Ground-Water Quality in Georgia for 1992

Margaret W. Chambers

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John C. Donahue

GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION
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CIRCULAR 12 I

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GEORGIA DEPARTMENT OF NATURAL RESOURCES
Lonice C. Barrett, Commissioner
ENVIRONMENTAL PROTECTION DIVISION
Harold F. Reheis, Director
GEORGIA GEOLOGIC SURVEY
William H. McLemore, State Geologist

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This report for calendar year 1992 is the ninth in a series of annual summaries discussing the chemical quality of ground water in Georgia. These summaries are among the tools used by the Georgia Environmental Protection Division (EPD) to assess trends in the quality of the State's ground-water resources. EPD is the State organization with regulatory responsibility for maintaining and, where possible, improving ground-water quality and availability. The EPD has implemented a comprehensive state-wide ground-water management policy of anti-degradation (EPD, 1991). Five components constitute EPD's ground-water quality assessment program:

1. The Georgia Ground-Water Monitoring Network. This program is maintained by the Geologic Survey Branch of EPD and is designed to evaluate the ambient ground-water quality of ten aquifer systems throughout the State of Georgia. The data presented in this report were provided by this program.

2. Sampling of public drinking water wells as part of the Safe Drinking Water Program (Water Resources Management Branch). This program provides data on the quality of ground water that is being used by the residents of Georgia.

3. Special studies addressing specific water quality issues. An ongoing survey of nitrite/nitrate levels in shallow wells located throughout the State of Georgia (Shellenberger, in preparation; Stuart, 1995) and the operation of a Pesticide Monitoring Network (currently conducted jointly by the Geologic Survey Branch and the Georgia Department of Agriculture) are examples of these types of studies (Webb, 1995).

4. Ground-water sampling at environmental facilities such as municipal solid waste landfills, RCRA facilities, and sludge disposal facilities. The primary responsibility for monitoring these facilities are the EPD Branches of Land Protection, Water Protection, and Hazardous Waste Management.

5. The development of a wellhead protection program (WHP), which is designed to protect the area surrounding a municipal drinking water well from contaminants. Georgia's WHP Plan was approved by the Environmental Protection Agency (EPA) September 30, 1992, and was promulgated to the Georgia Safe Drinking Water Rules effective June 30, 1993. The protection of public water supply wells from contaminants is important not only for ground water quality, but also aids to ensure safe health standards for public ground-water usage.

Analyses of water samples collected for the Georgia Ground-Water Monitoring Network during calendar year 1992 and from previous years are the data base for this summary. The Georgia Ground-Water Monitoring Network is comprised of 154 wells and springs which are monitored on a bi-annual, annual, or semi-annual basis. 163 representative water samples were collected from 123 wells and 5 springs in 1992. A review of the 1992 data, and comparison of these data with analyses of samples collected as early as 1984, indicates that ground-water quality at most of the 128 sampling sites generally has changed little and remains excellent.

1.2 FACTORS AFFECTING CHEMICAL GROUND-WATER QUALITY

The chemical quality of ground water is the result of complex physical, chemical, and biological processes. Some of the more significant controls are the chemical quality of the water entering the ground-water flow system, the reactions of infiltrating water with the soils and rocks that are encountered, and the effects of the well and pump system.

Most water enters the ground-water system in upland recharge areas. Water seeps through interconnected pores and joints in the soils and rocks until it is discharged to a surface-water body (e.g., stream, river, lake, or ocean). The initial chemistry, amount of recharging and the attenuation capacity of soils have a strong influence on the quality of ground water in recharge areas. Chemical interactions of water with the aquifer host rocks has an increasing significance with longer underground residence times. As a result, ground water from discharge areas tends to be more highly mineralized than ground water in recharge areas.

The well and pump system can also have a strong influence on the quality of the well water. Well casings, through compositional breakdown, can contribute metals (e.g., iron from steel casings) and organic compounds (e.g., tetrahydrofuran from PVC pipe cement) to the water. Pumps often aerate the water being discharged. Improperly constructed wells, on the other hand, can present a conduit for local pollution to enter the ground-water flow system.

1.3 HYDROGEOLOGIC PROVINCES OF GEORGIA

Three hydrogeologic provinces in Georgia are defined by their general geologic and hydrologic characteristics (see Figure 1-1). These provinces include:

1) the Coastal Plain Province of south Georgia;
2) the Piedmont/Blue Ridge Province, which include all but the northwest corner of northern Georgia
3) the Valley and Ridge Province of northwest Georgia

Each of these provinces is described in greater detail below.

1.3.1 Coastal Plain Province

Georgia's Coastal Plain Province is composed of a wedge of loosely consolidated sediments that gently dip and thicken to the south and southeast. Ground water in the Coastal Plain Province flows through interconnected pore space between grains in the host rocks and through solution-enlarged voids. The oldest outcropping sedimentary formations (Cretaceous) are exposed along the Fall Line, which is the northern limit of the Coastal Plain Province. Successively younger formations occur at the surface to the south and southeast.

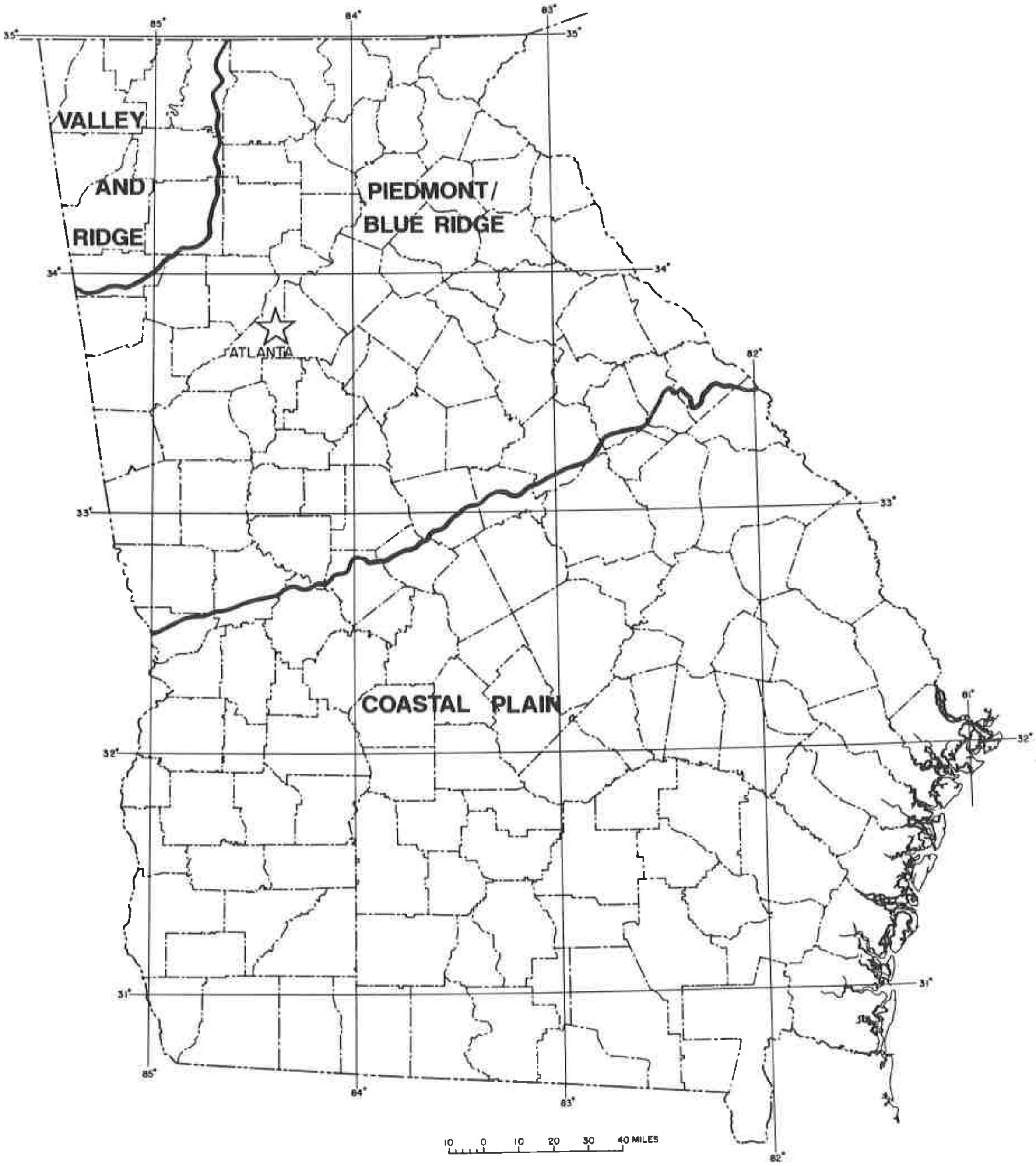


Figure 1-1. The hydrogeologic provinces of Georgia.

The Coastal Plain contains Georgia's major confined (artesian) aquifers. Confined aquifers are those which are overlain by a layer of impermeable material (e.g., clay or shale) and contain water at greater-than-atmospheric pressures. Water enters the aquifers in their up-dip outcrop areas where the permeable rocks of the aquifer are exposed. Many of the Coastal Plain aquifers are unconfined in their up-dip outcrop areas, but become confined in down-dip areas to the southeast, where they are overlain by successively younger rock formations. Ground-water flow through confined Coastal Plain aquifers is generally to the south and southeast, in the direction of dip of the rocks.

Rocks forming the seven major confined aquifers in the Coastal Plain range in age from Cretaceous to Miocene. Horizontal and vertical changes in the permeability of the rock units that form these aquifers and the quality of ground water they contain determine the thickness and extent of the aquifers. Several aquifers may be present in a single geographic area, forming a vertical 'stack'.

The Cretaceous and Jacksonian aquifer systems (primarily sands) are a common source of drinking water within a 35-mile wide band that lies adjacent to and south of the Fall Line. Southwestern Georgia relies on four vertically stacked aquifers (sands and carbonates) for drinking-water supplies: the Providence, Clayton, Claiborne and Floridan aquifer systems. A large area of south-central and southeastern Georgia is served by the Floridan aquifer system (primarily carbonates). The Miocene aquifer system (sands and carbonates) is the principal "shallow" unconfined aquifer system occupying much of the broad area underlain by the Floridan aquifer system. It becomes confined in the coastal counties and locally in the area of Grady, Thomas, Brooks, and Lowndes counties area.

1.3.2 Piedmont/Blue Ridge Province

Crystalline rocks of metamorphic and igneous origin (primarily Precambrian and Paleozoic in age) underlie the Piedmont/Blue Ridge provinces. These two provinces differ geologically, but are discussed together here because they share common hydrologic properties. The principal water-bearing features are fractures, compositional layers and other geologic discontinuities in the rock, as well as intergranular porosity in the overlying soil and saprolite horizons. Thick soils and saprolites are often important as the "reservoir" that supplies water to the water-bearing fracture and joint systems. Ground water typically flows from local highlands towards discharge areas along streams. However, during prolonged dry periods or in the vicinity of heavy pumpage, ground water may flow from the streams into the fracture and joint systems.

1.3.3 Valley and Ridge Province

The Valley and Ridge Province is underlain by consolidated Paleozoic sedimentary formations. The permeable features of the Valley and Ridge Province are principally fractures and solution voids; intergranular porosity also is important in some places. Ground-water and surface-water systems are locally closely interconnected. Dolostones and limestones of the Knox Group are the principal aquifers where they occur in the axes of broad valleys. The greater permeabilities of the thick carbonate sections in this Province, in part due to solution-enlarged joints, permit development of more extensive aquifer systems than in the Piedmont and Blue Ridge Province.

1.4 REGIONAL GROUND-WATER PROBLEMS

Data from ground-water investigations in Georgia, including the Ground-Water Monitoring Network, indicate that virtually all of Georgia has shallow ground water sufficient for domestic supply. Iron and manganese are the only constituents that occur routinely in concentrations exceeding drinking-water standards. These two naturally-occurring metals can cause staining of objects to a reddish-brown, but do not pose a health risk.

Only a few occurrences of polluted or contaminated ground waters are known from North Georgia (Table 4-1). Aquifers in the outcrop areas of Cretaceous sediments south of the Fall Line typically yield acidic water that may require treatment. The acidity occurs naturally, and results from the inability of the sandy aquifer sediments to buffer acidic rainwater and acid producing reactions between infiltrating water and soils and sediments. Nitrite/nitrate concentrations in shallow ground water from the farm belt of southeastern Georgia are almost always within drinking-water standards, but are somewhat higher than levels found in other areas of the State.

The Floridan aquifer system includes two areas of naturally occurring reduced ground-water quality in addition to its karstic plain in southwest Georgia. The Gulf Trough, a narrow, linear geological feature extending from southwestern Decatur County through central Bulloch County typically yields water with high total dissolved solids concentrations. Elevated levels of barium, sulfate, and radionuclides have been reported in ground water from the Gulf Trough. High levels of total dissolved solids also are common to the lower section of the Floridan aquifer system along the Georgia coast. Ground-water withdrawls have allowed upconing of brine from deeper parts of the aquifer in the Brunswick area.

2.0 GEORGIA GROUND-WATER MONITORING NETWORK

2.1 MONITORING STATIONS

Stations of the 1992 Ground-Water Monitoring Network are situated in the seven major aquifers and aquifer systems of the Coastal Plain Province and in the unconfined ground-water systems of the Piedmont and Blue Ridge Provinces and of the Valley and Ridge Province (see Table 2-1). Monitoring stations are located in three critical settings:

a. areas of surface recharge;
b. areas of potential pollution related to regional activities (e.g. agricultural and industrial areas)
c. in areas of significant ground-water use.

The majority of monitoring stations are municipal, industrial, and domestic wells that have reliable well-construction data. Some of the monitoring stations that are located in recharge areas are sampled more than once a year in order to monitor more closely changes in ground-water quality. The monitoring Network also includes monitoring wells in specific areas where the State's aquifers are recognized to be susceptible to contamination or pollution (e.g. the Dougherty Plain of south-western Georgia and the State's coastal area). These monitoring wells are maintained jointly by the Geologic Survey Branch and the United States Geological Survey.

2.2 USES AND LIMITATIONS

Regular sampling of wells and springs of the Ground-Water Monitoring Network permits analysis of ground-water quality with respect to location (spatial trends) and with respect to the time of sample collection (temporal trends). Spatial trends are useful for assessing the effects of the geologic framework of the aquifer and regional land-use activities on ground-water quality. Temporal trends permit an assessment of the effects of rainfall and drought periods on ground-water quantity and quality. Both trends are useful for the detection of non-point source pollution. Examples of non-point source pollution include acid rain and regional land-use activitiesforxample,application of agricultural chemicals on crop lands).

It should be noted that the data of the Ground-Water Monitoring Network represent water quality in only limited areas of Georgia. Monitoring water quality at 154 sites located throughout Georgia provides an indication of ground-water quality at the localities sampled and at depths corresponding to the screened interval in the well at each station in the Monitoring Network. Caution should be exercised in drawing strict conclusions and applying any results reported in this study to ground waters that are not being monitored.

Stations of the Ground-Water Monitoring Network are intentionally located away from known point sources of pollution. The wells provide baseline data on ambient water quality in Georgia. EPD requires other forms of ground-water monitoring for activities that may result in point source pollution (e.g., landfills, hazardous waste facilities and land application sites) through its environmental facilities permit programs.

Ground-water quality changes gradually and predictably in the areally extensive aquifers of the Coastal Plain Province. The Monitoring Network allows for some definition of the chemical processes occurring in large confined aquifers. Unconfined aquifers in northern Georgia and the surface recharge areas of southern Georgia are of comparatively small areal extent and more open to interactions with land-use activities. The wider spacing of monitoring stations does not permit equal characterization of water-quality processes in all of these settings. The quality of water from monitoring wells completed in unconfined north Georgia aquifers represents only the general nature of ground water in the vicinity of the monitoring wells. In contrast, ground water from monitoring wells located in surface recharge areas of Georgia Coastal Plain aquifers may more closely reflect the general quality of water that has entered these aquifers. Ground water in the recharge areas of the Coastal Plain aquifers is the future drinking-water resource for down-flow areas. Monitoring wells in these recharge areas, in effect, constitute an early warning system for potential future water quality problems in confined portions of the Coastal Plain aquifers.

