 6 inches, based on revised dredge cut lines. That overcut should be extended up to 9 inches in areas where existing cut lines must be used.*”: These and other statements about the thickness of the overcut do not appear to be consistent. See General Comments, above, on overcuts.

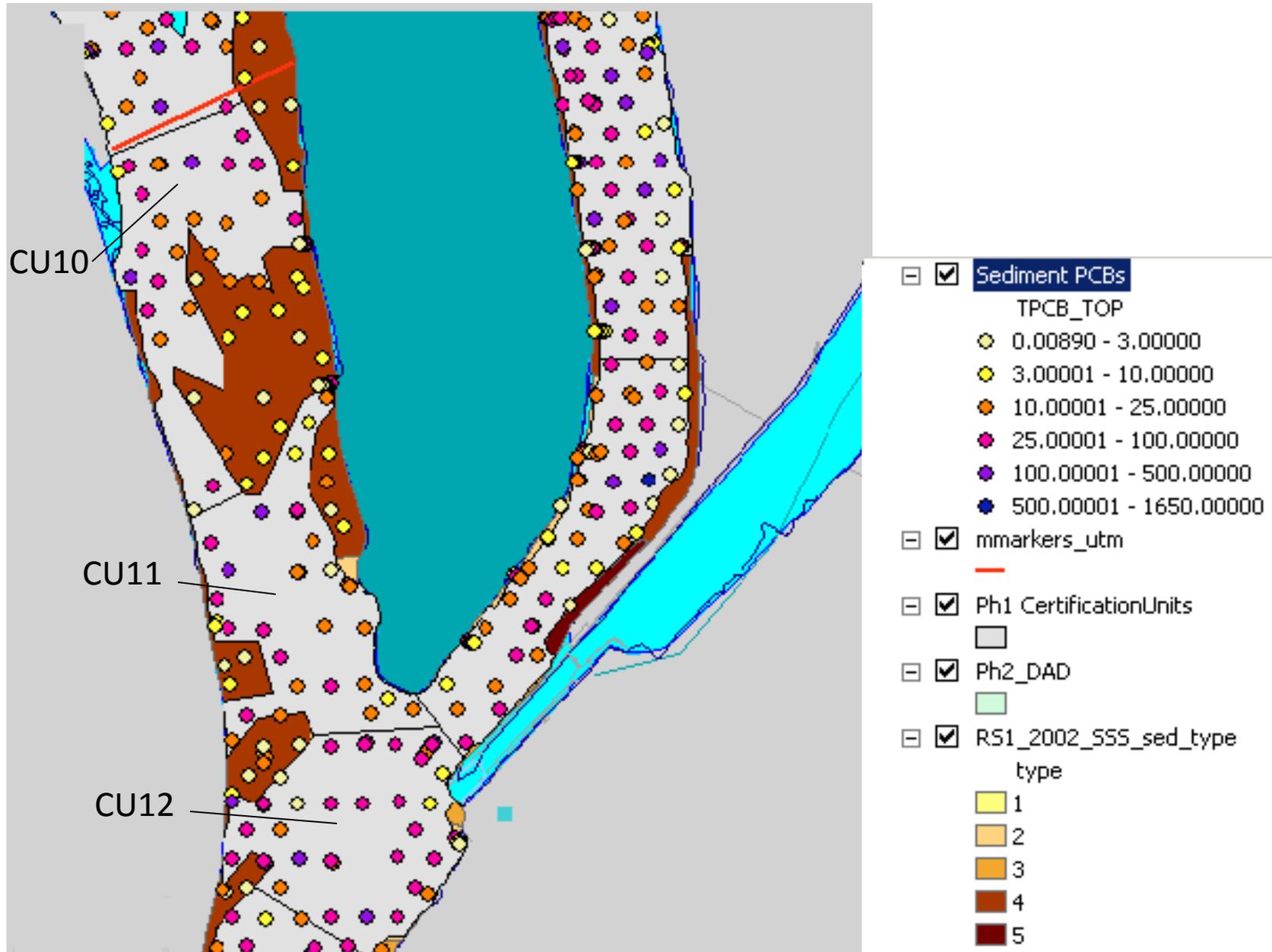
Page II-74, c., “*As mentioned above for Case B1, capping without a formal petition to EPA should only be allowed where actual DoC has been reached, followed by at least one dredging pass targeting no more than 6 inches of removal.*”: The maximum area of CU that can be capped without obtaining EPA approval should be incorporated into the Residual Standard. This option was built into the EPS (see Vol. 1 pg. 60).

