Influence of Growing Season Stream Flows on Periphyton Growth

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Reference: McDowell RJ, CA Pruitt, RA Bahn (eds.), *Proceedings of the 2015 Georgia Water Resources Conference*, April 28-29, 2015, University of Georgia, Athens.

Abstract. Water extractions for irrigation in the lower Flint River Basin (LFRB) can reduce summertime stream flows below historic levels, particularly during droughts. Anecdotal evidence suggests that these low-flow conditions promote periphyton growth. We conducted controlled experiments to examine how flow conditions affect summertime periphyton growth, biomass, and composition in Ichawaynochaway Creek, a major tributary of the lower Flint River. Creek water was pumped through replicate artificial stream channels lined with clean ceramic tiles to achieve a 5 discharge treatments ranging from 0.25 to 5 gpm. Tiles were collected twice weekly for four weeks to quantify periphyton biomass (ash-free dry mass and chlorophyll a) and calculate growth rate. Noticeable growth occurred in all discharge treatments, but growth rates and final biomass increased with discharge and were approximately 3-fold greater at the highest as compared to the lowest discharge. Flow also affected periphyton taxonomic composition as higher discharge promoted development of thick diatom (Class: Bacillariophyceae) mats and lower discharge allowed dominance by unattached masses of filamentous green algae of the order Zygnematales. These treatment responses were consistent with observations of variation in periphyton assemblages across different flow conditions within the creek itself during the same time period. Additional experimentation (to be reported in the conference manuscript) has examined whether nutrient limitation contributes to slower periphyton development at low flows and how stream herbivores respond to flow-related differences in periphyton growth and composition. These findings provide insight into how alterations to summertime flow regimes affect stream ecological conditions within the LFRB.