2.3 ANALYSES

Analyses are available for 163 water samples collected during 1992 from 123 wells and 5 springs. In 1984, the first year of the Ground-Water Monitoring Network, hydrogeologists sampled water from 39 wells located in the Piedmont/Blue Ridge and Coastal Plain Provinces. Nine of these wells have been sampled each year since 1984. During the past seven years, the Ground-Water Monitoring Network has expanded to cover additional wells and springs, encompassing all three hydrogeologic provinces, with the majority of monitoring done in the Coastal Plain.

Ground water from all monitoring stations is tested for the basic water quality parameters included in the Monitoring Network's standard analysis. The standard parameters include pH, specific conductivity, chloride, fluoride, sulfate, nitrite/nitrate, and thirty metals (see Appendix, Table A-1). Where regional land-use activities have the potential to affect ground-water quality in the vicinity of a monitoring station, additional parameters such as chlorinated pesticides (Organics Screen #2), and phenoxy herbicides (Organics Screen #4) are tested. These and additional chemical screens are listed in the Appendix (Tables A-1, A-2, A-3, and A-4). Tables 2-2a and 2-2b summarize the significance of the common major constituents of a water-quality analysis.

The Drinking Water Program of the EPD's Water Resources Management Branch has established Maximum Contaminant Levels (MCL's) for some of the parameters that are included in the analyses performed on Ground-Water Monitoring Network samples. Primary Maximum Contaminant Levels are established for parameters that may have adverse effects on the public health when the Primary MCL's are exceeded. Secondary Maximum Contaminant Levels are established for parameters that may give drinking water an objectionable odor or color and consequently cause persons served by public water systems to discontinue its use. The Primary and Secondary MCL's for Ground Water Monitoring Network parameters are given in the Appendix. New MCL's for certain substances became effective July

30, 1992, and are listed in Tables A-5, A-6, and A-7 in the Appendix. Among the more consequential changes to the MCL's are those involving aluminum, barium, lead, cadmium, and benzene.

In-place pumps are used whenever possible to purge wells and collect water samples. Using these pumps minimizes the potential for cross-contamination of wells. Some wells that are included in the Ground-Water Monitoring Network are continuous water-level monitoring stations and do not have dedicated pumps. A two horse-power, trailer-mounted four-inch electric submersible pump and a three-inch, truck-mounted submersible pump are the principal portable purge-and-sampling devices used. A battery-powered, portable Fultz sampling pump and a PVC hand pump are occasionally used at stations that cannot be sampled using the principal sampling pumps.

Sampling procedures are adapted from techniques used by the U.S. Geological Survey and the U.S. Environmental Protection Agency. Hydrogeologists purge the wells (3 to 5 volumes of the well column) prior to the collection of a sample to minimize the influence of the well, pump and distribution system on water quality. Municipal, industrial, and domestic wells typically require approximately 45 minutes of purging prior to sample collection. Wells without dedicated pumps often require much longer periods of purging.

Hydrogeologists monitor water quality parameters prior to sample collection. Measurements of pH, dissolved oxygen content, specific conductivity, and temperature are observed using field instruments. The instruments are mounted in a manifold that captures flow at the pump system discharge point before the water is exposed to atmospheric conditions. Typical trends include a lowering of pH, dissolved oxygen content, and specific conductivity, and a transition toward the mean annual air temperature with increased purging time. The hydraulic flow characteristics of unconfined aquifers and pump effects often alter these trends.

Samples are collected once the parameters being monitored in the field stabilize or otherwise indicate that the effects of the well have been minimized. Files at the Georgia Geologic Survey contain records of the field measurements. The sample bottles are filled and then promptly placed in an ice water bath to preserve the water quality. After several hours, the bottles are transferred to a dry cooler refrigerated with an ice tray. The hydrogeologists then transport the samples to the laboratories for analysis on or before the Friday of the week in which they were collected.

During 1992, EPD laboratories performed inorganic chemical analyses for volatile and semivolatile organic compounds (screens 8, 9, and 10, see Tables A-1 through A-4 in Appendix) until November of that year, when the laboratories suspended operations for a move. The Cooperative Extension Service Laboratories at the University of Georgia began performing the above analyses for the remainder of the year. The Cooperative Extension Service Laboratories also performed pesticide analyses (screens 1, 2, 3, 4, 5, and 7, see Table A-2 in Appendix) for samples collected in 1992. In December of 1992, the screen 5 pesticide analysis was transferred to the Georgia Department of Agriculture (GDA) Laboratories. The GDA Laboratories will eventually be performing all routine pesticide analyses, which will result in a savings of time and expense.

Table 2-1. Georgia Ground-Water Monitoring Network, 1992

AQUIFER SYSTEM	NUMBER OF MONITORING STATIONS & SAMPLES TAKEN IN 1992	PRIMARY STRATIGRAPHIC EQUIVALENTS	AGE OF AQUIFER FORMATIONS
Cretaceous	18 stations (23 samples taken in 1992)	Ripley Formation, Cusseta Sand, Blufftown Formation, Eutaw Formation, and Tuscaloosa Formation	Late Cretaceous
Providence	4 stations (4 samples taken in 1992)	Providence Sand	Late Cretaceous
Clayton	6 stations (6 samples taken in 1992)	Clayton Formation	Paleocene
Claiborne	7 stations (7 samples taken in 1992)	Tallahatta Formation	Middle Eocene
Jacksonian	7 stations (11 samples taken in 1992)	Barnwell Group	Late Eocene
Floridan	47 stations (63 samples taken in 1992)	Predominantly Suwannee Limestone and Ocala Group	Predominantly Middle Eocene to Oligocene
Miocene	10 stations (14 samples taken in 1992)	Predominantly Altamaha Formation and Hawthorne Group	Miocene-Recent
Piedmont	16 stations (20 samples taken in 1992)	Various igneous and metamorphic complexes	Predominately Paleozoic and Precambrian
Blue Ridge	4 stations (4 samples taken in 1992)	Various metamorphic complexes	Predominately Paleozoic and Precambrian
Valley and Ridge	9 stations (11 samples taken in 1992)	Shady Dolomite, Knox Group,and Chickamauga Group	Paleozoic,mostly Cambrian and Ordovician

Table 2-2a. The Significance of Parameters of a Basic Water Quality Analysis: Cations (after Wait, 1960).

<table>
<tr><th>PARAMETER(S)</th><th>SIGNIFICANCE</th></tr>
<tr><td>pH (Hydrogen ion concentration)</td><td>pH is a measure of the concentration of the hydrogen ion. Values of pH less than 7.0 denote acidity and values greater than 7.0 indicate alkalinity. Corrosiveness of water generally increases with decreasing pH. However, excessively alkaline waters may also attack metals. A pH range between 6.0 and 8.5 is considered acceptable.</td></tr>
<tr><td>Calcium and magnesium *</td><td>Calcium and magnesium cause most of the hardness of water. Hard water consumes soap before a lather will form and deposits scale in boilers, water heaters, and pipes. Hardness is reported in terms of equivalent calcium carbonate. The hardness of a water can be estimated by the sum of multiplying the parts per million of calcium by 2.5 and that of magnesium by 4.1.

<table>
<tr><th>Water Class</th><th>Hardness (parts per million)</th></tr>
<tr><td>Soft</td><td>Less than 60</td></tr>
<tr><td>Moderately Hard</td><td>60 to 120</td></tr>
<tr><td>Hard</td><td>121 to 180</td></tr>
<tr><td>Very Hard</td><td>More than 180</td></tr>
</table></td></tr>
<tr><td>Sodium and potassium *</td><td>Sodium and potassium have little effect on the use of water for most domestic purposes. Large amounts give a salty taste when combined with chloride. A high sodium content may limit the use of water for irrigation.</td></tr>
<tr><td>Iron and manganese</td><td>More than 300 parts per billion of iron stains objects red or reddish brown and more than 50 parts per billion of manganese stains objects black. Larger quantities cause unpleasant taste and favor growth of iron bacteria but do not endanger health.</td></tr>
</table>

*Major metallic ions present in most ground waters.

Table 2-2b. The significance of Parameters of a Basic Water Quality Analysis: Anions (after Wait, 1960).

PARAMETER(S)	**SIGNIFICANCE**
Chloride	Chloride salts in excess of 100 parts per million give a salty taste to water. Large quantities make the water corrosive. Water that contains excessive amounts of chloride is not suitable for irrigation. It is recommended that chloride content should not exceed 250 parts per million.
Nitrate/Nitrite	Concentrations much greater than the local average may suggest pollution. Excessive amounts of nitrate/nitrite in drinking or formula water of infants may cause a type of methemoglobinemia ("blue babies"). Nitrate/nitrite in concentrations greater than 10 parts per million (as nitrogen) is considered to be a health hazard.
Sulfate	Sulfate in hard water increases the formation of scale in boilers. In large amounts, sulfate in combination with other ions imparts a bitter taste to water. Concentrations above 250 parts per million have a laxative effect but 500 parts per million is considered safe.

3.0 GROUND-WATER QUALITY IN GEORGIA

3.1 OVERVIEW

Georgia's ten major aquifers and aquifer systems are grouped into three hydrogeologic provinces for the purposes of this report.

The Coastal Plain Province is comprised of seven major aquifers that are restricted to specific regions and depths within the province because of their geometry (see Figure 3-1). These major aquifer systems, in many cases, incorporate smaller aquifers that are locally confined. Monitoring wells in the Coastal Plain aquifers are generally located in three settings:

1. Recharge (or outcrop) areas, which are located in regions that are geologically up-dip and generally to the north of confined portions of these aquifers.
2. Up-dip, confined areas, which are located in regions that are proximal to the recharge areas, yet are confined by overlying geologic formations. These areas are generally south to southeast of the recharge areas.
3. Down-dip, confined areas, located to the south and southeast in the deeper, confined portions of the aquifers distal to the recharge areas.

The two hydrogeologic provinces of north Georgia, the Piedmont/Blue Ridge Province and the Valley and Ridge Province, are characterized by small-scale, localized ground-water flow patterns. Deep regional flow systems are unknown in northern Georgia. Ground-water flow in the Piedmont/Blue Ridge Province is generally controlled by geologic discontinuities (such as fractures) and compositional changes within the aquifer. Local topographic features, such as hills and valleys, influence ground-water flow patterns. Many of the factors controlling ground-water flow in the Piedmont/Blue Ridge Province are also present in the Valley and Ridge Province. Furthermore, widespread development of karst features may significantly enhance porosity and permeability in localized areas and exert a strong influence on local ground-water flow patterns.

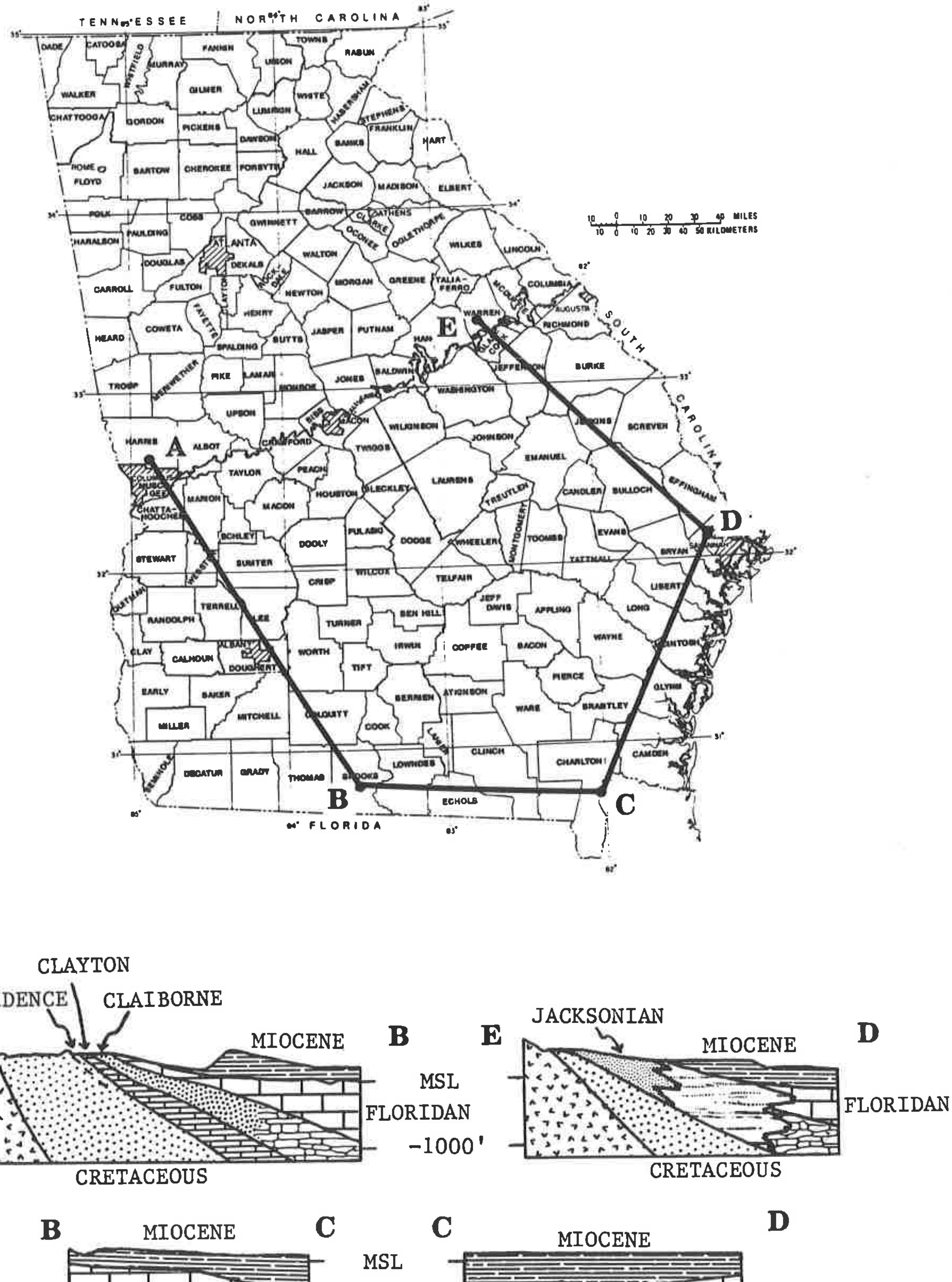


Figure 3-1. The seven major aquifers and aquifer systems of the Coastal Plain Province.

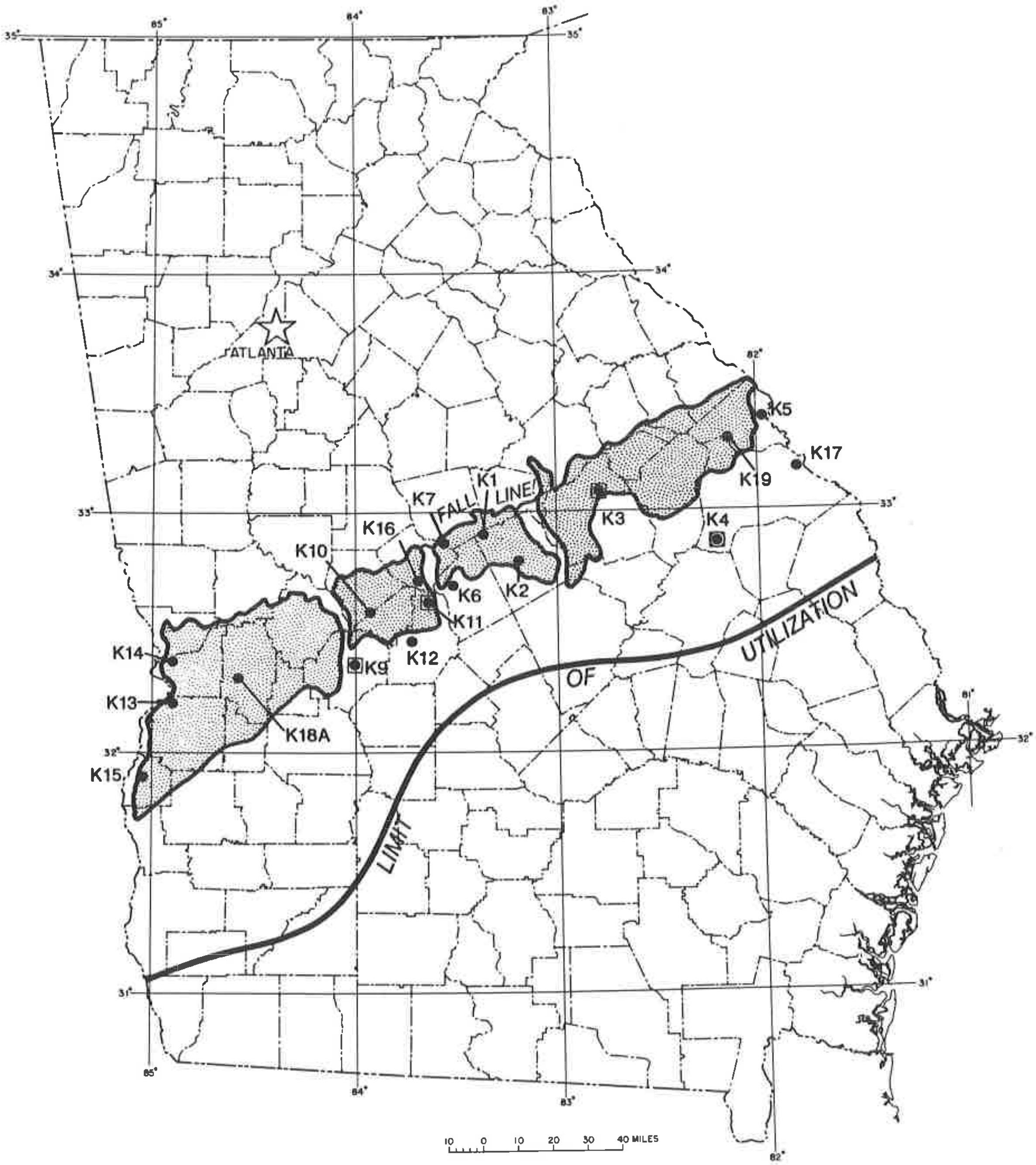
3.2 CRETACEOUS AQUIFER SYSTEM

The Cretaceous aquifer system is a complexly interconnected group of aquifer subsystems developed in the Late Cretaceous sands of the Coastal Plain Province. These sands crop out in an extensive recharge area immediately south of the Fall Line in west and central Georgia (see Figure 3-2). Overlying sediments restrict Cretaceous outcrops to valley bottoms in parts of the northeastern Coastal Plain. Five distinct subsystems of the Cretaceous aquifer system, including the Providence aquifer system, are recognized west of the Ocmulgee River (Pollard and Vorhis, 1980). These merge into three subsystems to the east (Clarke, et al., 1985). Aquifer sands thicken southward from the Fall Line, where they pinch out against crystalline Piedmont rocks, to a sequence of sand and clay approximately 2,000 feet thick at the southern limits of the main aquifer-use area. Leakage from adjacent members of the aquifer system provides significant recharge in down-dip areas.