Page III-38, Section 3.4.4, Para 2: “*Therefore, it appears that capacity of the filter presses is adequate for the volume of material expected in Phase 2. It may, however, be necessary to schedule dredging such that all dredges are not operating simultaneously in areas with high silt and clay contents.*”: It is not clear how this recommendation matches with dredging multiple CUs simultaneously and closing CUs from an upstream to downstream direction. Sequencing should occur from upstream to downstream to avoid recontamination of remediated areas. Remediating multiple CUs simultaneously yet not operating simultaneously in areas with high silt and clay contents may pose logistical and contaminant transport issues.

Page III-48, Section 5.5, “*A significant amount of productive dredging time was lost as dredge operators attempted to meet the tight (i.e., ± 3-inch) vertical tolerances specified for the dredge cut in the design*”: A 3 inch overcut is proposed for Phase 2 residual dredging. Is the overcut thickness of 3 inches separate from the vertical dredging tolerance? If no vertical tolerance is proposed for residual dredging, then the benefits of overcut could be misguided.

Page III\_50, Section 5.6.3 Type 3 Backfill Placement and Riverine Fringing Wetland Reconstruction, to Top Page III\_51, Top: “deeper than anticipated depths of contamination resulted in deeper backfill, and stakes driven into backfill alone did not adequately secure the biologs. Alternate approaches to the riverine fringing wetland offshore biolog/wave break and other geotextile installations should be considered and appropriate changes should be made in their design for Phase 2.”: Alternative approaches should not result in hardening of the river, e.g., NOAA would have a lower preference for use of rock gabions at the riverward edge of the wetland than for more natural approaches.

Figure 1. Total PCBs (mg/kg) top 2 inches West Channel Rogers Island



\* See Figure 2 for GE sediment trap locations in the West Channel of Rogers Island.

