Bank Remediation and Stabilization along the Tittabawassee River

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Background/Objectives. In central Michigan, logging and agricultural practices in the 1800s led to increased sediment loads in the Tittabawassee River, resulting in the formation of levees along the river banks. Levee formation during the early 1900s coincided with the direct discharge of wastewater from a chlorine manufacturing process into the river; the wastewater discharges included graphitic carbon particles containing sorbed chlorinated dibenzofurans. Furans belong to the dioxin family of chemicals, due to their similar chemical structures. Mixing of the graphitic particles with the sediments that deposited onto newly forming levees and in the channel bottom led to the presence of furans in the sediment bed, banks, and adjoining floodplain soils. Today, due to changes in river hydrology and reduced sediment loads, some of the banks are eroding, potentially releasing furans back into the river. One objective at this site was to identify, screen, select, and implement effective and strategies for remediating the contaminated banks.

Approach/Activities. Cores were collected along the banks of the Tittabawassee River to understand the distribution of furans and dioxins in the river banks, and to identify the areas with the highest furan and dioxin concentrations. Bank stability surveys and modeling were conducted to characterize the erosion potential of the banks during normal and high flow events. Bank stability surveys included quantification of bank angle, beneficial vegetation cover, bank height, presence of undercutting, and level of exposed roots. The banks with the highest probability of contributing furan and dioxin mass to the river (i.e., unstable banks with high furan and dioxin concentrations) were identified for remediation. Potential remediation strategies included bank soil removal or bank stabilization. Stabilization techniques primarily rely on green technologies such as planting and seeding deep-rooted native vegetation and canopy management (i.e., cutting back the tree canopy to provide more sunlight to the bank areas, fostering growth of deep rooted vegetation). Native vegetation can take several years to fully establish, so short-term maintenance is conducted. Additional technologies are used, as needed, including removal of at-risk trees along the bank, placement of erosion control products on the face of the bank, and placement of toe protection at the base of the banks. In some cases, soil removal was used to achieve an appropriate bank angle for stabilization.

Results/Lessons Learned. As of the end of 2017, more than 3 miles of banks (>18,000 feet) in over 20 bank areas along the Tittabawassee River have been prioritized and remediated. This presentation will discuss the implementation and long-term effectiveness of various bank stabilization techniques, highlighting examples from specific Tittabawassee River bank management areas. These projects have demonstrated bank stabilization techniques to be an ecologically-friendly and cost-effective approach to addressing contaminated banks as compared to traditional soil removal strategies. Long-term monitoring is being used to monitor bank stability and to identify ongoing maintenance requirements, as needed.