Authors: Susa H. Stonedahl, David G. Cooper*, Jessica M. Everingham*, Matthew K. Kraciun*, and Forrest Stonedahl

*denotes SAU student

Title: Quantifying the impact on hyporheic flow of assuming homogenous hydraulic conductivity distributions within permeameters

Abstract: Hydraulic conductivity (K) is an important sediment property related to the speed with which water flows through sediments. It affects hyporheic uptake and residence time distributions, which are critical to assessing solute transport and nutrient depletion in streams. In this study we investigated the effect of millimeter-scale K variability on measurements that use one of the simplest *in situ* measurement techniques, the falling-head permeameter test. In a laboratory setting vertical K values and their variability were calculated for a variety of sands. We created composite systems by layering these sands and measured their respective K values. Spatial head distributions for these composite systems were modeled using the finite difference capability of MODFLOW with inputs of head levels, boundaries, and known localized K values. These head distributions were then used to calculate the volumetric flow rate through the column, which was used in the Hvorslev constant-head equation to calculate vertical K values. We found that these simulated system K values reproduced the same qualitative trends as the laboratory measurements, and provided a good quantitative match in some cases. We then used the model to select distinct heterogeneous K distributions (i.e. layered, randomly distributed, and systematically increasing) that have the same simulated system K value. These K distributions were used in a two-dimensional dune/ripple-scale pumping model to approximate hyporheic residence time distributions and provide estimates of the error associated with the assumed homogeneity of the K distributions. The results have direct implications for both field studies where hydraulic conductivity is being measured and also for determining the level of detail that should be included in computational models.