Water quality of the Cretaceous aquifer system, excluding the Providence aquifer system (discussed separately in this report), was monitored in 18 wells. Two of these wells (GWN-K4 and GWN-K17) are located away from the recharge area. The remainder are located in up-dip areas in or adjacent to outcrop and surface recharge areas for the Cretaceous aquifer system.

Water from the wells was soft and, in the up-dip area wells, acidic, while water from downdip wells (GWN-K4, GWN-K13, GWN-K14, GWN-K15, GWN-K17) was basic.

Iron concentrations exceeded the State Secondary Maximum Contaminant Level (MCL) of 300 parts per billion in only three wells: one in Washington County yielded 560 parts per billion, one in Burke County yielded 5,400 parts per billion, and one in Macon County yielded 1,500 parts per billion. Figure 3-3 shows trends in iron concentrations for selected wells in the Cretaceous aquifer. Concentrations of major alkali metals (calcium, magnesium, potassium and sodium) were generally either low or below detection limits. Other trace metals (aluminum and zinc) were present in minor amounts.



General recharge area (from Davis, et al., 1988)

• Soft water

○ Manganese exceeds MCL

□ Iron exceeds MCL

Figure 3-2. Water quality of the Cretaceous aquifer system.

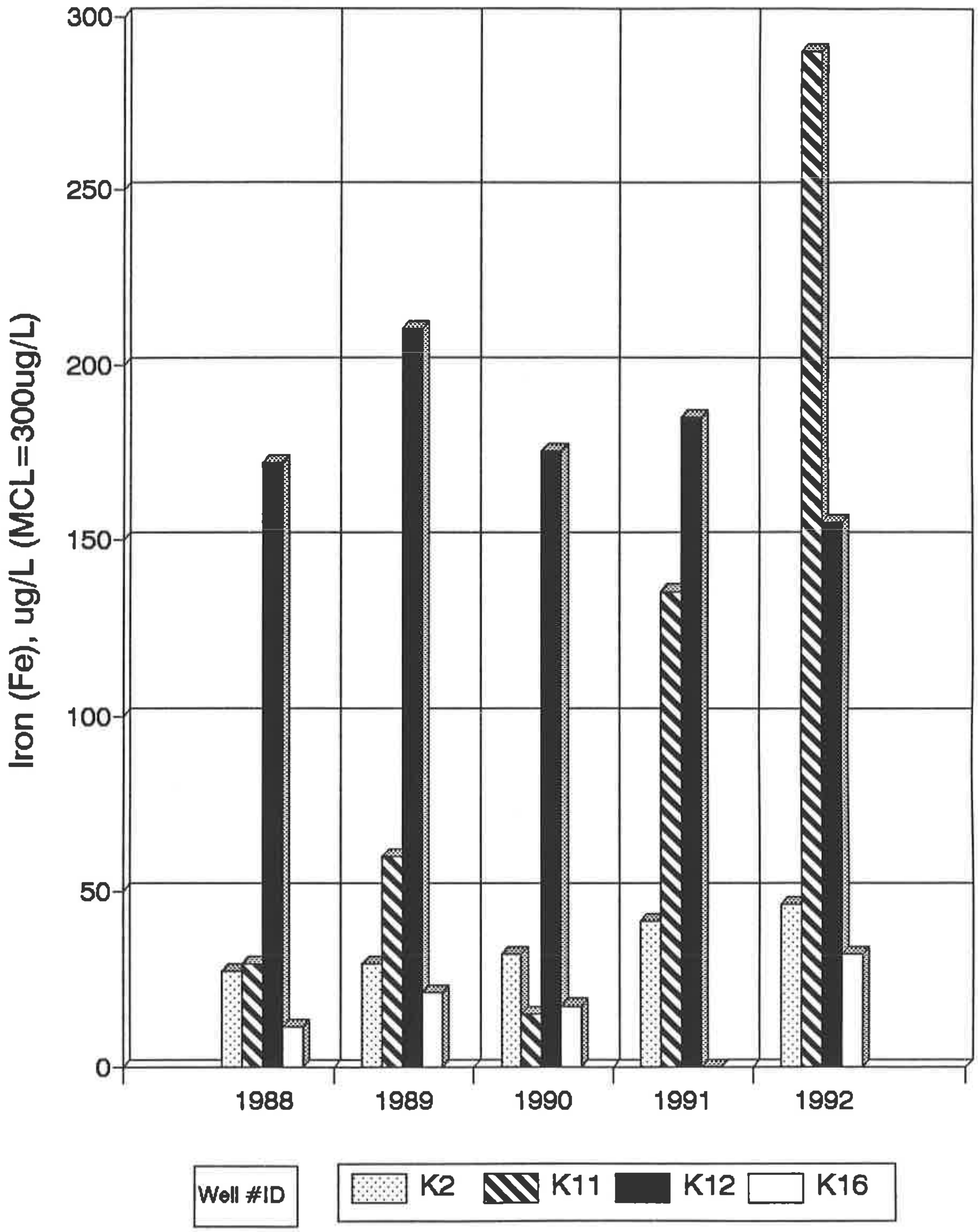


Figure 3-3. - Iron concentrations in selected wells in the Cretaceous aquifer system.

Water samples from six wells contained detectable levels of nitrite/nitrate. The highest value, 1.1 parts per billion was measured from one well (GWN-K10) that has consistently measured high the past several years. Figure 3-4 shows trends in levels of combined nitrite/nitrate (reported as parts per million nitrogen) for wells that have historically yielded water with detectable and non-detectable nitrite/nitrate levels.

3.3 PROVIDENCE AQUIFER SYSTEM

Sand and coquinoid limestone of the Late Cretaceous Providence Formation comprise the Providence aquifer system of southwestern Georgia. Outcrops of the aquifer system extend from northern Clay and Quitman Counties through eastern Houston County. In its up-dip extent, the aquifer system thickens both to the east and to the west of a broad area adjacent to the Flint River. Areas where the thickness of the Providence exceeds 300 feet are known in Pulaski County, and similar thicknesses have been projected in the vicinity of Baker, Calhoun, and Early counties (Clarke, et al., 1983).

The permeable Providence Formation-Clayton Formation interval forms a single aquifer east of the Flint River (Clarke, et al., 1983). This same interval is recognized as the Dublin aquifer system to the east of the Ocmulgee River (Clarke, et al., 1985). Outcrop areas and adjacent covered areas to the east of the Flint River, where the aquifer is overlain by permeable sand units, are surface recharge areas. The Chattahoochee River forms the western discharge boundary for this flow system in Georgia.

Water samples were taken from four wells in the Providence aquifer system in 1992 (Figure 3-5). Concentrations of metals were generally low or below detection limits, except for a sample from well PD1, where iron and aluminum levels exceeded the secondary MCL's, with levels of 4300 parts per billion and 3800 parts per billion, respectively. Well PD1, a test well, is pumped only for sampling, while the other wells see regular use. Sodium, chloride, and sulfate were more abundant in the

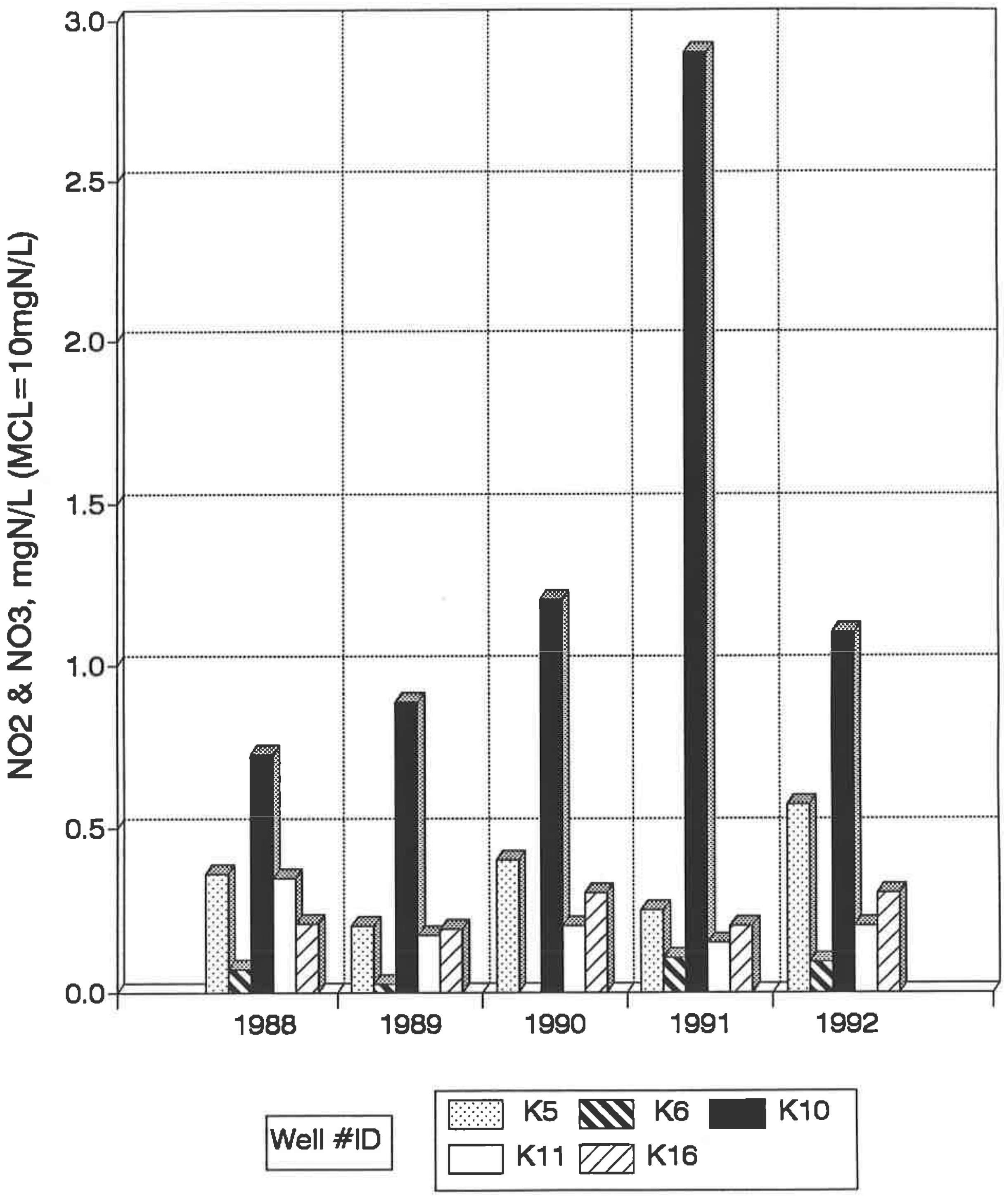
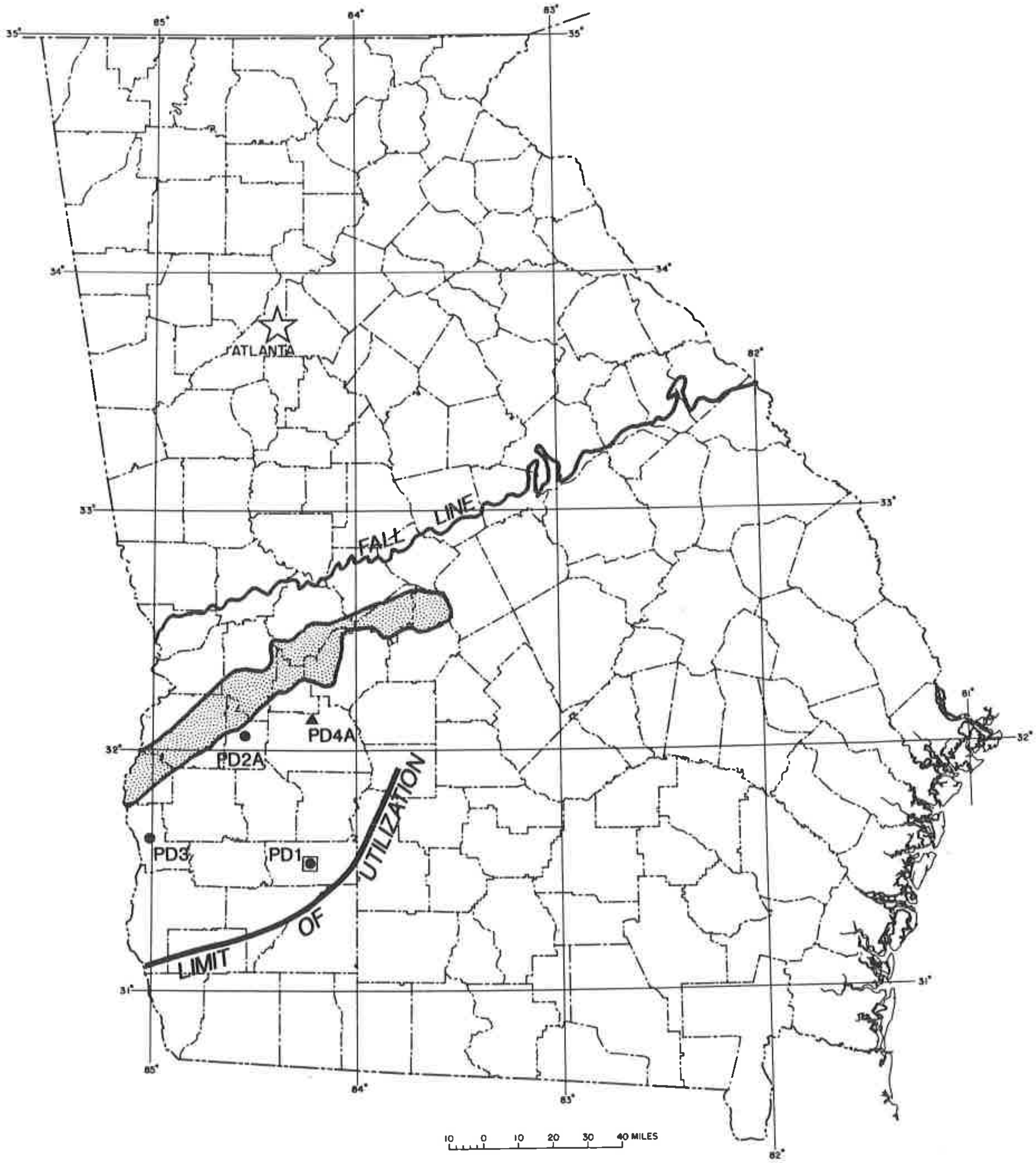


Figure 3-4. - Nitrite/nitrate concentrations in select wells in the Cretaceous aquifer system.



