Modern streamflow measuring equipment, water quality sampling techniques and a better understanding of pollutant washoff are continuously being developed as today’s society is in critical need of improving water management, minimizing developmental impacts and preventing environmental hazards. In particular, the study of the spatial, temporal and volumetric characteristics of annual pollutant loading caused by variations in precipitation, land use and other anthropogenic factors is of great significance due to their relation to future global water demands.

The research presented here falls in three parts. In the first part of the dissertation, an acoustical doppler velocity profiler installed in a submerged concrete channel is proposed to continually measure the annual fluctuation in streamflow levels down to dry channel conditions. The tailwater influenced, intermittent streamflow conditions for the City of Kissimmee, Florida were selected for the evaluation of this approach under a 3-year study from 2006 to 2008. The performance of these concrete channels were systematically evaluated by comparisons with established field measurement techniques over various stream configurations and flow conditions.

The second part of this research investigates the dynamics of flood wave detection with respect to enabling an automatic water quality sampler to start collecting samples. The main focus was on the accurate detection of flood waves in the absence of rainfall and the presence of fluctuating baseflows and stream stages. In the 3-year study, it was shown that a dual parameter trigger, utilizing independent measuring equipment, resulted in accurate flood wave detection with minimal false triggering of the autosampler. In addition, an incremental or percent deviation from a moving average of stage or flow proved to be a more consistent indicator for the presence of a flood wave.

In the third part of this work, the frequency of water quality sampling and the associated level of detail for sampling of rainfall events were investigated with respect to accurately depicting annual pollutant loads. It was found that the seasonal variations in baseflow pollutant loads are not accurately represented by current 4-quarter grab sampling. Also, significant pollutant loading within rainfall events may not be captured by only performing grab sampling during baseflow conditions. In addition, although increased pollutant concentrations were observed within the initial 30 minutes of the flood wave, their actual loadings did not represent a significant impact on the annual pollutant loads. A bi-weekly grab sampling frequency was found to be adequate in many cases to depict the annual pollutant loads, but depending upon the targeted constituent and particular streamflow condition, rainfall event sampling might also be necessary. The results of this research complemented with other studies will promote better understanding of intermittent streamflows, accurate flood wave detection, and assessment of annual pollutant loads to our nation’s waterbodies.

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The public is welcome to attend.