

Streamflow Losses through Karst Features in the Upper Peace River Hydrologic Area, Polk County, Florida

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In October 2001, the U.S. Geological Survey in cooperation with the Southwest Florida Water Management District began a study to evaluate streamflow losses in the Upper Peace River Hydrologic Area. Historically, the Upper Peace River was a gaining stream---ground-water levels were above surface-water levels, wells and second-order magnitude springs flowed, and tributaries drained the surrounding highlands (scarps). However, strip-mining of phosphate ore (1) altered the landscape, (2) changed the natural surface-water drainage patterns, and (3) changed the ground-water flow patterns by removing the upper 50 feet of sediments and lowering the potentiometric surface of the aquifers. Today (2005), this area of the Peace River is a losing stream. Streamflow losses are predominately through karst features found in the low-water channel and flood plain. The features range in size from isolated, small pipes and fractures to numerous, large interconnected horizontal and vertical fractures, large enough for an adult to enter.

Streamflow losses through karst features were measured at selected sites in May-June 2002 and May 2004. Portions of the Peace River ceased flowing during these low-flow periods, and intermittent flow was observed with the commencement of summer rain. During the period of intermittent flow, the river was drained by way of karst features downstream from the Peace River at Bartow gage. Streamflow losses to karst features ranging from 9 to 16 cubic feet per second were measured between the Peace River at Bartow and Peace River at Clear Springs gaging stations. South of the Clear Springs gaging station, the Peace River received surface-water inflow from mine outfalls (6 to 14 cubic feet per second) and tributaries (3 to 18 cubic feet per second). Locations of streamflow losses and gains were spatially consistent among the three seepage runs.

The potential for the exchange of water between the river and the ground-water system was evaluated for the period November 2002 through October 2004 using a single existing pair of wells located in close proximity to the river. Preliminary analysis indicates that the river stage is higher than the aquifer heads, indicating the potential for the river to be a losing stream. The head difference varies seasonally and is smaller during the wet season and larger during the dry season. This seasonal fluctuation is reflected in variations in the measured losses and gains.

To enhance our understanding of the distribution, timing, and volume of surface-water exchange with ground-water throughout the study area, three new well clusters located on the Peace River flood plain are being drilled. The hydrogeologic framework and permeability distribution is being evaluated from geologic core analysis, geophysical logging, and aquifer testing. The potential for the exchange of water between the river and the ground-water system will be evaluated from continuous measurements of river stage and aquifer heads at the new well sites.