General recharge area (after Davis, et al., 1988)

● Soft water

▲ Moderately hard water ☐ Iron exceeds MCL

Figure 3-5. Water quality of the Providence aquifer system.

down-dip samples. The only well to yield a sample with detectable nitrate/nitrite, 0.3 parts per million nitrogen, was the up-dip well GWN-PD2A. Other elements detected consisted of calcium, magnesium, barium, strontium, fluoride, titanium, zirconium, and copper.

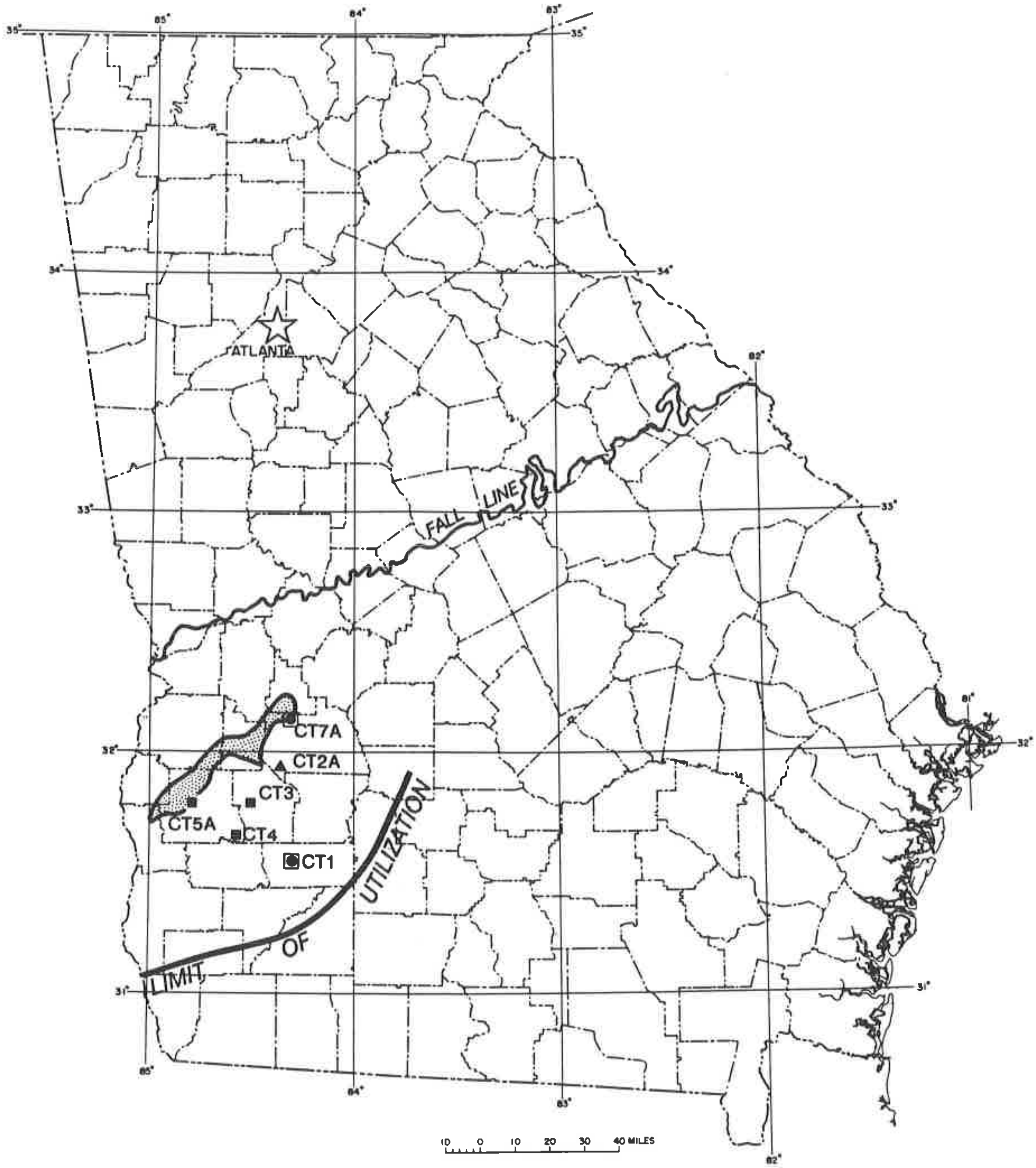
Water quality analysis for the Providence Aquifer System are reported in the Appendix.

3.4 CLAYTON AQUIFER SYSTEM

The Clayton aquifer system of southwestern Georgia is developed in the middle limestone unit of the Paleocene Clayton Formation. Limestones and calcareous sands of the Clayton aquifer system crop out in a narrow belt extending from northeastern Clay County to southwestern Schley County (see Figure 3-6). Aquifer thickness varies irregularly, ranging from 50 feet near outcrop areas to 265 feet in southeastern Mitchell County (Clarke, et al., 1984). Both the Flint River, to the east, and the Chattahoochee River, to the west, are areas of discharge for the aquifer system in its up-dip extent. Leakage from the underlying Providence aquifer system and the overlying Wilcox confining zone is significant in down-dip areas (Clarke, et al., 1984). The Clayton Formation and Providence Formation merge to form a single aquifer unit in up-dip areas (Long, 1989). In areas east of the Ocmulgee River, the combination of these two aquifers is referred to as the Dublin aquifer system (Clarke, et al., 1985).

Six out of seven wells in the Clayton aquifer system were used to monitor water quality in 1992. Wells GWN-CT5A and GWN-CT7A are located in or near the recharge area.

Except for the sample from the recharge area well GWN-CT7A, whose ph level was 4.7, the water samples were slightly basic, a condition consistent with those of other limestone waters. Iron concentrations range from non-detectable to 2,000 parts per billion in well GWN-CT1 and 590 parts per billion in GWN-CT7A. Potassium, titanium, barium, molybdenum, fluorine, strontium, and zinc were also detected.



General recharge area (after Davis, et al., 1988)

- ● Soft water
- ▲ Moderately hard water
- ■ Hard water

□ Iron exceeds MCL

Figure 3-6. Water quality of the Clayton aquifer system.

Chloride content was very low in the down-dip wells, less than 2 parts per million, but was somewhat elevated in the up-dip well (GWN-CT7A), at 11 parts per million.

Nitrate/nitrite concentration trends were low in down-dip wells, but higher in GWN-CT7A (7.3 parts per million nitrogen). Detectable sulfate was limited to the down-dip wells. No synthetic organic chemicals were found.

Trends of iron and nitrite/nitrate concentrations in Clayton aquifer wells are shown in Figures 3-7 and 3-8. Water quality analysis for the Clayton aquifer system are shown in the Appendix.

3.5 CLAIBORNE AQUIFER SYSTEM

Sands of the Middle Eocene Claiborne Group are the primary members of the Claiborne aquifer system of southwestern Georgia (see Figure 3-9). Claiborne Group sands crop out in a belt extending from northern Early County through western Dooly County. Limited recharge may be derived down-dip in the vicinity of Albany in Dougherty County by leakage from the overlying Floridan aquifer system (Hicks, et al., 1981). Discharge boundaries of the aquifer system are the Ocmulgee River, to the east, and the Chattahoochee River, to the west.

The aquifer generally thickens from the outcrop area towards the southeast, attaining a thickness of almost 300 feet in eastern Dougherty County. In down-dip areas where the Claiborne Group can be divided into the Lisbon Formation above and the Tallahatta Formation below, the Claiborne aquifer system is generally restricted to the Tallahatta Formation, and the Lisbon Formation acts as a confining unit that separates the Claiborne aquifer from the overlying Floridan aquifer (McFadden and Perriello, 1983; Long, 1989). The permeable Tallahatta unit is included in the Gordon aquifer system east of the Ocmulgee River (Brooks, et al., 1985).

Seven wells were used to monitor water quality in the Claiborne aquifer. The pH of the water samples ranged from acidic in the updip

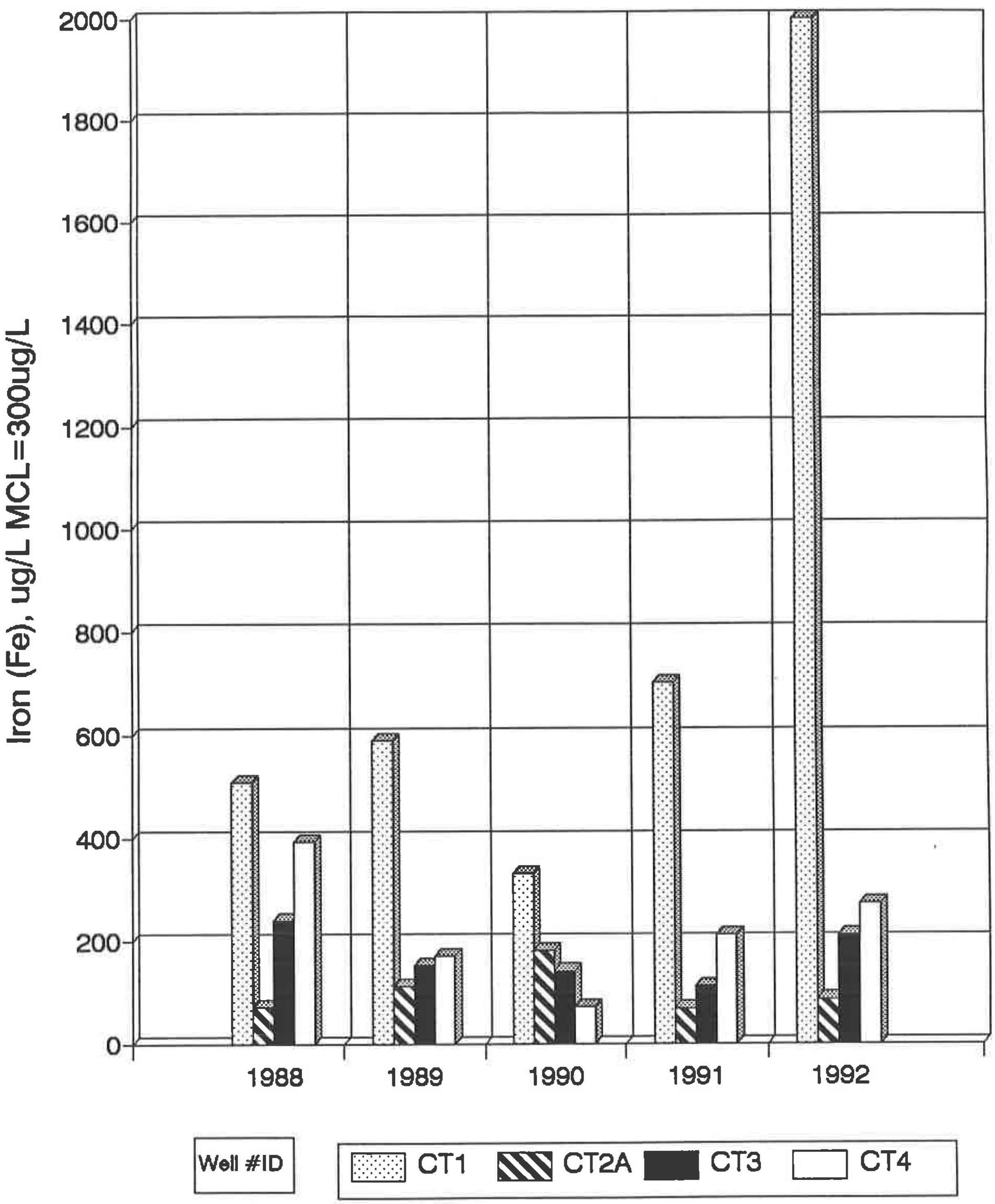


Figure 3-7. - Iron concentrations in selected wells in the Clayton aquifer system.

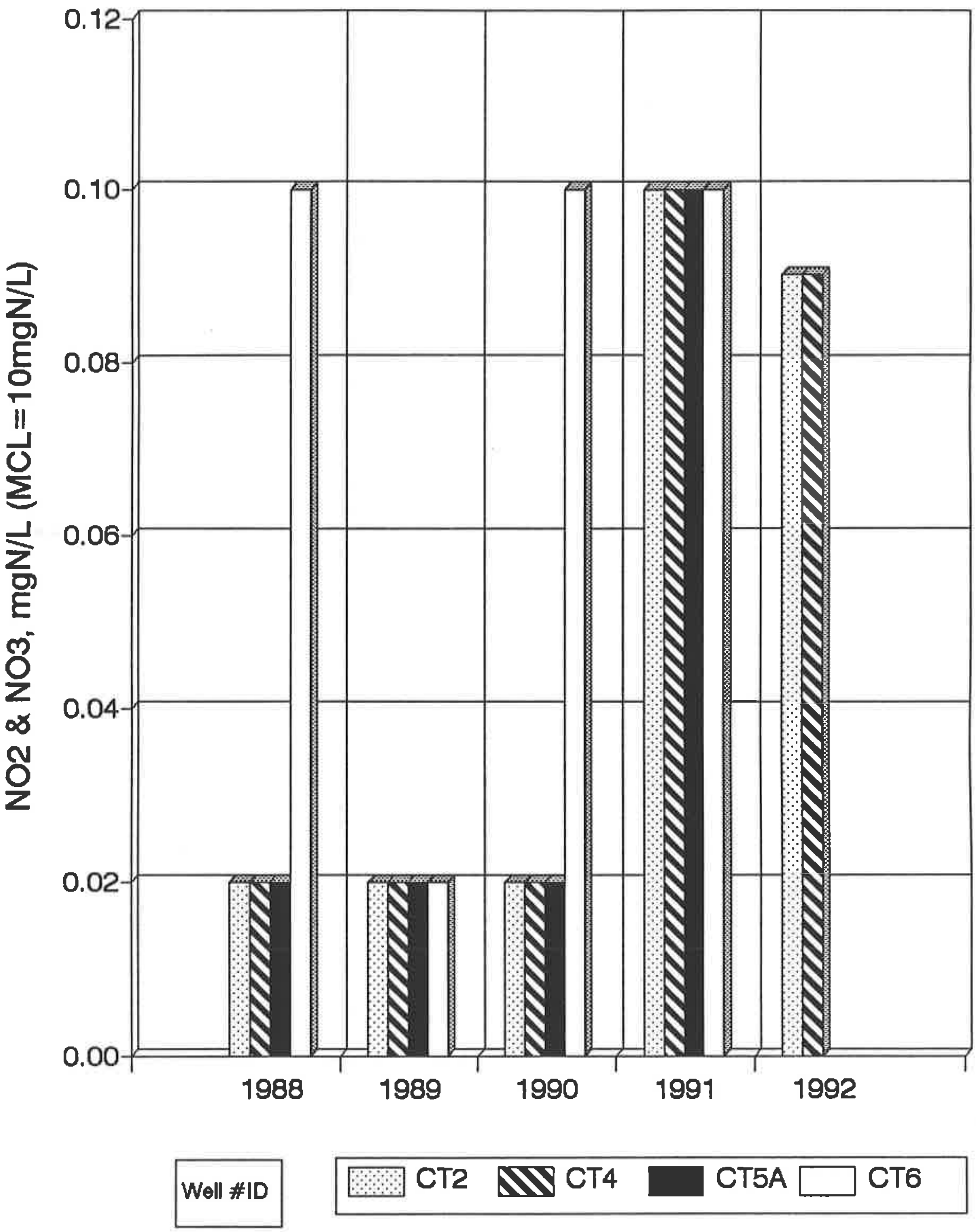
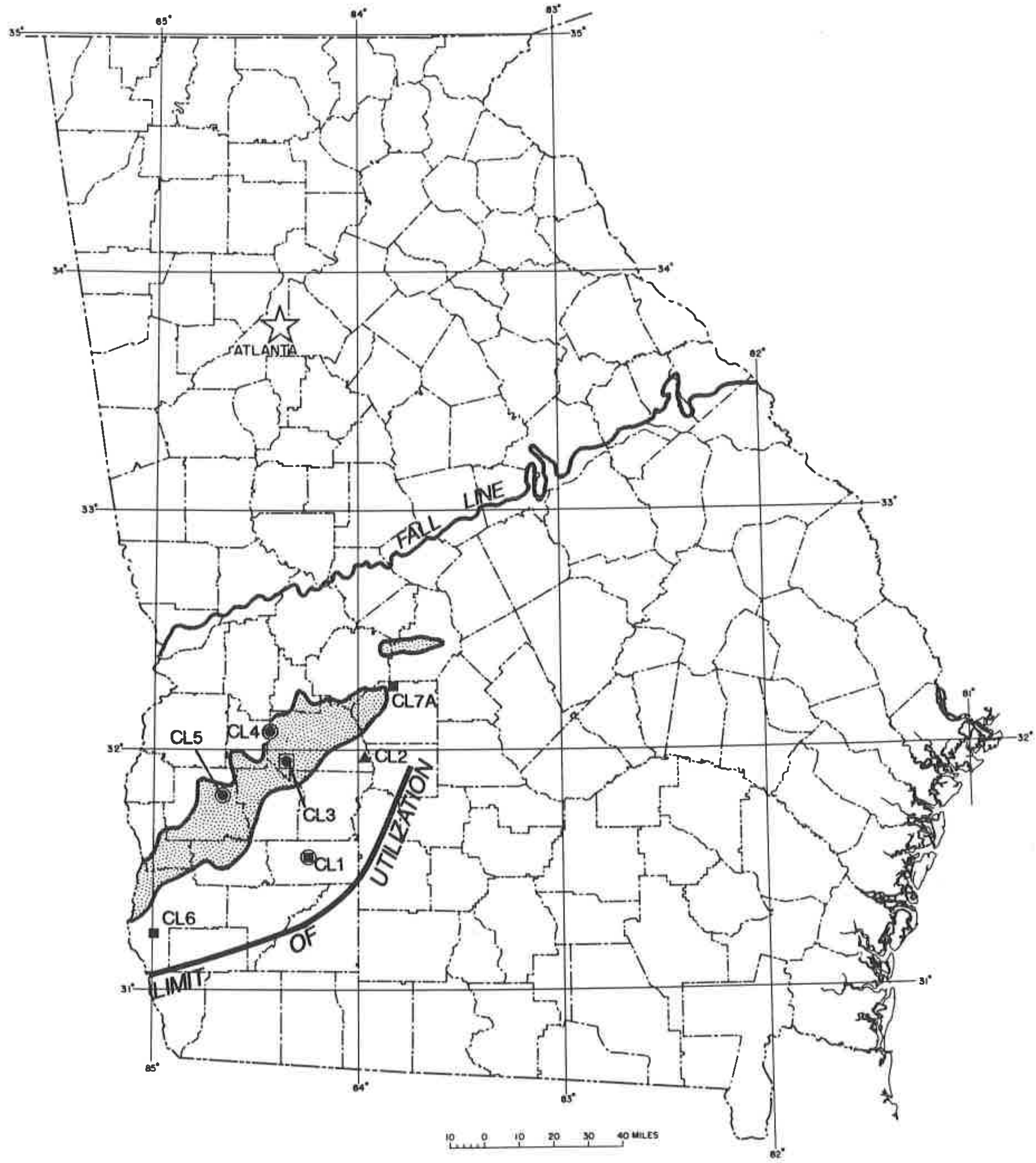


