

Hydrology - Water Resources Report 1

Ground-Water Resources Of Darlington, Dillon, Florence, Marion, and Marlboro Counties, South Carolina

WITH AN ANALYSIS OF MANAGEMENT ALTERNATIVES for THE CITY OF FLORENCE

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ABSTRACT

Long-term pumping has caused a 200-foot lowering of ground-water levels at the city of Florence and lesser amounts throughout much of the five-county surrounding area. About 40 million gallons of water per day were withdrawn from wells in the region in 1992, about 20 percent of this at Florence.

Major wells tapping confined aquifers in the five counties yield between 100 and 2,400 gallons per minute. Wells range in depth from less than 100 to nearly 1,000 feet, and some of them tap aquifers in both the Middendorf and Black Creek Formations. The freshwater-bearing Upper Cretaceous section extends to about sea level at the north end of Marlboro County, to about 500 feet below sea level at Florence and Dillon, and to about 1,000 feet below sea level at the south end of the region.

The large water-level decline at Florence has taken place since 1900, as a result of pumping from the Middendorf Formation. Effects of pumping from the Black Creek Formation have been minor in comparison.

Pumping tests indicate a median transmissivity of 19,000 gallons per day per foot for the Middendorf aquifers and 13,000 for the Black Creek. The values are close to the medians determined for the two formations in the Coastal Plain as a whole.

If pumping from wells is to continue as the source of water supplies, a plan should be formulated to distribute withdrawals areally and among the aquifers. An effective plan will moderate drawdown of the potentiometric surface of the Middendorf Formation and direct additional development of the Black Creek Formation.

A finite-difference computer model has been utilized to ascertain the effects of selected pumpage increases on water levels in Darlington, Dillon, Florence, Marion, and Marlboro Counties. The model simulated aquifer response to hypothetical pumping from wells in Darlington, Dillon, Florence, Marion, and Marlboro Counties from 1993 through 2003. The simulations indicate that the Black Creek and Middendorf aquifers are capable of sustaining long-term pumping at 1992 rates with little change in potentiometric levels. The only significant influence on Black Creek aquifers is the city of Marion pumping, which is predicted to cause more than 20 feet of localized water level declines from 1993 through 2003. In that period -- if

the city of Florence maintains its reported 1992 pumping rate -- annual pumping increase in the five-county region will cause a 10-foot lowering of the Middendorf's potentiometric surface in much of this study area, with localized declines of 15 to 25 feet near Hartsville, Dillon, Timmonsville, Lake City, and Marion. In Marlboro County, the Middendorf aquifers will not be significantly affected. If, however, the city of Florence increases its pumpage by 3 percent annually during that period, the Middendorf's potentiometric surface will undergo 60 feet of decline at Florence and 20 feet or more throughout much of Darlington, Florence, Dillon, and Marion, Counties.

A ground-water management modeling program based on simulation and optimization techniques was developed to investigate management alternatives for the city of Florence well system. The model simulates a management framework in which pumping is restricted by a specified total available drawdown. Three management alternatives were evaluated: (1) redistributed pumpage, (2) increasing total available drawdown, and (3) adding new wells to the system. Although some improvements were achieved, none of these alternatives provided sufficient ground water to satisfy the demand for the next 10 years while maintaining potentiometric levels at acceptable elevations.

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