Figure 2. GE sediment trap location West Channel Rogers Island

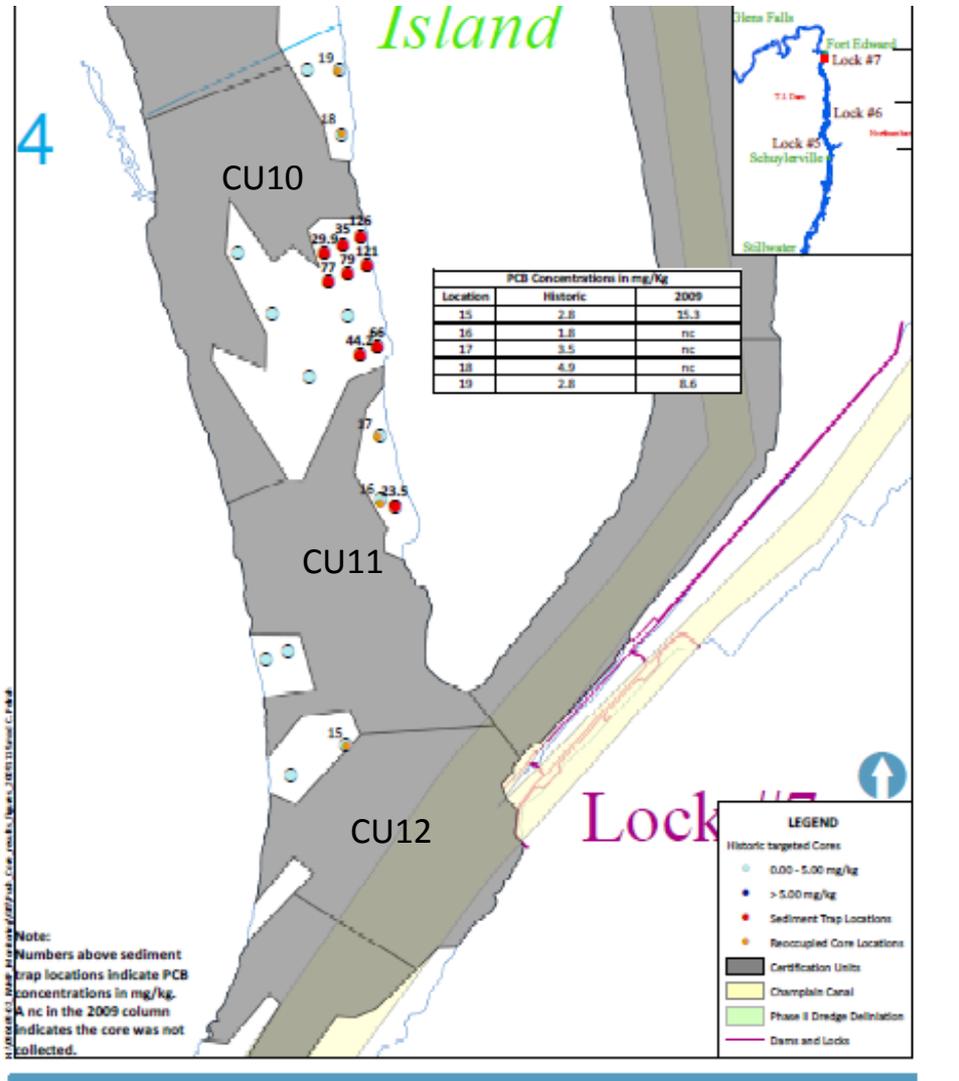
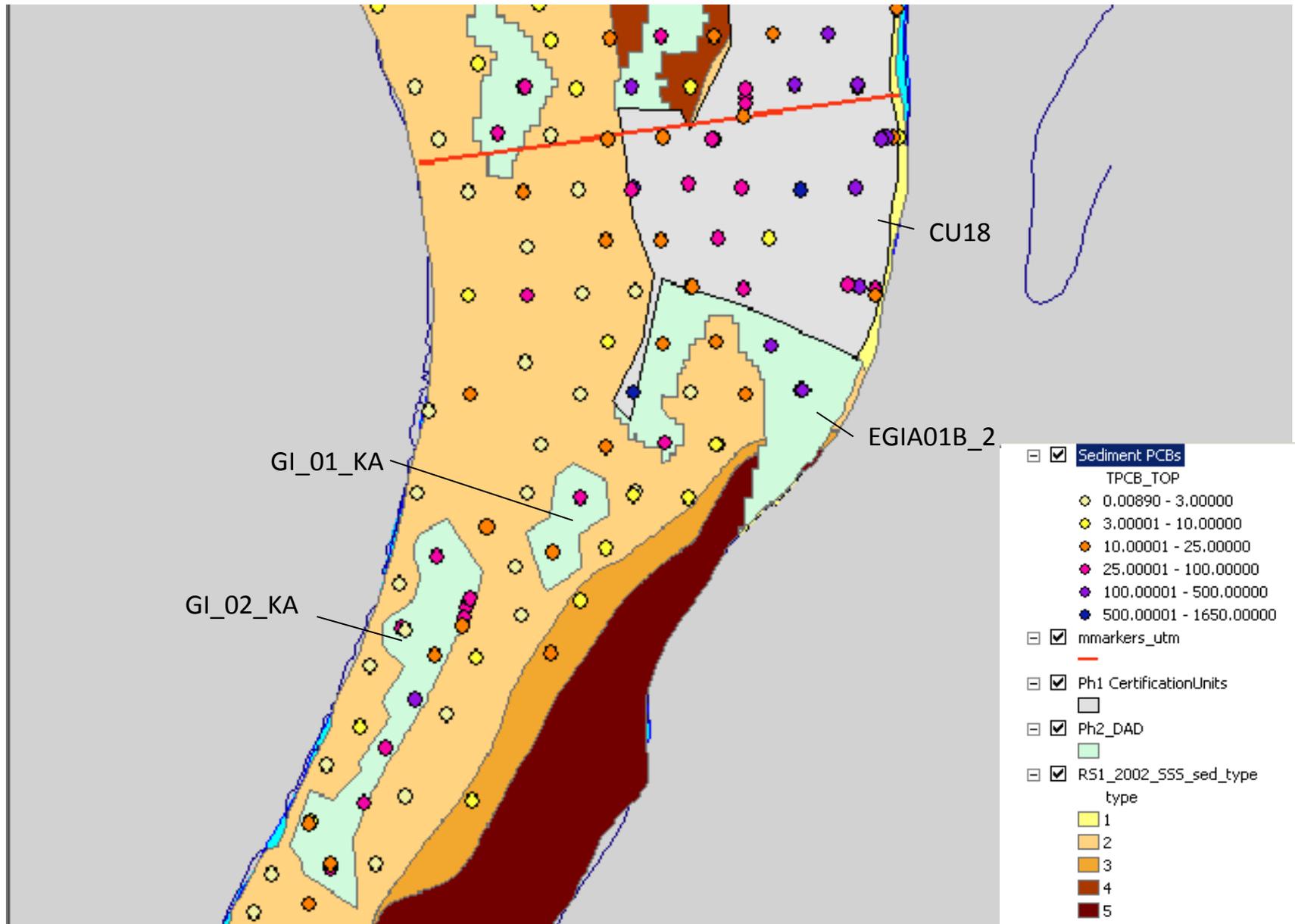


Figure 2.8-34

West Rogers Island Sediment Sampling Results  
 Supplement to Phase 1 Data Compilation  
 General Electric Company



Figure 3. Total PCBs (mg/kg) top 2 inches East Griffin Island Area



\* See Figure 4 for GE sediment trap locations in the East Griffin Island Area.

