Lessons Learned for Management of Organic-Rich Wetland Sediment and Vegetation for Dewatering and Disposal

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Background. The former Zephyr Refinery is located on a plateau between the Muskegon River and Bear Creek. Operations at the refinery from the 1930s through the early 1990s resulted in substantial releases of petroleum hydrocarbons with records indicating some single releases exceeded 150,000 gallons. The former fire suppression ditch serviced to provide operational water for the refinery, which was pumped up the cliff and used to put out fires that occurred at the refinery. Remedial actions to hydraulically control the migration of contaminants have been undertaken over the past 15 years as source control measures. Previous investigations of the refinery and surrounding properties indicated that impacted groundwater and light non-aqueous phase liquid had migrated into wetland sediments adjacent to Bear Creek and the Muskegon River including the Fire Suppression Ditch Site. The United States Environmental Protection Agency Great Lakes National Program Office and the nonfederal project partner Michigan Department of Environmental Quality conducted a site characterization, remedial design, and implemented remedial construction for removal and disposal of sediment impacted by petroleum hydrocarbons (oil and diesel range organics), oil and grease, and heavy metals in lowland wetland areas downgradient of the refinery. Among the challenges of remedial design and remedy implementation, management of organic-rich sediment in the wetland areas for dewatering with an objective to reduce disposal weight was addressed by field and laboratory testing and development of requirements for specifications. Finally, the construction activities further modified sediment management based on the receiving landfill's geotechnical requirements imposed upon the construction contractor.

Approach. Affinity of organic-rich sediment for management (handling, dewatering, transport/disposal) will depend upon sediment gradation, abundance of organic matter and its state of decay, clay fraction, plasticity/liquidity, density, and other factors. Wetland sediment containing vegetation and fire suppression ditch sediment was characterized, both to determine extent of contamination, but also to provide physical and engineering properties to support the design for sediment management and disposal. Additional bench-scale field testing was performed to assess moisture reduction with time by gravity drainage using a straight-forward methodology to test moisture content changes for a small stockpile of sediment. Treatability study results providing moisture absorption and physical property changes with addition of cement were included, with the objective to limit use of cement to manage disposal weight. The design approach included cutting vegetation to manage separately, while root mass and adhered soil was considered part of the excavation, and specifications required certain conditions were met to provide for stockpile retention time to facilitate gravity drainage. Based on requirements from the receiving landfill, changes were made during construction that will be identified as part of the lessons learned.

Results/Lessons Learned. This presentation will examine lessons learned regarding design of sediment management of organic-rich wetland sediment when the approach to maintain low disposal weight of removed sediment is addressed by the design using specification performance requirements, and will identify the changes during construction that were necessary and the outcome of those changes.