Total Phosphorus Mass Balance Modeling in the Lower Boise River, Ada and Canyon Counties, Idaho

Alexandra Etheridge
230 Collins Rd
Boise, ID 83702
Telephone: 208-387-1357
aetherid@usgs.gov

The U.S. Geological Survey (USGS), in cooperation with Idaho Department of Environmental Quality, has developed two spreadsheet mass-balance models for total phosphorus (TP) in the lower Boise River. The models incorporate data from three synoptic sampling events conducted by the USGS since August 2012. The models will inform the development of a TP total maximum daily load (TMDL) for the lower Boise River. The modeling reach spans from river mile 50.2 at Veterans Memorial Parkway in Boise to river mile 3.8 near the mouth near Parma. The timing of synoptic sampling events allowed the USGS to evaluate phosphorus loading in the Boise River during irrigation season, shortly after irrigation season ended, and shortly before the subsequent irrigation season began.

The models can be used to evaluate sources of phosphorus in the Boise River during each sampling timeframe. Results show differences in both flow dynamics and phosphorus loading. Effluent from municipal wastewater treatment facilities represented the largest source of phosphorus in the watershed during each sampling event. However, it is unknown how much phosphorus from point sources is diverted from the river in irrigation supply water and subsequently returned to the Boise River through drains, tributaries, or shallow groundwater. In late August, substantial groundwater discharge to the Boise River was measured from Middleton to Parma, and phosphorus loading from groundwater represented 57 percent of the measured load in the river near Parma. Modeling scenarios indicate that phosphorus reductions from both point and non-point sources are necessary to meet the TMDL during the compliance period (May 1 to September 30). During the non-irrigation season in late October and early March, return flows from tributaries and drains comprised the majority of groundwater gains in the lower Boise River, and represented 31 and 15 percent of the load in the river near Parma, respectively. Both the October and the March models indicate that phosphorus cycling through aquatic plants and/or bed sediment may influence phosphorus uptake and release in the lower Boise River. Modeling scenarios in the October and March models show that point-source reductions will have a greater effect on lowering phosphorus concentrations in the Boise River during the non-irrigation season. The mass balance models do not account for biological or depositional processes in the Boise River, but they are useful indicators of reaches in the river where phosphorus uptake and subsequent release by aquatic plants may occur.