Geohydrology of the City of Lawrenceville area

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Cooperator City of Lawrenceville
Year Started 1994

Problem

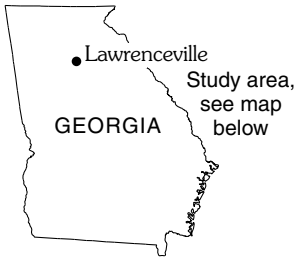
Areas of northern Georgia that are underlain by fractured igneous and metamorphic crystalline rock have almost exclusively used surface water drawn from rivers and lakes as a source for municipal water supply. The city of Lawrenceville in Gwinnett County is one of only a few municipalities in the Atlanta Region that uses ground water to supplement their water supply. Currently (2001) only a small part of the city's water supply (approximately 5 percent) comes from ground-water sources; however, the city is developing additional ground-water resources in the area to increase this amount. Information gained from this study will also benefit other communities planning to develop a ground-water supply in a fractured crystalline rock setting.

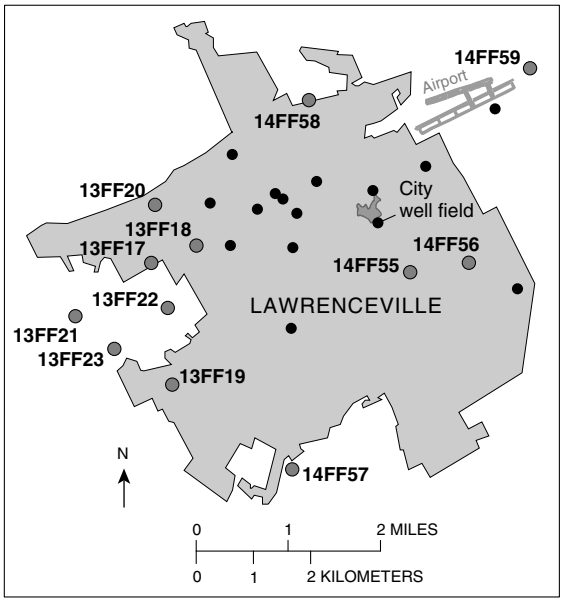
Objectives

- Evaluate the hydrogeology of the study area;
- Determine ground-water occurrence and flow near the city production wells;
- Determine areal extent and recharge pathways to pumped wells;
- Determine the storage potential and hydraulic characteristics of water-bearing zones at each site; and
- Improve methods of evaluating the ground-water resource potential of metamorphic and igneous rocks.

Progress and Significant Results, 2001

- Investigated site-specific geologic structure and hydrogeologic controls in various parts of the city in order to help identify potentially productive portions of the aquifer.
- Conducted detailed geologic mapping surveys in a number of small subareas between fall 2000 and spring 2001. The surveys were conducted to identify small-scale jointing, fracturing, and structural relations not mapped during an earlier regional-scale mapping effort. Two-dimensional-resistivity surface geophysical surveys were conducted at some of the sites to help identify potential open-fracture zones prior to test drilling.
- Selected locations, and drilled 12 test wells between May and August 2001. Subsurface structure and lithologic units penetrated at each test well were characterized using borehole geophysical techniques including: borehole television camera, electric logs, fluid temperature and resistivity, natural gamma, caliper, digital acoustic televiewer and flowmeter logs.
- Collected water samples to determine age using chlorofluorcarbon (CFC) techniques, to help evaluate recharge mechanisms to the fractured crystalline rock, and monitored the hydraulic response in the aquifer.

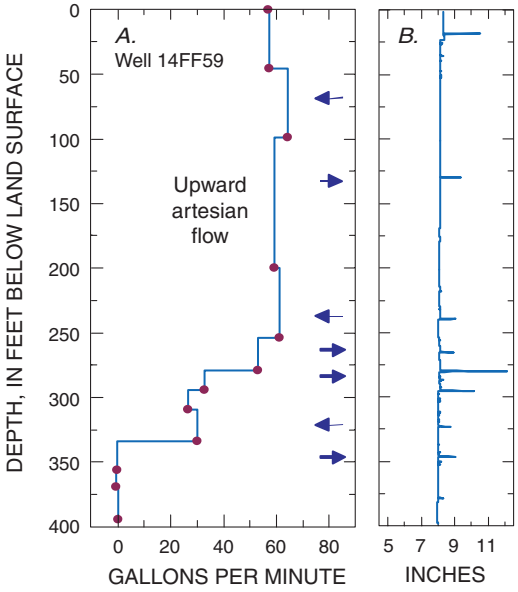




EXPLANATION

- **Existing well**
- **Recently drilled test well and site name**

Site name	Casing depth	Total depth
	In feet below land surface	
13FF17	15	480
13FF18	55	550
13FF19	65	477
13FF20	72	455
13FF21	40	505
13FF22	20	600
13FF23	30	400
14FF55	65	425
14FF56	26	605
14FF57	30	380
14FF58	34	550
14FF59	35	460



The photo above shows an electromagnetic flowmeter sonde used in Lawrenceville to measure precise flow rates along a borehole segment. The flowmeter log (A) from well 14FF59 shows most ground water is entering the borehole at fractures between 260 and 345 feet below land surface. The blue arrows indicate inflow (right facing arrows) and outflow (left facing arrows) from the borehole. The caliper log (B) shows peaks where the borehole diameter is enlarged at discrete fracture openings in the bedrock aquifer. Data are being used to characterize hydraulic properties of individual fracture zones. Photo by Lester J. Williams, USGS.

The USGS collected detailed structural and geologic information during 2001. Data are being used to relate surface and subsurface geologic features to better understand the geologic controls affecting the availability of ground water. Photo by Lester J. Williams, USGS.

Pumping tests were conducted on six test wells during 2001, such as well 14FF55 above. The USGS used an orifice weir to measure pump discharge. The USGS collected chlorofluorocarbon samples from the wells and monitored water levels to better define aquifer hydraulic properties. Photo by Lester J. Williams, USGS.

Test wells in the Lawrenceville study were drilled using an air rotary drilling rig. The photo to the left shows the discharge from air-lifting ground water from well 14FF59 after penetrating water-bearing fracture zones. Photo by Alan M. Cressler, USGS.