

THE DEVELOPMENT OF MAN MADE LAKES IN THE SURFICIAL AQUIFER SYSTEM IN PALM BEACH COUNTY

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The development of man made lakes in Palm Beach County has been a continuing controversy since the initiation of muck, soil, sand and lime rock excavation. Initially the focus of the controversy was not the potential for ground water and surface water contamination, safety hazards or the actual removal of the excavated materials, but the unsightly blight which the unmaintained open pits left on the landscape. In many cases these open pits still remain throughout the County, are aesthetically not pleasing, subject to legal and illegal filling and provide the potential for ground water and surface water pollution as "windows to the aquifer." Cross State, Lantana, West Lake Park and Dyer Boulevard Landfills were all developed from areas which were previously open pits left from mining operations.

The surficial aquifer begins only a few feet below the land surface and is only a few feet thick in the western part of the County. In the eastern part of the County the surficial aquifer ranges from approximately four to fifteen feet below the land surface to more than 300 feet in thickness. The depth to the water table varies due to drainage, perched water tables, seasonal fluctuations, locations and types of water control features and the Atlantic coastal ridge. The aquifer is made up of discontinuous mixtures of sand, shell, limestone, muck and marl in varying amounts and depths. In some areas marl (calcareous clay) can form hydrologic barriers to the upward and downward migration of water. If these formations are present in the surficial aquifer they typically reside eight to twenty feet below the land surface. These aquicludes are not continuous, are spotty in location and do not provide a means to prevent the movement of water to any great degree. Cap rock formations, made up of tightly cemented limestone deposits, are found at varying depths throughout the County. These formations, although porous, are highly impermeable and can also act as discontinuous aquicludes.

In the eastern part of the County, from approximately Juno Beach south, the surficial aquifer system is known as the northernmost extension of the Biscayne aquifer. This aquifer is locally described as the turnpike aquifer and most recently identified as a "discontinuous zone of secondary permeability in the surficial aquifer" (Swayze and Miller, 1984, P.8). The entire surficial aquifer system is hydrogeologically connected.

Lakes, borrow pits, canals, percolation ponds, impoundments, mines, exfiltration trenches and storm water ponds are all hydrogeologically connected to the surficial aquifer system. Due to the discontinuous nature of hydrologic barriers, any excavation into the water table enters the surficial aquifer system and the depth of the excavation is no longer an issue for or against ground water protection. The only potential protection, the surface layer of soil above the water table, is removed by excavation.

Although lakes can become a receptor for contaminated stormwater runoff and illegal dumping, they can be a benefit to the aquifer. An excavated area can provide increased water storage and a means for rainwater to replenish the surficial aquifer at a faster rate than through normal percolation. The surface area provided by a lake can also create an increased water loss from evapotranspiration.

In actuality, there are no surface water bodies with fresh water in Palm Beach County unless they are found in impoundments like Lake Okeechobee, the Conservation Areas, the Water Catchment Area, in seasonally fluctuating wetlands, the Loxahatchee River or the dredged Chain of Lakes. Surface water in the County is primarily exposed ground water. There is continual and direct exposure, mixing and interaction of one with the other.

Chlorides and Total Dissolved Solids are potential ground water and surface water contaminants and emanate both from the sea and residual connate water left from the receding of the seas during the Pleistocene Epoch. Chloride concentrations, movements of chlorides due to localized over pumping of wells and dewatering activities, seasonal fluctuations of chloride levels and overall increasing levels of chlorides in the surficial aquifer are a continuing concern. Examination of chloride records for over forty years (Miller, 1988, p. 23-33) indicate that chloride levels have increased throughout the County.

Over the thousands of years since the end of the Pleistocene Epoch, rainwater slowly permeated through the soils of the County, diluted the residual seawater and created an extensive freshwater lens. In the western and central portions of the County the increase in chlorides is due to the upward migration of residual seawater as the freshwater lens is removed by drainage and dewatering of those areas in the last forty years.

The ground water divides (movement of the water to the west instead of east) in the central portion of the County has prevented further eastward migration of chlorides. Even increasing demands on ground water withdrawals have not unduly influenced the movement of chlorides to the eastern portion of the County. However, as the wells move farther west, the potential impact for poor quality water increases (Miller, 1988, p.32-33).

The maximum contaminant levels set for ground water by the Florida Department of Environmental Regulation in Chapter 17-550, Florida Administrative Code, is 250 Mg/L for Chlorides and 500 Mg/L for Total Dissolved Solids. No excavation should be allowed in areas which approach these maximum contaminant levels unless sampling indicates there is no potential problem of contamination and contaminants are not allowed offsite.

Summary

All holes in the ground should be considered "windows to the aquifer". Holes in the ground are potential areas for contamination as are any other pervious surface in the County. There should be as much concern for holes in the ground at limited depths as deeper depths. The entire surficial aquifer is hydrogeologically connected and subject to the same movement of ground water and contamination. Chlorides are a potential contaminant of ground water and surface water resources. Movement of chlorides can be influenced by wells, construction of canals and dewatering operations. Excavation in areas of high chlorides should not be considered.

Sources

Swayze, Leo J. and Wesley L. Miller, "Hydrogeology of a Zone of Secondary Permeability in the Surficial Aquifer of Eastern Palm Beach County, Florida", United States Geological Survey, 1984.

Miller, Wesley L. "Description and Evaluation of the Effects of Urban and Agricultural Development on the Surficial Aquifer System, Palm Beach County, Florida", United States Geological Survey, 1988.