2022 Americas Site Solutions Technology Transfer Conference

Title: Estimating Time to Recovery of PCBs to Evaluate Monitored Natural Recovery Performance

Authors' Names: Lauren Brown, Kristin Searcy Bell, Victor Magar, Phyllis Fuchsman

Presenter's Name: Lauren Brown

Key Topic: Sediment Management/Shoreline Stabilization

PDP Manager/Managing Principal's Name: Annette Bachand/Henry Clauson

Client Name: DGIC

Project Name: Cottonwood Bay Monitored Natural Recovery Evaluation

Project Location: Dallas, Texas

Primary Ramboll Project Staff (Office): Kristin Searcy Bell and Victor Magar (Chicago, Illinois), Phyllis Fuchsman (Cleveland, Ohio), Lauren Brown (Portland, Maine)

ABSTRACT

Background/Objectives:

Monitored natural recovery (MNR) is a sediment response action that involves leaving contaminated sediments in place and relying on ongoing natural processes to reduce environmental risks. MNR relies on physical, chemical, and biological processes to isolate, destroy, or reduce exposure to or toxicity of contaminants in sediment. At the Cottonwood Bay Site (Dallas, Texas), the Texas Commission on Environmental Quality (TCEQ) approved a 2009 Remedial Action Plan (RAP) for the Site; the RAP identified dredging as the approved remedy to address contaminated sediment. However, 2014 surface sediment sampling results and an initial evaluation of MNR processes suggested that current surface sediment conditions at the Site were approaching site-specific performance targets. Consequently, with TCEQ approval and under TCEQ supervision, the project team revisited the Site to determine whether MNR is a viable remedy alternative. The objective of this project was to evaluate MNR performance, and to determine whether MNR can achieve site-specific remedial goals within a reasonable time frame. Multiple lines of evidence were evaluated to demonstrate MNR could achieve site-specific remedial goals for Cottonwood Bay in a reasonable time frame. Here we present the results of a provisional analysis modelling the time to recovery of sediment polychlorinated biphenyl (PCB) concentrations to reach human health-protective target concentrations in fish. When fish tissue PCB concentrations decline to target concentrations, then it is expected that fish consumption advisories can be eliminated.

Approach/Activities:

We estimated the time to recovery for PCBs in fish tissue in Cottonwood Bay and its adjacent waterbody (Mountain Creek Lake) by comparing modelled future sediment concentrations to target sediment concentrations. Future sediment PCB concentrations are estimated using the SEDCAM sediment attenuation model. Inputs to the model include site sediment PCB concentrations, incoming sediment PCB concentration, sediment deposition rate, and sediment mixing depth. Target sediment PCB concentrations are estimated through a series of calculations using site-specific sediment and fish tissue data and applying a fish tissue health assessment comparison (HAC) value to raw fish. We conducted the time to recovery evaluation using probabilistic modelling in R, a language and environment for statistical computing. For the probabilistic modelling, parameters with more than one value were input into the model as distributions, and the model was run using these distributions over 5000 iterations to provide a range of anticipated time to recovery results.

Results/Lessons Learned:

The time to recovery modelling indicates that PCB levels in white crappie and largemouth bass from the site are already acceptable for human consumption. Since largemouth bass are relatively territorial and expected to have a home range smaller than the combined Cottonwood Bay and Mountain Creek Lake waterbody, we also modelled time to recovery for the largemouth bass in Cottonwood Bay, which

has higher PCB concentrations. In this scenario, largemouth bass is predicted to achieve acceptable levels, with median estimated time to recovery of nine years. Channel catfish is also predicted to achieve acceptable levels in approximately eight years. The PCB concentrations in common carp, freshwater drum, and smallmouth buffalo (bottom-feeding species with high lipid content) are expected to decrease over time, but depending on incoming PCB concentrations, the long-term fish tissue PCB concentrations may continue to be greater than the HAC. Important uncertainties in the time to recovery model are related to limited data on PCB concentrations in incoming sediment and in some areas of the waterbody, as well as the simplifying assumption that PCB bioaccumulation from sediment to fish is constant over time. The monitoring plan includes collection of incoming suspended sediment samples from seven sources entering Cottonwood Bay for PCB analysis; the new data will be used to update the time to recovery estimates.

Aspect of Work that Relates to Sustainability:

Monitored natural recovery is applied at the site as a remedy that minimizes the disturbance on the existing habitat and the need for construction transportation and materials.