Figure 3-8. - Nitrite/nitrate concentrations in selected wells in the Clayton aquifer system.



General recharge area (from Davis, et al., 1988)

- ● Soft water
- ■ Hard water
- □ Iron exceeds MCL
- ○ Manganese exceeds MCL

Figure 3-9. Water quality of the Claiborne aquifer system.

area (4.3 for well GWN-CL5 at Shellman in Randolph County) to slightly basic in the downdip area (7.6 for GWN-CL6 in Early County). Samples from two wells, GWN-CL1 and GWN-CL3, exceeded the secondary MCL for iron with levels of 390 and 1,500 parts per billion, respectively. Manganese levels in samples from wells GWN-CL4 and GWN-CL5 and the aluminum level in the sample from well GWN-CL5 exceeded the secondary MCL's for these elements. Figure 3-10 shows trends in iron concentrations ranging from non-detctable to detectable levels.

Calcium and sodium concentrations were generally greatest in samples from the downdip wells. The calcium concentrations are consistent in range with ground waters derived from limestone. Metals detected included aluminum, barium, strontium, zinc, copper, yttrium, and cobalt.

Samples from three of the wells (GWN-CL3, GWN-CL4, and GWN-CL5), all in the recharge area, contained detectable levels of nitrite/nitrate, with GWN-CL5 measuring 8.4 parts per million. Water samples from this well have historically had high nitrate/nitrite (and manganese) levels. Figure 3-11 shows nitrite/nitrate concentrations for selected wells. Chloride was detected in samples from all wells, with the maximum at 9.4 parts per million for GWN-CL5. Sulfate was detected in samples from the four confined-area wells, with a maximum of 7.3 parts per million in GWN-CL2. The recharge area wells contained no detectable sulfate. Traces of fluoride were also found in samples from five wells. The organic compounds tested for are given on page A-12 in the Appendix. Of these, traces of benzene were detected in GWN-CL4 at Plains.

3.6 JACKSONIAN AQUIFER SYSTEM

The Jacksonian aquifer system of central and east-central Georgia is developed predominantly in sands of the Eocene Barnwell Group. Outcrops of sand, clay of the Barnwell Group extend from Macon and Peach Counties eastward to Burke and Richmond Counties (see Figure 3-12). Aquifer sands form a northern clastic facies of the Barnwell Group and grade southward into less permeable silts and clays of a transition

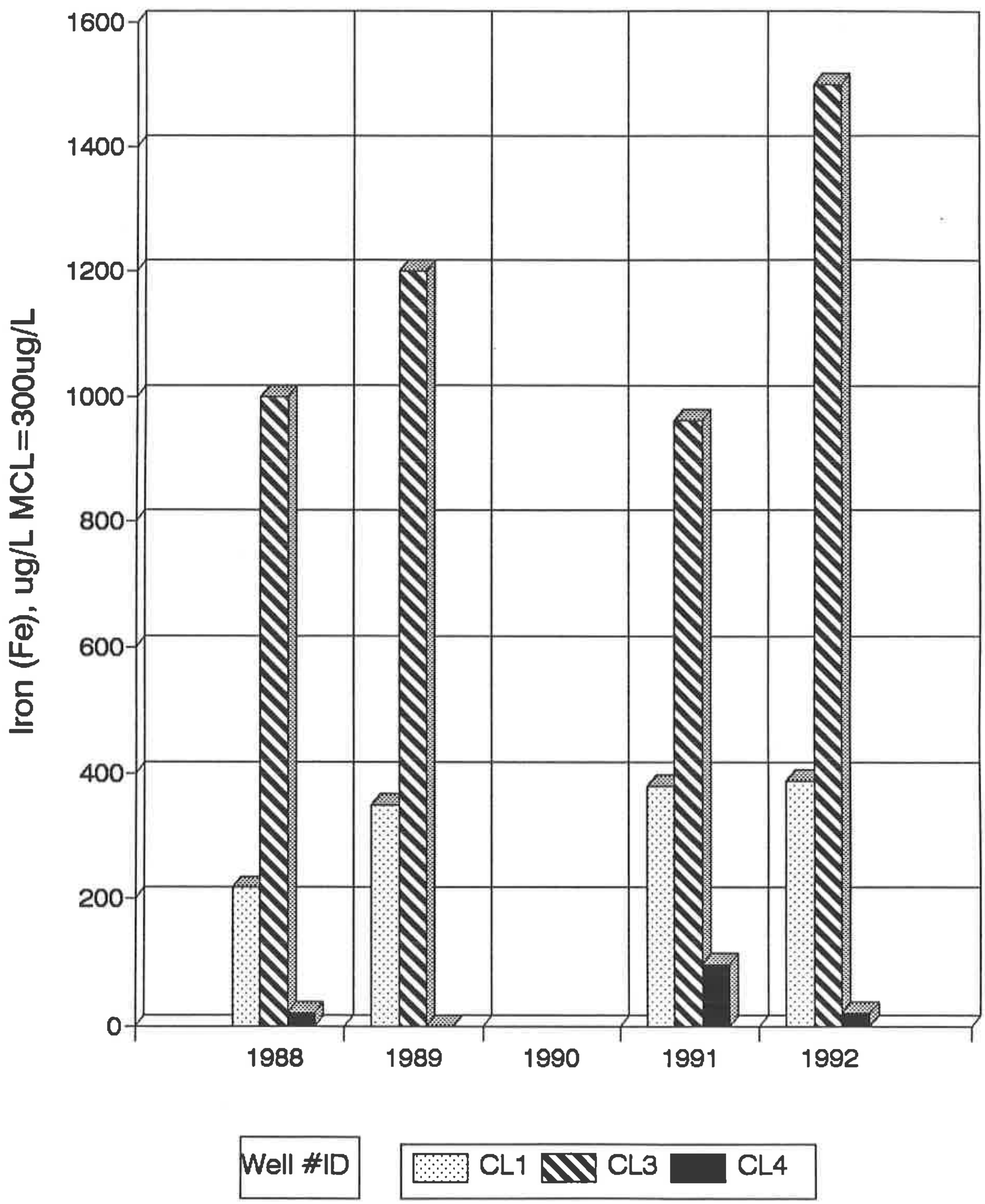


Figure 3-10. - Iron concentrations in selected wells in the Claiborne aquifer system.

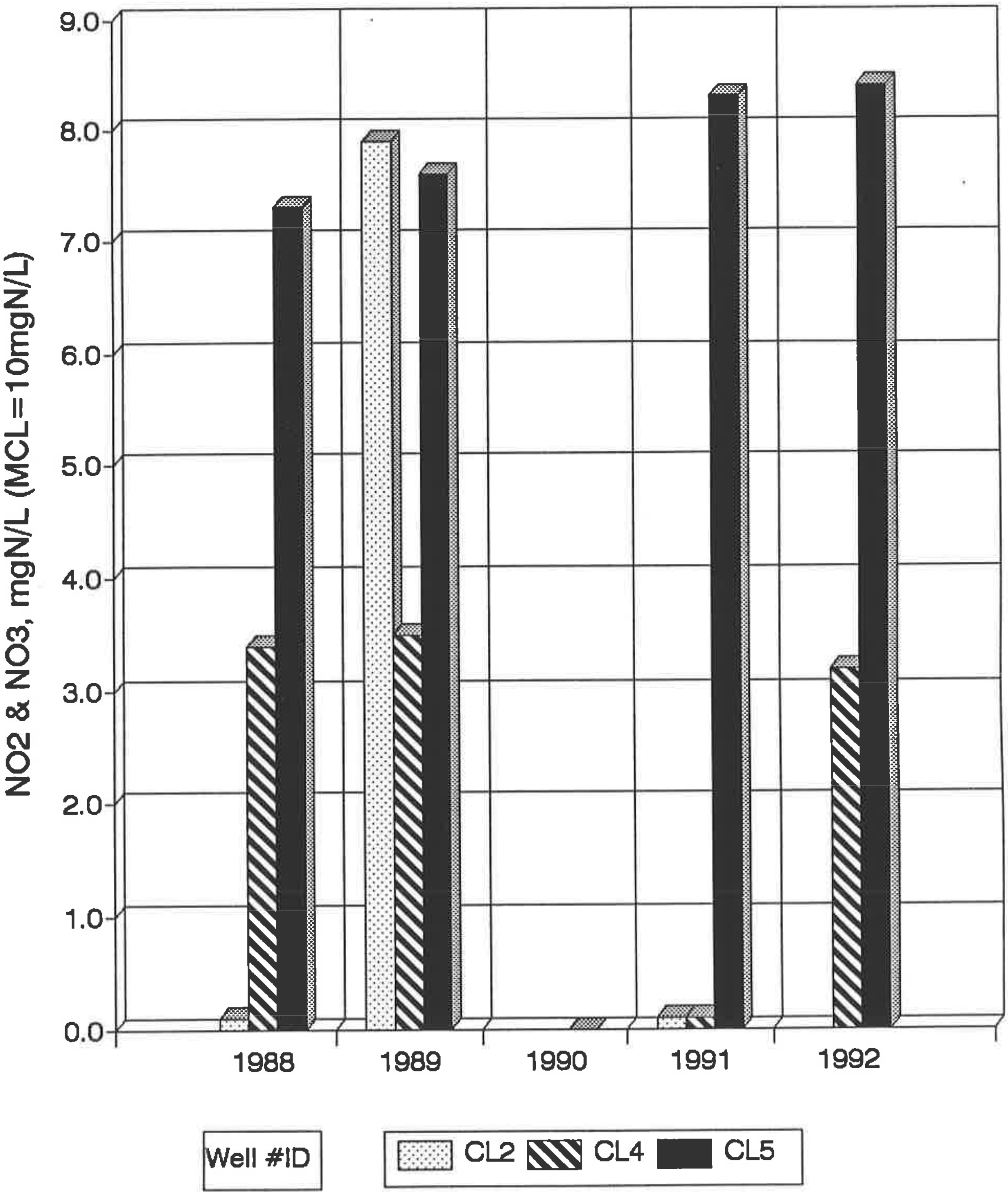
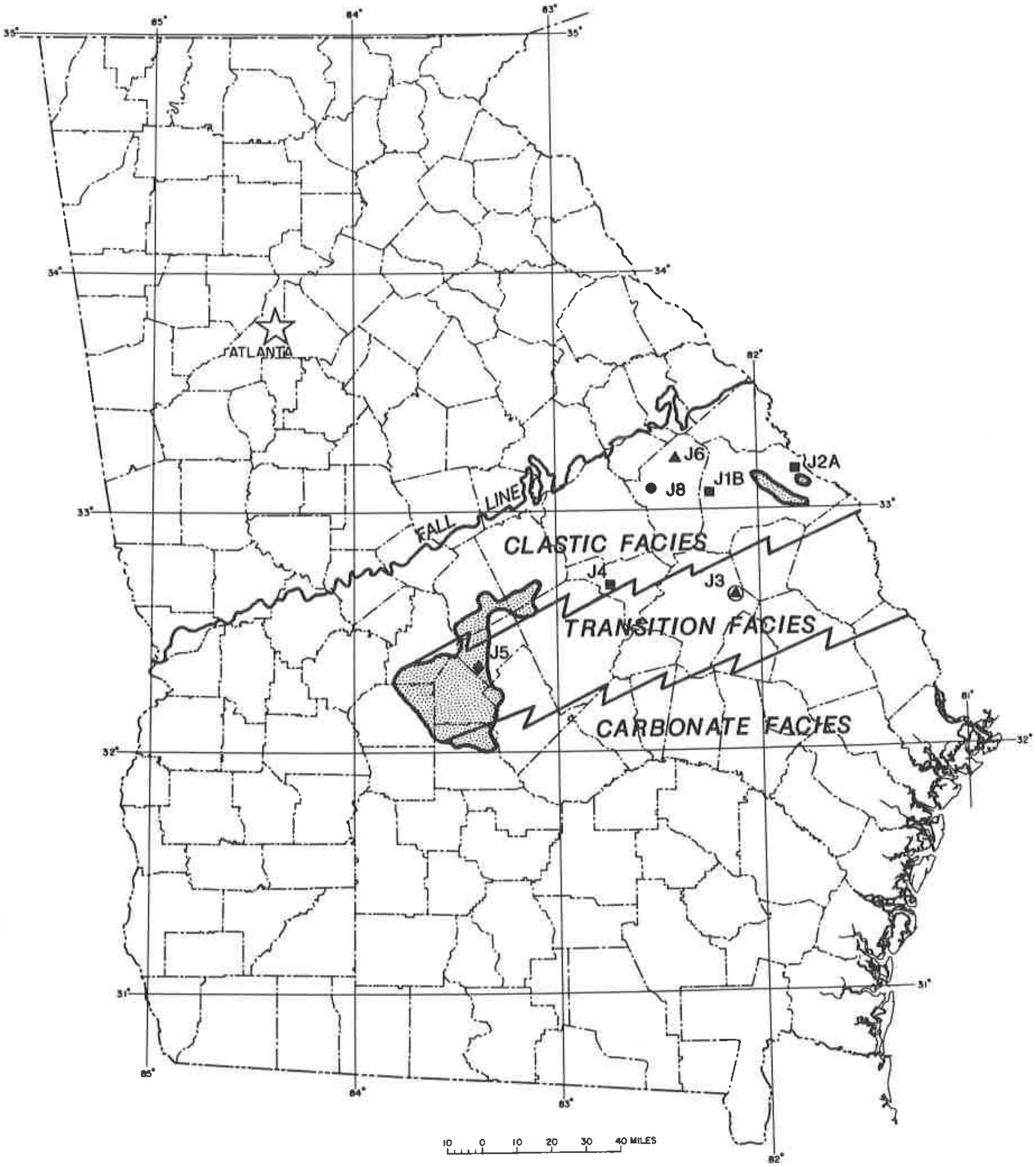


Figure 3-11. - Nitrite/nitrate concentrations in selected wells in the Claiborne aquifer system.