Figure 4. GE sediment trap location West Griffin Island Area.

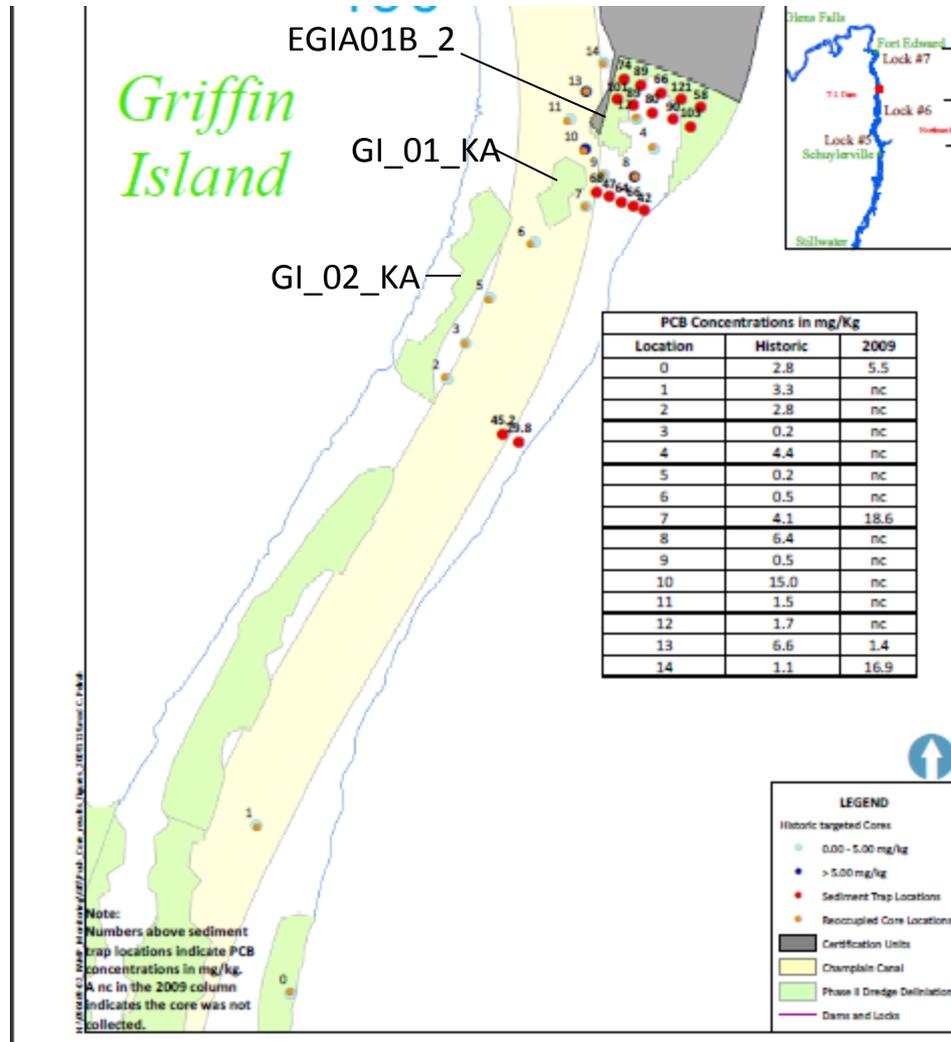


Figure 2.8-35

East Griffin Island Sediment Sampling Results  
Phase 1 Data Compilation  
General Electric Company



### Sediment Type Classification

- 1 (clay, silt, fine sands): smooth, generally featureless bottom; principally composed of soft aqueous silty sediments.
- 2 (sands): smooth to mottled bottom; principally composed of semi-compact to compact sand deposits.
- 3 (coarse gravel and sand mixtures): irregular bottom; principally composed of compact gravel and cobble deposits intermixed with sand.
- 4 (mixed sediments): smooth and irregular bottom; a varying assemblage of sediments typically associated with Types 1, 2, and 3.
- 5 (rocky): extremely irregular bottom; principally composed of bedrock, cobbles, and/or boulders that are often overlain by a variable thickness of unconsolidated sediments.

Source: QEA (2005) Phase 1 DAD