Comparing Instream and Upland Bedrock Fracturing and Stream Reach Orientation to Predict Groundwater/Surface Water Interaction in the Lower Flint River Basin

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Abstract. To manage finite freshwater resources in the karst terrain of southwest Georgia, it is important to determine the degree of connectivity between surface water and groundwater. To do so, we compared instream and upland joint patterns, stream reach orientation, and stream reach chemistry in and adjacent to the Lower Flint River Basin (LFRB) to determine if these factors could predict groundwater/surface water interaction on a landscape scale. Stream reach orientations (n=37,134) in the LFRB show a strong N6W trend with lesser trends at ~N40W, and N85E. Bedrock joints measured in limestone exposures in the channel of Ichawaynochaway Creek (n=125) generally mimic the dominant N-S jointing trend and contain subsidiary sets at approximately ~N27W and N20E. One set of joints measured in a limestone near the divide between the LFRB and the Chattahoochee River Basin show a strong N36W orientation. Upland fracture patterns measured in Cretaceous and Miocene sandstones, and the Cretaceous Riley Formation show a significant regional change in fracture orientation, from approximately N50E east of the LFRB, to progressively more northerly trends closer to the LFRB. This trend is consistent with previous interpretations of regional tectonic stress regimes, and may reflect a change from Atlantic to Gulf-directed subsidence with a "hinge line" in the LFRB. Enhanced groundwater/surface water interaction (as increased specific conductance) is 33% more common in Ichawaynochaway Creek in reaches where the stream is oriented ~N40W. Interaction of these reaches with an orthogonal pattern (~N40E) may also be enhancing connectivity in the western and northern portions of the LFRB. Trends in upland fracture and stream orientation in the western and southwestern portions of the LFRB suggest connectivity may follow different patterns.