General recharge area (from Davis, et al., 1988)
Facies boundary (from Vincent, 1982)
● Soft water
▲ Moderately hard water O Manganese exceeds MCL
■ Hard water
♦ Very hard water

Figure 3-12. Water quality of the Jacksonian aquifer system.

facies (Vincent, 1982). The water-bearing sands are relatively thin, generally ranging from ten to fifty feet in thickness. Limestones equivalent to the Barnwell Group form a southern carbonate facies and are included in the Floridan aquifer system. The Savannah River and Ocmulgee River are eastern and western discharge boundaries respectively for the up-dip flow system of the Jacksonian aquifer system.

Water quality for 1992 in the Jacksonian aquifer was monitored in five wells in the clastic facies and two wells in the transition facies.

The pH's of the samples ranged from 6.6 in GWN-J8 through 7.9 in GWN-J2A. Iron, aluminum, and manganese concentrations in the samples were below the secondary MCL's for drinking water, except for transitional facies well GWN-J3, which yielded a sample containing manganese at 120 parts per billion. Major alkali metal concentrations were generally low, with the highest concentrations occurring in a sample from the transition well GWN-J3. Magnesium was detected in nine of the wells, with the highest content occurring in the sample from transition well GWN-J3. Of the major anions tested, nitrite/nitrate is more abundant in samples from the up-dip wells. Neither chloride nor sulfate exceeded MCL's (see Appendix). See Figures 3-13 and 3-14 for trends in iron and nitrite/nitrate concentrations in selected wells. Other elements detected included fluorine, zinc, vanadium, copper, arsenic, and mercury. An instrument malfunction is believed responsible for thallium detection reported for one of the samples from well GWN-J1B.

3.7 FLORIDAN AQUIFER SYSTEM

The Floridan aquifer system, formerly known as the Principal Artesian aquifer system, consists predominantly of Eocene and Oligocene limestones and dolostones that underlie most of the Coastal Plain Province. Other units are included locally in the aquifer. The aquifer is a major source of ground water for much of its outcrop area and through-out its down-dip extent to the south and east.

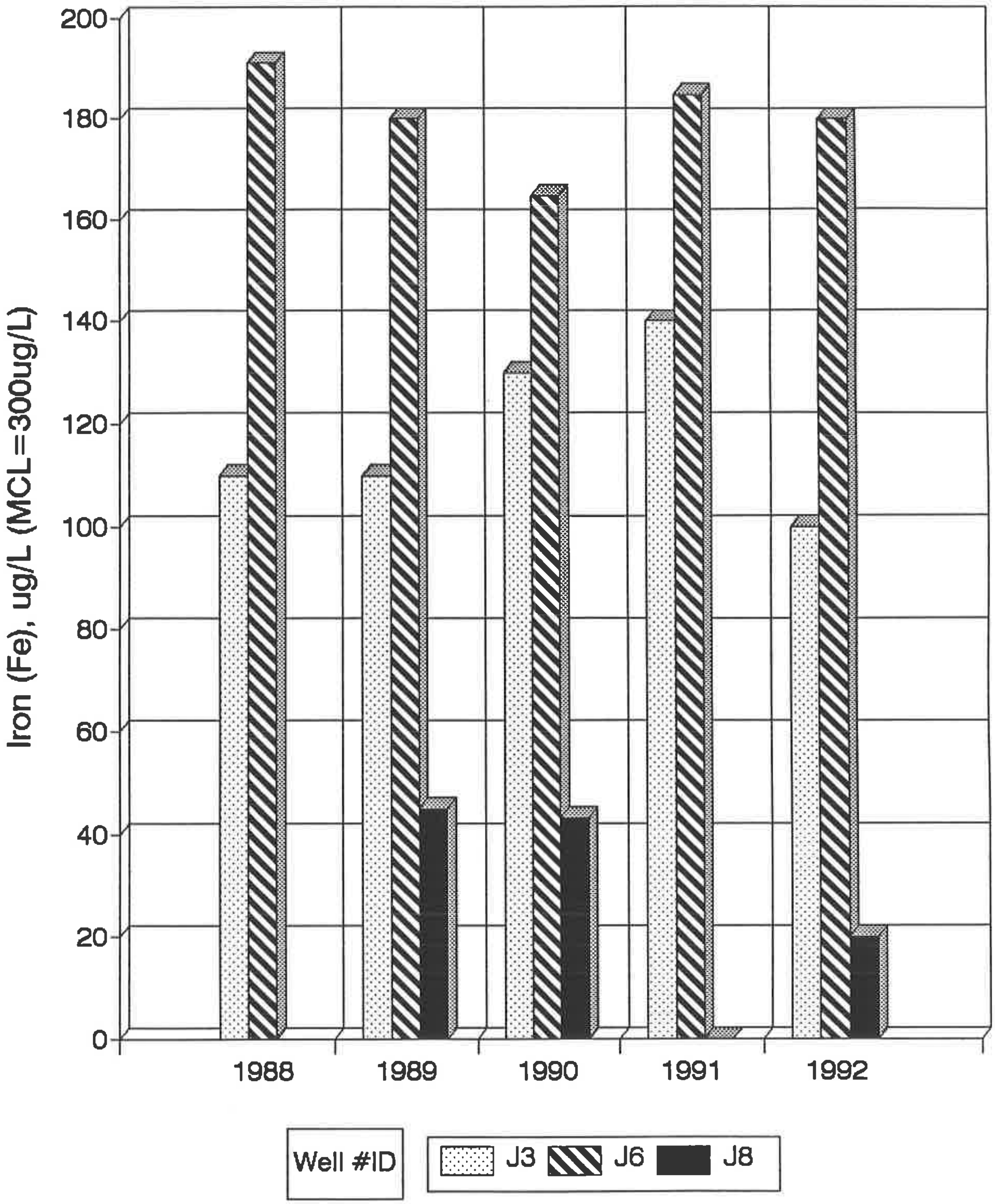


Figure 3-13. - Iron concentrations in selected wells in the Jacksonian aquifer system.

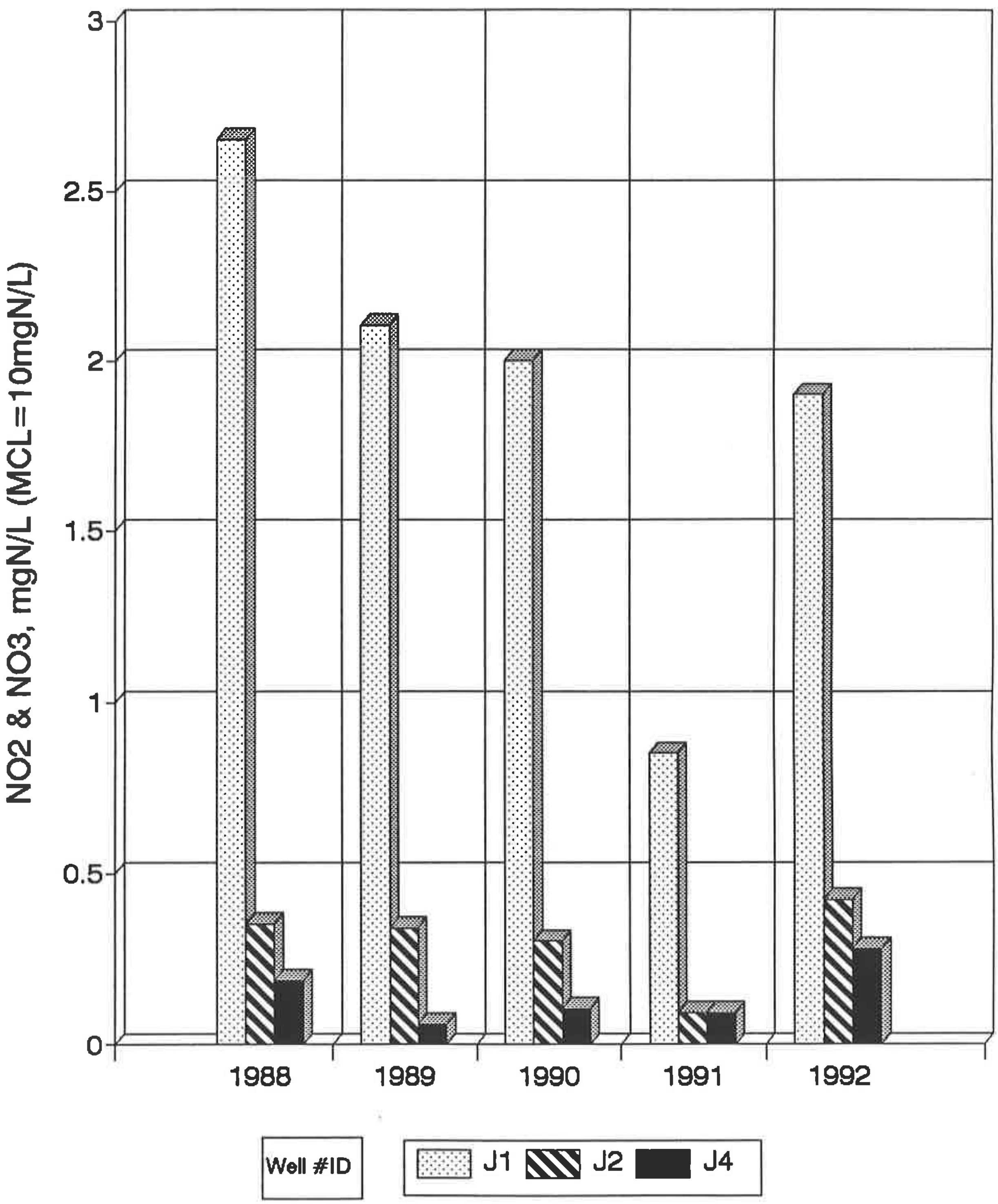
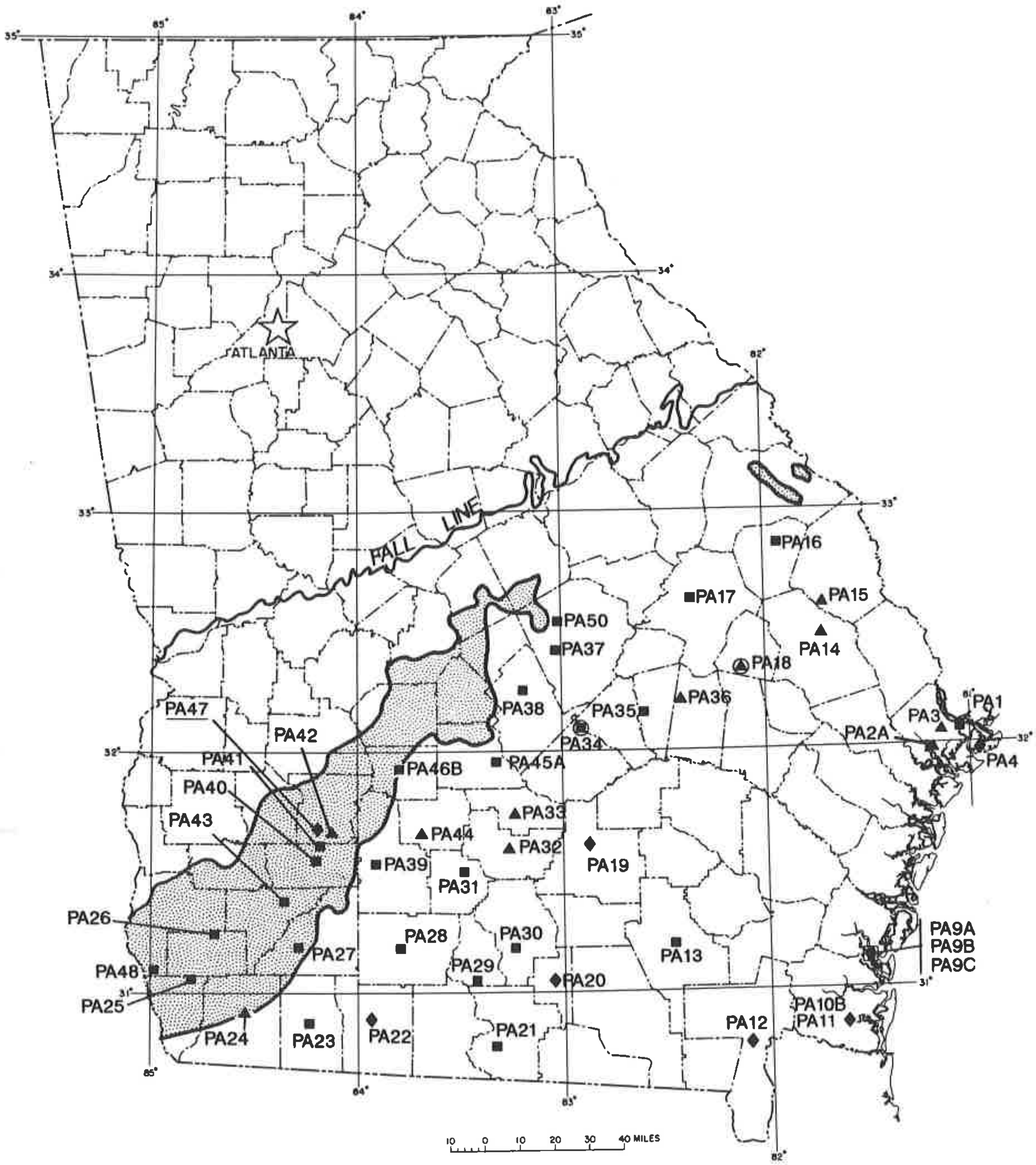


Figure 3-14. - Nitrite/nitrate concentrations in selected wells in the Jacksonian aquifer system.

Floridan aquifer system carbonates form a single permeable zone in up-dip areas and two permeable zones in down-dip areas (Miller, 1986). The upper water-bearing units of the Floridan are the Eocene Ocala Group and the Oligocene Suwanee Limestone (Crews and Huddlestun, 1984). These limestones crop out in the Dougherty Plain (a karstic area in southwestern Georgia) and in adjacent areas along strike to the north-east. In Camden and Wayne Counties, the Oligocene unit is absent, and the upper part of the Floridan is restricted to units of Eocene age (Clarke, et al., 1990). The lower portion of the Floridan, which consists mainly of dolomitic limestone of middle and lower Eocene age and pelletal, vuggy, dolomitic limestone of Paleocene age, is deeply buried and not widely used, except in several municipal and industrial wells in the Savannah area (Clarke, et al., 1990). From its up-dip limit, defined in the east by clays of the Barnwell Group, the aquifer thickens to well over 700 feet in coastal Georgia. A dense limestone facies along the trend of the Gulf Trough locally limits ground-water quality and availability (Kellam and Gorday, 1990). The Gulf Trough is a linear depositional feature in the Ocala Group that extends from southwestern Decatur County through central Bulloch County.

A ground-water divide separates a southwestward flow system in the Floridan aquifer in the Dougherty Plain from the Floridan aquifer system's major southeastward flow system in the remainder of Georgia. Rainfall infiltration in outcrop areas and leakage from extensive surficial aquifers provides recharge to the Dougherty Plain flow system (Hayes, et al., 1983). The main body of the Floridan aquifer system, to the east, is recharged by leakage from the Jacksonian aquifer system and by rainfall infiltration in outcrop areas and in areas where overlying strata are thin. Significant recharge also occurs in the Brooks, Echols, and Lowndes counties area where the Withlacoochee River and numerous sinkholes breach upper confining beds (Krause, 1979).

In 1992, ground-water samples were collected from 47 wells in the Floridan aquifer system (see Figure 3-15). The pH's for all water samples taken were neutral to basic, with GWN-PA41 slightly acidic with a level of 6.9. Iron exceeded the secondary MCL in samples from two



General recharge area (from Davis, et al., 1988)

▲ Moderately hard water
■ Hard water
♦ Very hard water
□ Iron exceeds MCL
○ Manganese exceeds MCL
PA47 NOx exceeds MCL

Figure 3-15. Water quality of the Floridan aquifer system.

wells, GWN-PA9B and GWN-PA9C in Glynn County, while manganese exceeded the secondary MCL in samples from two wells, GWN-PA18 in Candler County and GWN-PA34 in Telfair County. Aluminum exceeded the secondary MCL's in five wells, ranging from concentrations of 210 to 280 parts per billion. Most wells yielding water with detectable manganese are located in the Gulf Trough area (wells GWN-PA18, GWN-PA19, GWN-PA29, and GWN-PA32 through GWN-PA36). Trends in iron levels in selected wells in the Floridan aquifer are shown in Figure 3-16.

