Assessing Stability of Engineered Caps in the Upper Hudson River Impacted by a 100-year Flood Event

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Background/Objectives. PCB contamination in the Hudson River extends back to the 1950s. A 2002 Record of Decision (ROD) called for active remediation of PCB contamination in the Upper Hudson River (UHR, River Mile 154 to 194), including the removal of approximately 2.65 million cubic yards of contaminated sediment in two phases. Dredging took place over a seven year period (2009-2015), and as part of the remediation, dredge areas that proving challenging to fully remediate were covered with an engineered cap. 17 acres of river bottom were covered with an engineered cap during Phase 1 in 2009 and 56 acres were capped during Phase 2 dredging (2011-2015). In April 2011, after placement of Phase 1 caps, a 100-year flood event occurred in the Upper Hudson River with a maximum river discharge of 47,100 cfs. This event created a unique opportunity to evaluate the impact of an extreme flood event on the recently placed caps. The objective of this presentation is to assess the performance of the engineered caps under 100-year flood conditions, assess how well metrics designed to evaluate cap stability performed, and compare stability of caps located in the thalweg and shoal areas.

Approach/Activities. The Ongoing Maintenance and Monitoring (OM&M) program contained a number of metrics designed to monitor the stability of the engineered caps following the initial placement of the cap, including monitoring following, high flow events. Bathymetric surveys were required after initial cap placement and 1 year following cap placement, then 5 and 10 years after placement, and then every 10 years in perpetuity. Measurable Loss was defined as a loss of more than 3 inches of cap thickness over a contiguous 4,000 square foot (sf) area or a contiguous area representing over 20 percent of the cap area, whichever is less, as determined by differencing bathymetric surveys. If Measurable Loss was identified, then visual and physical surveys would be conducted to confirm the loss, at which time repairs would be made as necessary. In addition, cap surveys were required to be performed following any high flow event (100-year flood event). Following the April 2011 100-year flood event, bathymetric surveys of the Phase 1 engineered caps were conducted in June of 2011.

Results/Lessons Learned. Comparison of the 2009 and June 2011 bathymetric surveys indicated that one percent or less of each Phase 1 cap area (9 individuals caps) experienced >3inches of erosion, with the largest contiguous area of >3 inches of erosion being 1700 square feet, indicating no Phase 1 caps exhibited Measureable Loss based on the OM&M metric. Further, only 0.13 acres of total Phase 1 cap area experienced erosion greater than 3 inches. Between 85% and 100% of the area of individual Phase 1 caps experienced sediment deposition, indicating that the engineered caps were placed in predominantly depositional areas, even under 100-year flood conditions. Although the engineered caps only had time to consolidate for approximately 19 months (with no compaction following placement), the results of this analysis demonstrate that the engineered caps were largely successful in withstanding 100-year flood conditions. Additionally, the dredged areas generally became net depositional, increasing accumulation of system sediment on top of the caps and isolating material below the cap.