Ground-Water Flow Patterns of Augmented Lakes and Wetlands in the Northern Tampa Bay Area, Florida

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Over the past several decades, pumping from the Upper Floridan aquifer for municipal water supply in the Northern Tampa Bay area has accelerated downward leakage from the overlying surficial aquifer, lowering the water table and the water level of many lakes and wetlands. To restore the water levels, selected lakes and wetlands have been augmented with ground water from the Upper Floridian aquifer. The hydrologic consequences of using ground water to maintain lake and wetland water levels were investigated in two cooperative studies between the U.S. Geological Survey and Southwest Florida Water Management District. These studies generated detailed descriptions of the hydrogeologic framework and ground-water interactions at augmented and non-augmented lakes and wetlands in the Northern Tampa Bay area.

Similar ground-water flow patterns were observed around both augmented lakes and augmented wetlands. In comparison to non-augmented sites, the water levels of augmented lakes or wetlands were as much as 15 feet higher than the surrounding water-table elevation. Thus, the majority of the water used to augment lake and wetland water levels leaks into the surficial aquifer, raising the level of the water table. Augmentation maintains a sizeable, conical, ground-water mound around the lake or wetland. The water-table mounds mapped around lakes and wetlands typically extended 150 to approximately 500 feet laterally from the water's edge. The lateral outflow gradient is controlled by the horizontal and vertical hydraulic conductivity distribution, and is an important control on the augmentation rate required to maintain lakes and wetland water levels.

Hydrogeologic data from wells completed at various depths were used to compare the stratigraphy and the vertical flow patterns in augmented and non-augmented basins. The total vertical head loss beneath lakes or wetlands, and the distribution of this head loss within the surficial aquifer and the intermediate confining unit, varied at each site depending upon the hydrogeologic framework. Typically larger vertical head losses within the surficial aquifer indicated poorer confinement by the clay intermediate confining unit separating the surficial and Upper Floridan aquifers.

Net ground-water flow estimates provided insight into the differences in ground-water leakage rates at augmented and non-augmented sites. Leakage dominated the water budget at augmented sites, exceeding both rainfall and evaporation rates. For example, the monthly net ground-water outflow rates for two augmented sites (Round Lake and Duck Pond) were 8 and 20 times greater than the typical rate at non-augmented sites.

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