Sodium concentrations ranged from 1.5 to 790 parts per million, and magnesium ranged from undetectable to 85 parts per million. Both elements are most abundant in samples from wells in the coastal area, with the highest concentrations of these elements occurring in a sample from well GWN-PA9C in Brunswick. Calcium ranged from 25 parts per million in a sample from well GWN-PA2A in Savannah to 170 parts per million in well GWN-PA9C. Barium concentrations drawn from a sample taken from well GWN-PA33 had a barium concentration of 2000 parts per billion, equal to the primary MCL. Other metals detected consist of potassium, zinc, bismuth, cadmium, lead, zirconium, vanadium, molybdenum, arsenic, and mercury. The anions tested for consisted of chloride, sulfate, fluoride, nitrate/nitrite, and cyanide. Chloride ranged from 0.2 to 790 parts per million; and, sulfate ranged from undetectable to 512 parts per million. The concentration pattern of fluoride is similar to that of sulfate and chloride.

Most of the samples collected from the confined portions of the Floridan aquifer contained no detectable nitrite/nitrate, whereas most samples in the unconfined portion contained nitrite/nitrate. The highest level, 13.9 parts per million nitrogen, was measured for a sample taken from well GWN-PA47 and was the only sample to contain nitrite/nitrate in excess of the MCL. Trends in nitrite/nitrate levels in selected wells in the Floridan Aquifer are presented in Figure 3-17.

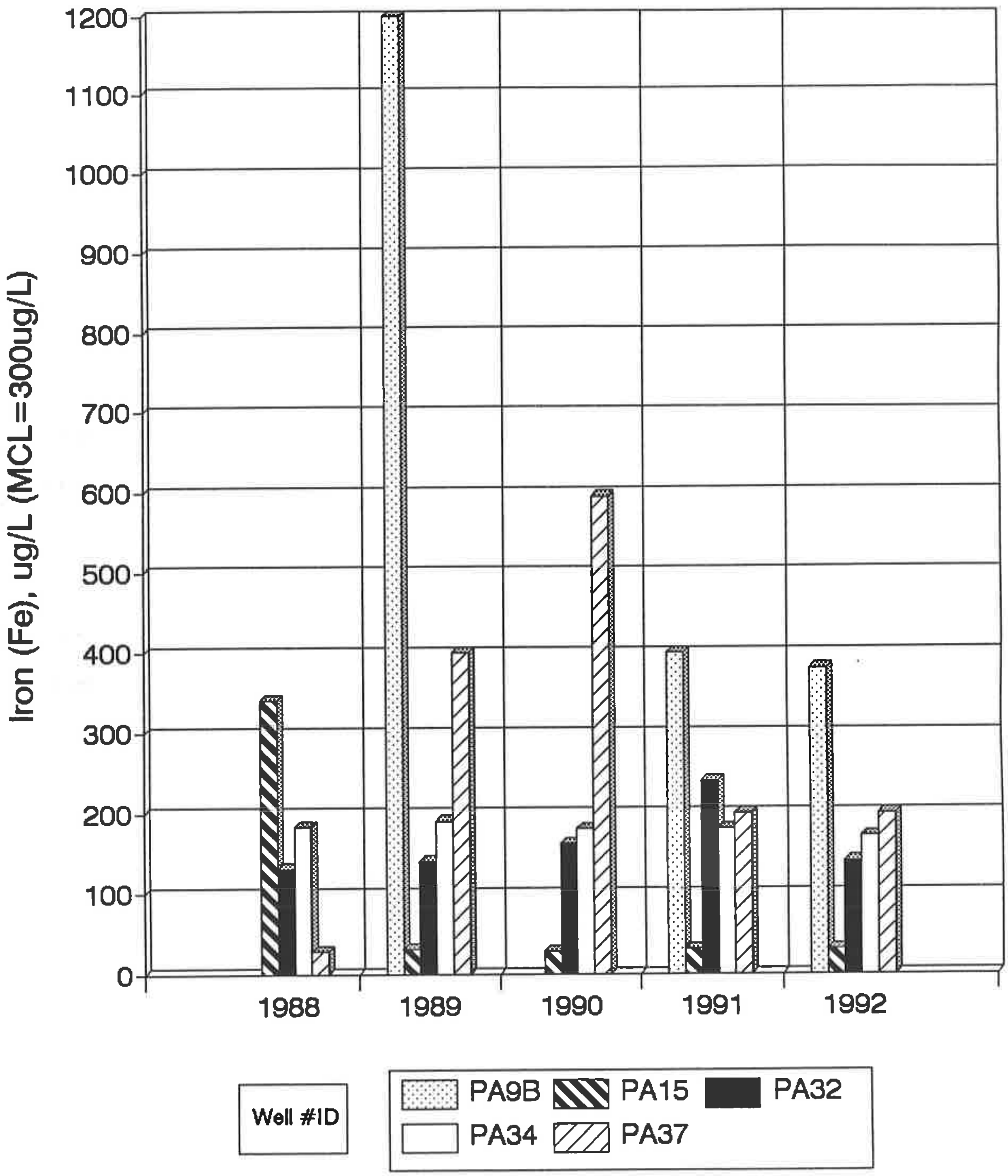


Figure 3-16. - Iron concentrations in selected wells in the Floridan aquifer system.

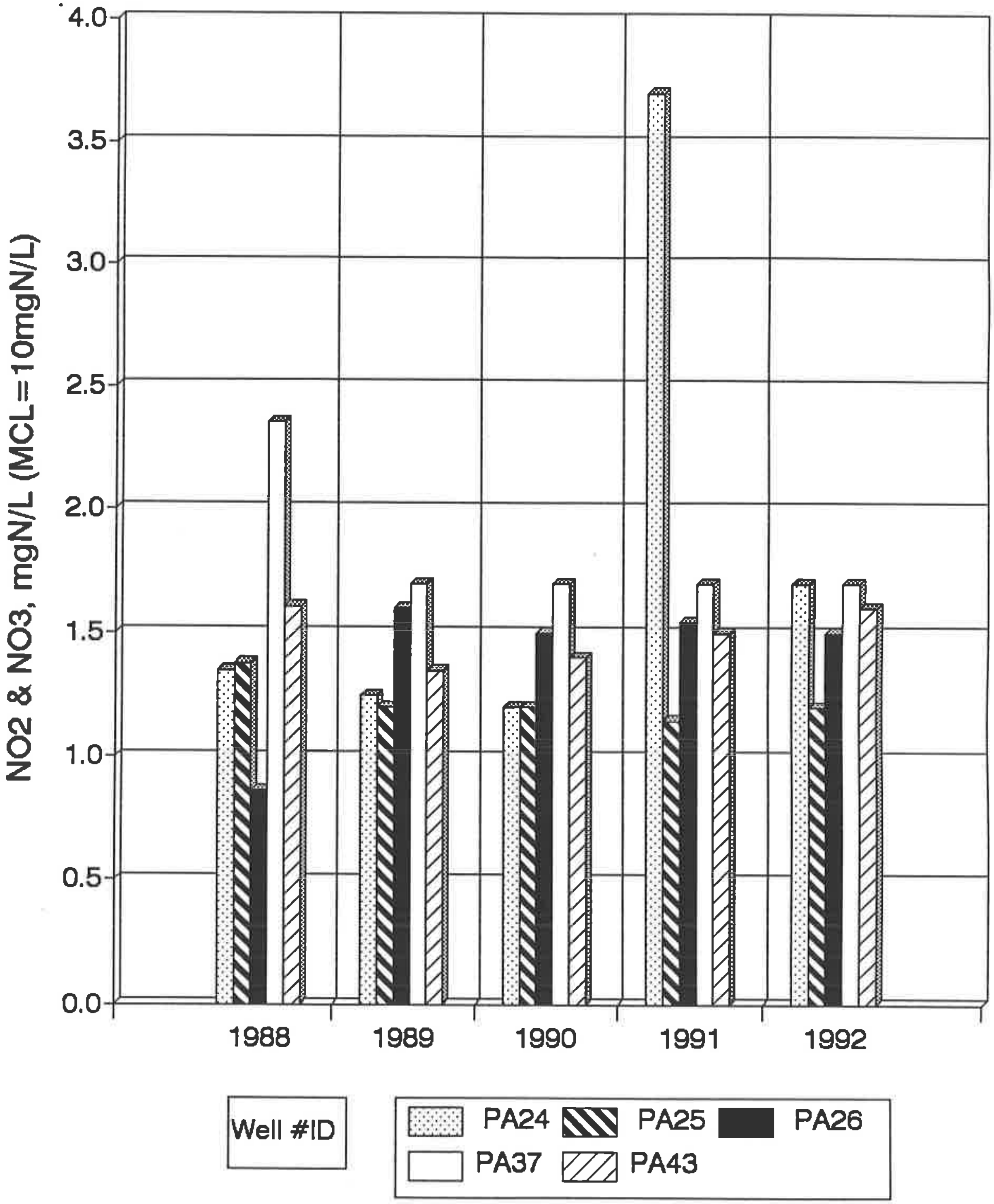


Figure 3-17. - Nitrite/nitrate concentrations in selected wells in the Floridan aquifer system.

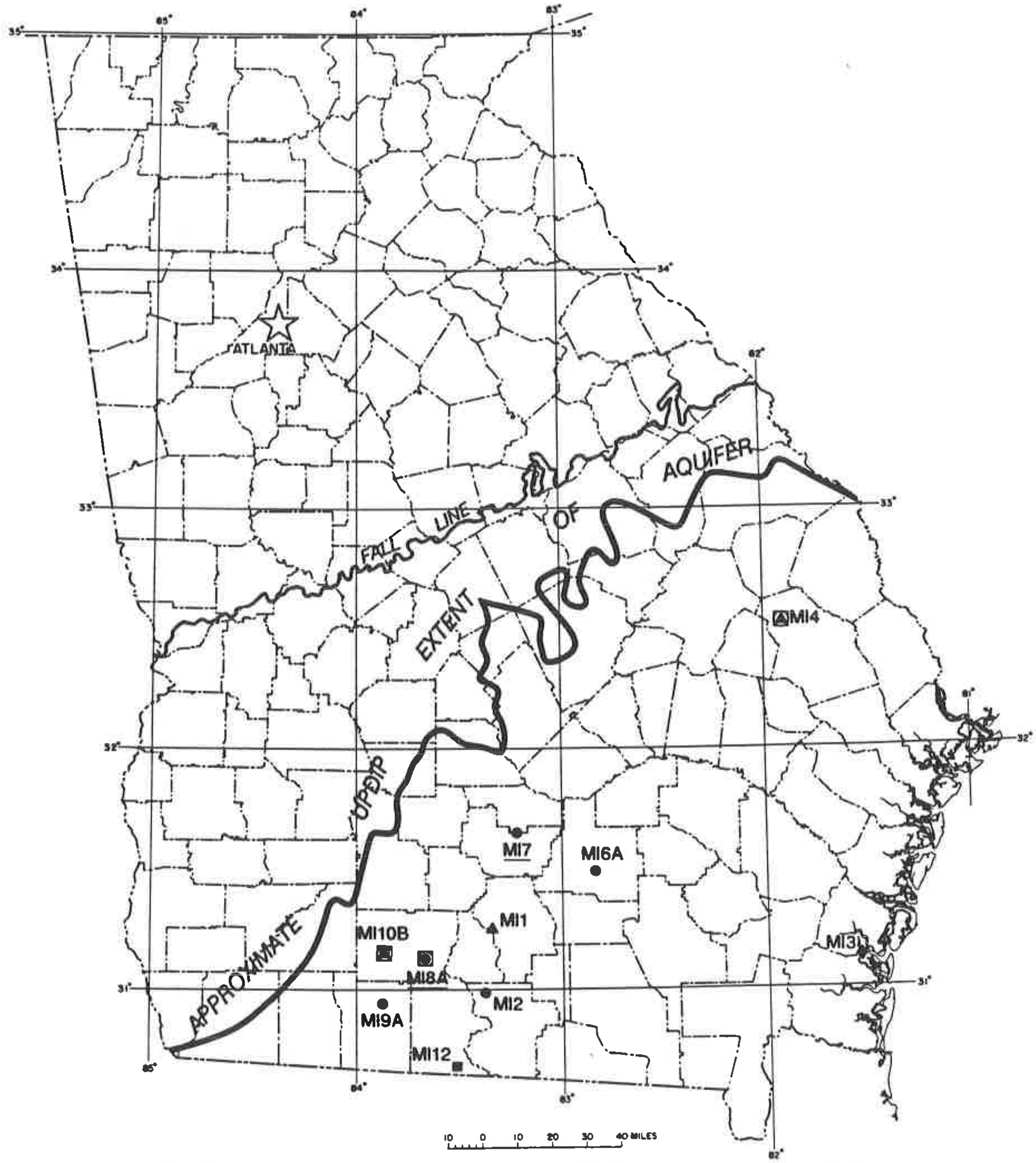
3.8 MIOCENE AQUIFER SYSTEM

Much of south-central and southeastern Georgia lies within outcrop areas of the Miocene Altamaha Formation and Hawthorne Group. Discontinuous lens-shaped bodies of sand, 50 to 80 feet thick, are the main permeable units. Miocene clays and sandy clays are thickest, more than 500 feet, in Wayne County (Watson, 1982).

Areas of confinement exist along the coastal counties. Leakage from overlying surface aquifers into the Miocene aquifer system and, in some areas, from the underlying Floridan aquifer system is significant in the coastal counties (Watson, 1982). Two principal aquifer units are present in the coastal area (Joiner, et al., 1988). Clarke (et. al, 1990) use the names upper and lower Brunswick aquifers to refer to these two sandy aquifer units.

Water quality of the Miocene aquifer system was monitored in ten wells (see Figure 3-18). The pH of the samples ranged from 4.27 to 7.9. Iron and manganese ranged from undetectable to 1300 and 170 parts per billion, respectively. Water samples from two wells, GWN-MI4 and GWN-MI10B, contained iron and manganese in excess of the secondary MCL's. Figure 3-19 shows trends in iron concentrations in selected wells. Aluminum exceeded the secondary MCL in samples from GWN-MI7 and GWN-MI8A. Sodium ranged from 1.1 to 23 parts per million while calcium ranged from 2.4 parts per million to 73 parts per million. Metals detected were potassium, magnesium (all wells), barium, vanadium, zinc, and mercury. None of these metals is present in excess of applicable MCL's.

Chloride and sulfate ranged from 2.6 parts per million and undetectable, respectively, to 36.4 and 40.7 parts per million. Both anions were highest in samples from the coastal well GWN-MI3, while chloride was lowest in the deeper domestic wells (GWN-MI1, GWN-MI2, GWN-MI10B, and GWN-MI12). Detectable levels of nitrite/nitrate, ranging from 0.1 to 10.5 parts per million, were found in samples from five



- ● Soft water
- ▲ Moderately hard water
- ■ Hard water
- ♦ Very hard water
- □ Iron exceeds MCL
- O Manganese exceeds MCL
- MI7 NOx exceeds MCL

Figure 3-18. Water quality of the Miocene aquifer system.

