The Problem and Consequences of Conowingo Reservoir Infill on the Chesapeake Bay Water Quality

Gopal Bhatt[1]*, Lewis Linker*[2]*, Gary Shenk*[3]*, Qian Zhang*[4]*, Richard Tian*[4]

[1]Pennsylvania State University, Chesapeake Bay Program Office, Annapolis, MD USA
[2]US Environmental Protection Agency, Chesapeake Bay Program Office, Annapolis, MD USA
[3]US Geological Survey, Chesapeake Bay Program Office, Annapolis, MD USA
[4]Univ of Maryland Center for Env Science, Chesapeake Bay Program Office, Annapolis, MD USA

The Susquehanna River is the largest tributary to the Chesapeake Bay that contributes approximately 41% of nitrogen, 25% of phosphorus, and 27% of sediment to the tidal Bay. Recent studies have documented how, over time, sedimentation has filled in the three Lower Susquehanna reservoirs, altering their behavior. The upper two reservoirs, Lake Clarke and Lake Aldred, reached full infill capacity, also called dynamic equilibrium, prior to the beginning of the Chesapeake Bay Program (CBP) Partnership's Phase 6 Watershed Model simulation period of 1985 to 2014, and recent research has indicated that the most downstream reservoir, the Conowingo, is at or approaching dynamic equilibrium (Cerco, 2016, doi:10.2134/jeq2015.05.0230; Linker et al., 2016, doi:10.2134/jeq2014.11.0461; Zhang et al. 2016, doi:10.1021/acs.est.5b04073). Hirsch (2012, URL: https://pubs.usgs.gov/sir/2012/5185/) found that scouring of sediment may be increasing over time in the Conowingo based on an analysis of monitoring data. Langland (2015, doi:10.3133/ofr20141235) used monitoring and bathymetric surveys to show that sedimentation had altered all three reservoirs. Model refinements were made to the CBP Partnership's Phase 6 Watershed Model using multiple lines of evidence in the estimation of how the deposition and scour rates have changed as well as variability in the bioavailability of nutrients. The model was applied to estimate changes in sediment and nutrients delivery under different watershed management, climate, and reservoir infill states. Under the 1995 management, additional delivery of about 20 Mlb/yr of nitrogen, 3.5 Mlb/yr of phosphorus, and 1.3 Mton/yr of sediment was estimated between 1995 Infill and the current state of dynamic equilibrium, and an additional delivery of 12 Mlb/yr of nitrogen, 1.8 Mlb/yr of phosphorus, and 0.7 Mton/yr of sediment under the Phase 2 Watershed Implementation Plan. The model was used by the CBP partnership to support decision-making and estimating additional management actions that will be needed for mitigating these additional loads.

Contact Information: Gopal Bhatt, Penn State University, USEPA Chesapeake Bay Program, 1750 Forest Drive, Annapolis, MD, USA 21401, Phone: 814-360-4061, Email: gbhatt@chesapeakebay.net