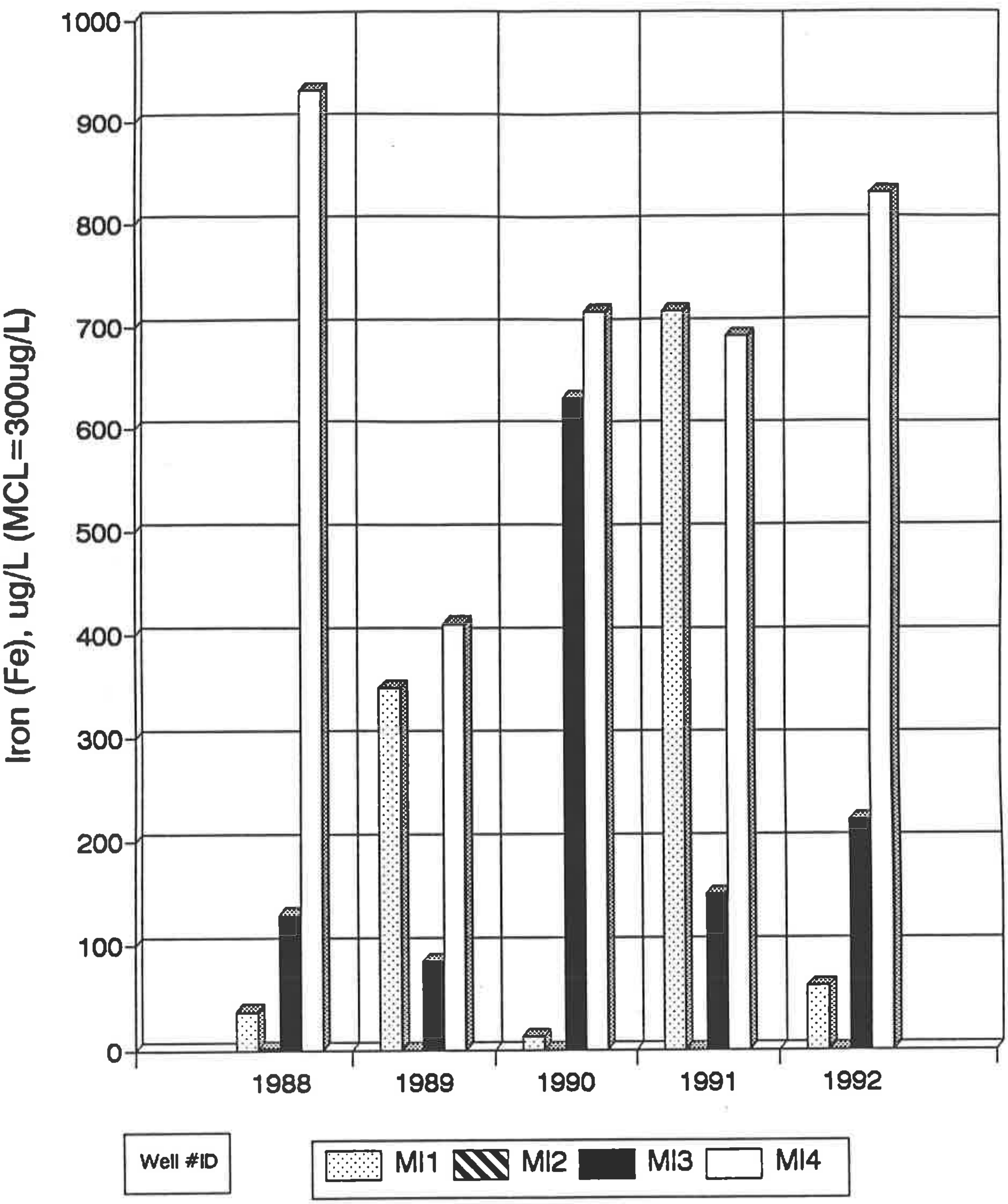


Figure 3-19. - Iron concentrations in selected wells in the Miocene aquifer system.

wells (GWN-MI6 through GWN-MI9A, and GWN-MI12). Concentrations of nitrate/nitrite for selected wells are illustrated in Figure 3-20.

3.9 PIEDMONT/BLUE RIDGE UNCONFINED AQUIFERS

Georgia's Piedmont and Blue Ridge Physiographic Provinces are developed on metamorphic and igneous rocks that are predominately Precambrian and Paleozoic in age. Soil and saprolite horizons, compositional layers, and openings along fractures and joints in the rocks are the major water-bearing features. Fracture density and interconnection provide the primary controls on the rate of flow of water into wells completed in crystalline rocks. The permeability and thickness of soils and shallow saprolite horizons determine the amount of discharge that can be sustained.

Ground-water samples were collected from eighteen wells and two springs in the Piedmont and Blue Ridge Provinces. Figure 3-21 shows locations of the monitoring stations. Water from wells and springs in the crystalline-rock aquifers ranged in pH from 5.0 in well GWN-P14 to 7.7 in well GWN-P15A, with ten of the stations yielding acidic water. Iron and manganese ranged from undetected to 17,400 and 340 parts per billion, respectively. The two metals exceeded secondary MCL's in water samples from nine of the sampling stations. Figure 3-22 shows trends in iron concentrations for selected wells. Aluminum exceeded the secondary MCL in samples from three wells (GWN-P3, GWN-P8, and GWN-P10A). Sodium was detected at relatively low concentrations in samples from all stations. Calcium and magnesium were detected in samples from all stations except well GWN-P14. Potassium, barium, strontium, copper, yttrium, cobalt, molybdenum, titanium, vanadium, and nickel were other metals detected. Concentrations of metals were below any applicable MCL's.

Chloride and sulfate concentrations in the water samples were ranged from undetectable to 11.5 and 88.3 parts per million, respectively. Sulfate levels were below 15 parts per million in all but two wells, GWN-P9 and GEN-P10A. Nitrite/nitrate was present in water from ten stations, all at levels well below the MCL. Figure 3-23 shows

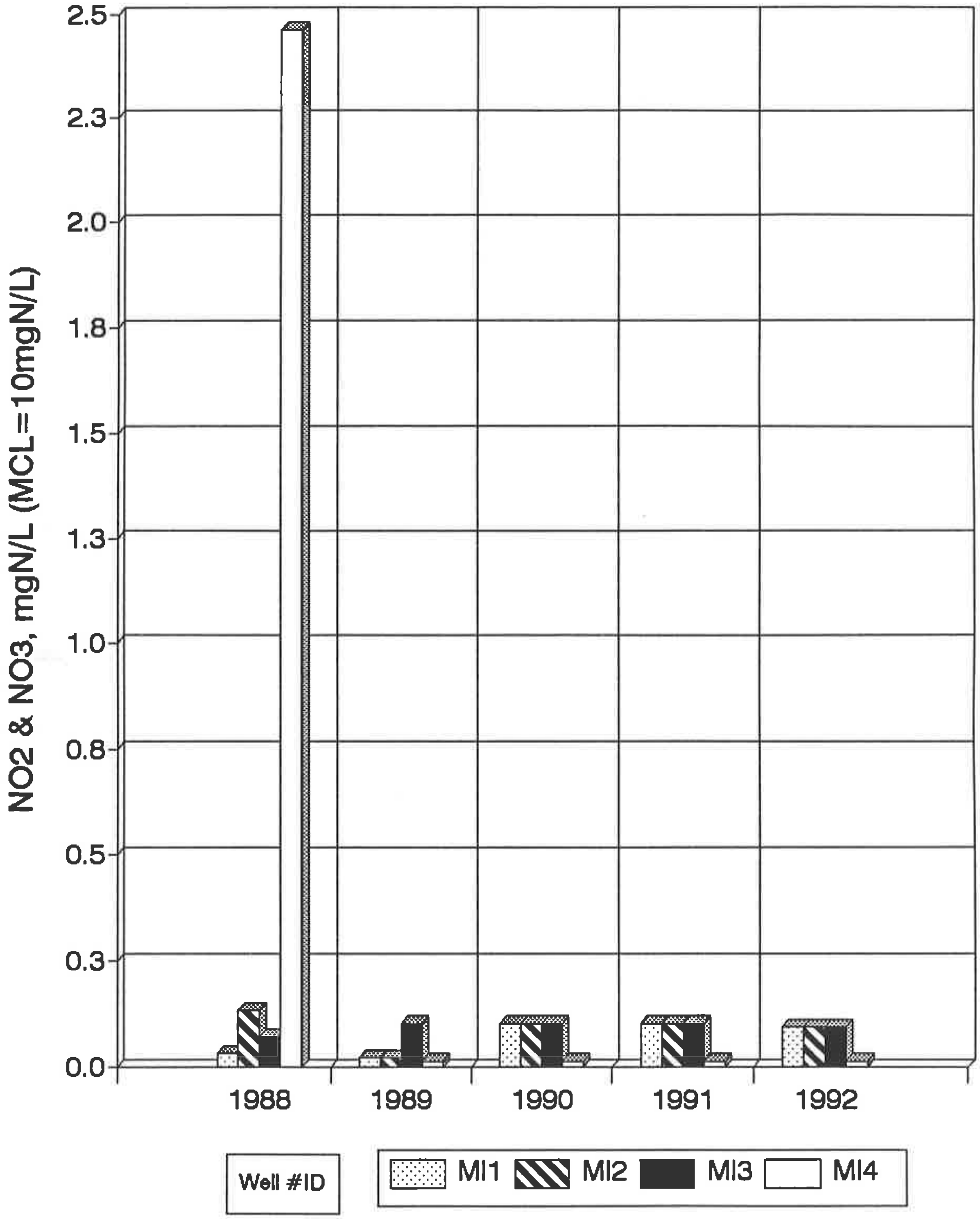
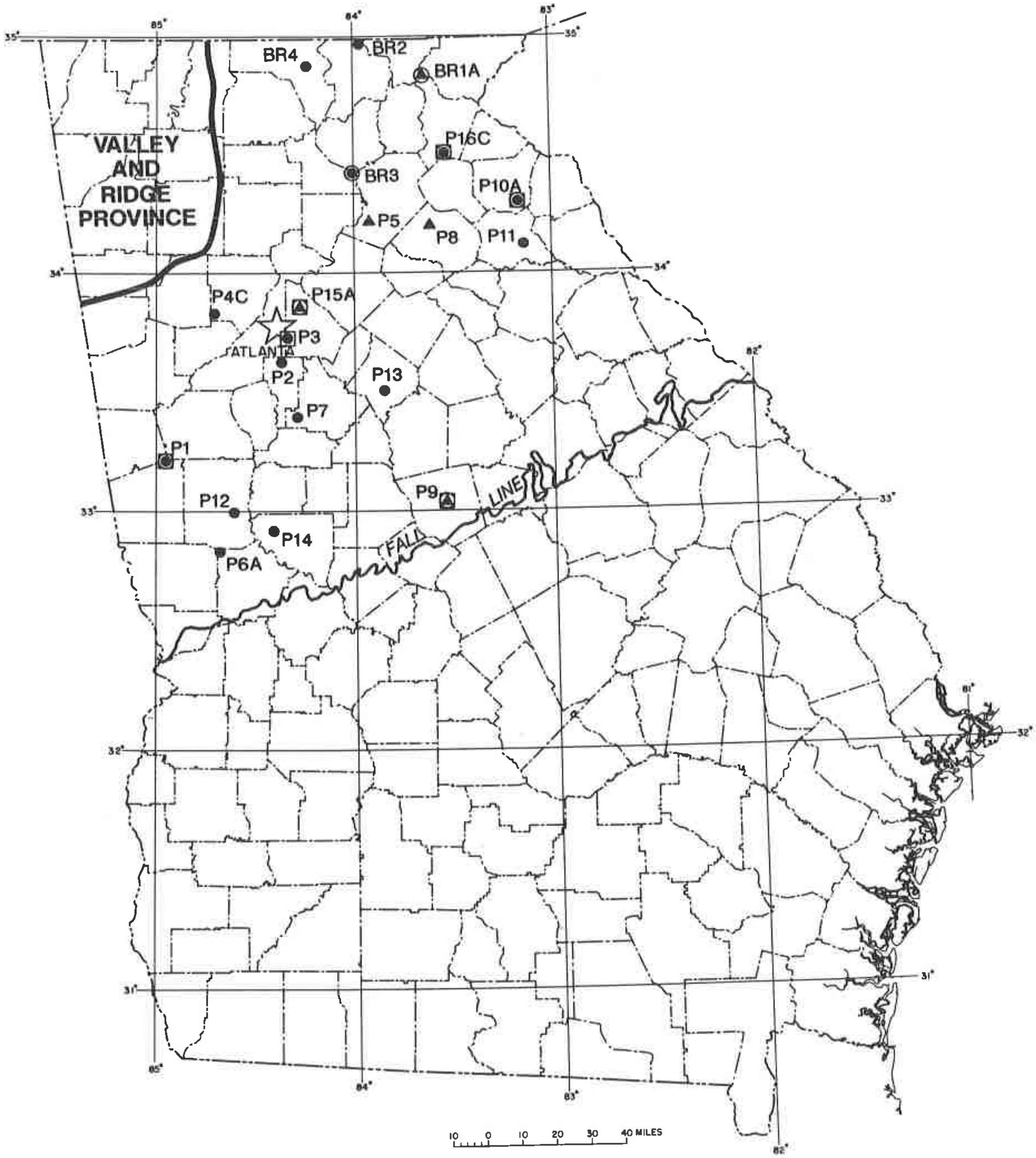


Figure 3-20. - Nitrite/nitrate concentrations in selected wells in the Miocene aquifer system.



● Soft water
▲ Moderately hard water
○ Manganese exceeds MCL
□ Iron exceeds MCL

Figure 3-21. Water quality of the Piedmont/Blue Ridge unconfined aquifers.

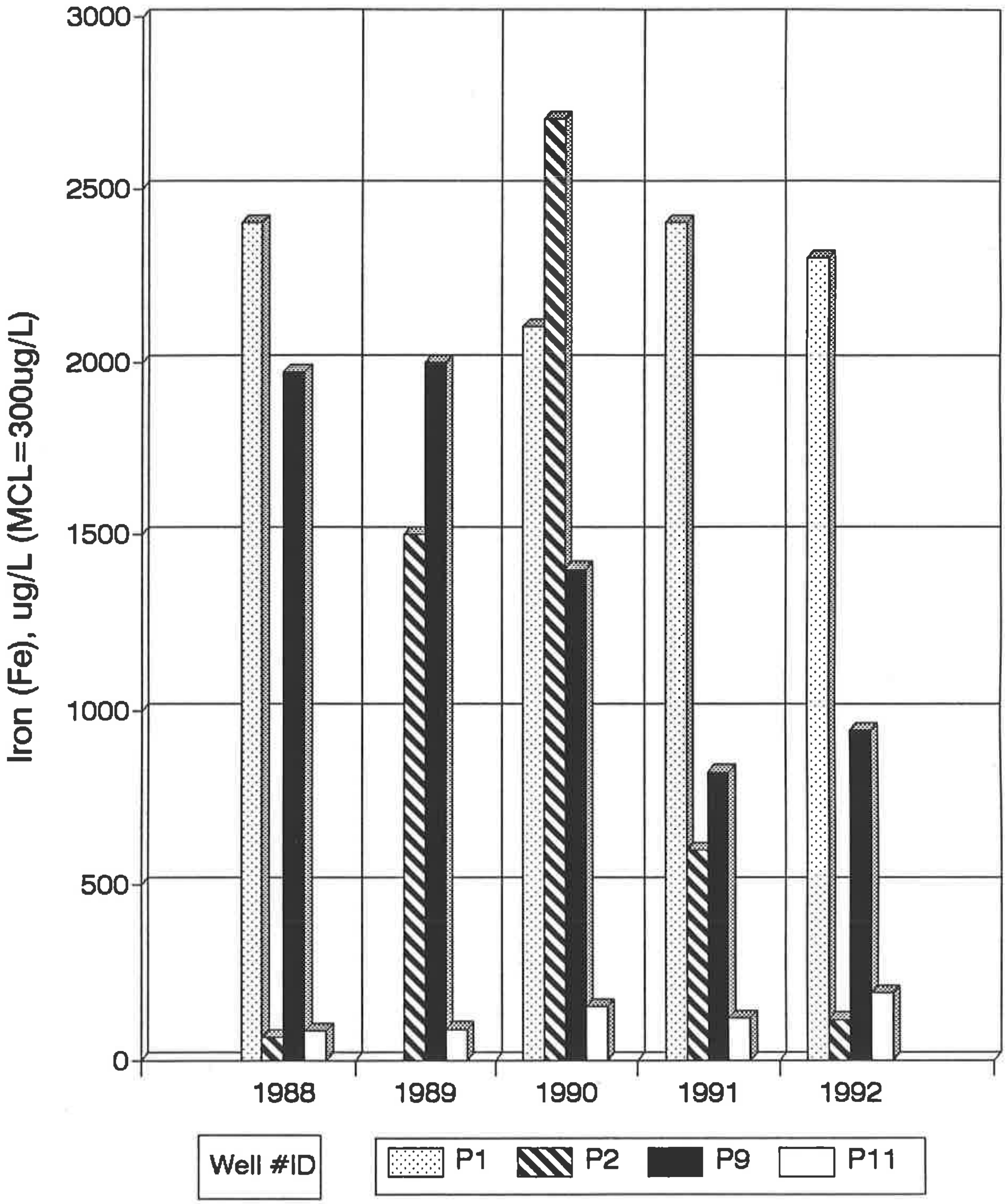


Figure 2-22. - Iron concentrations in selected wells in the Piedmont aquifer system.

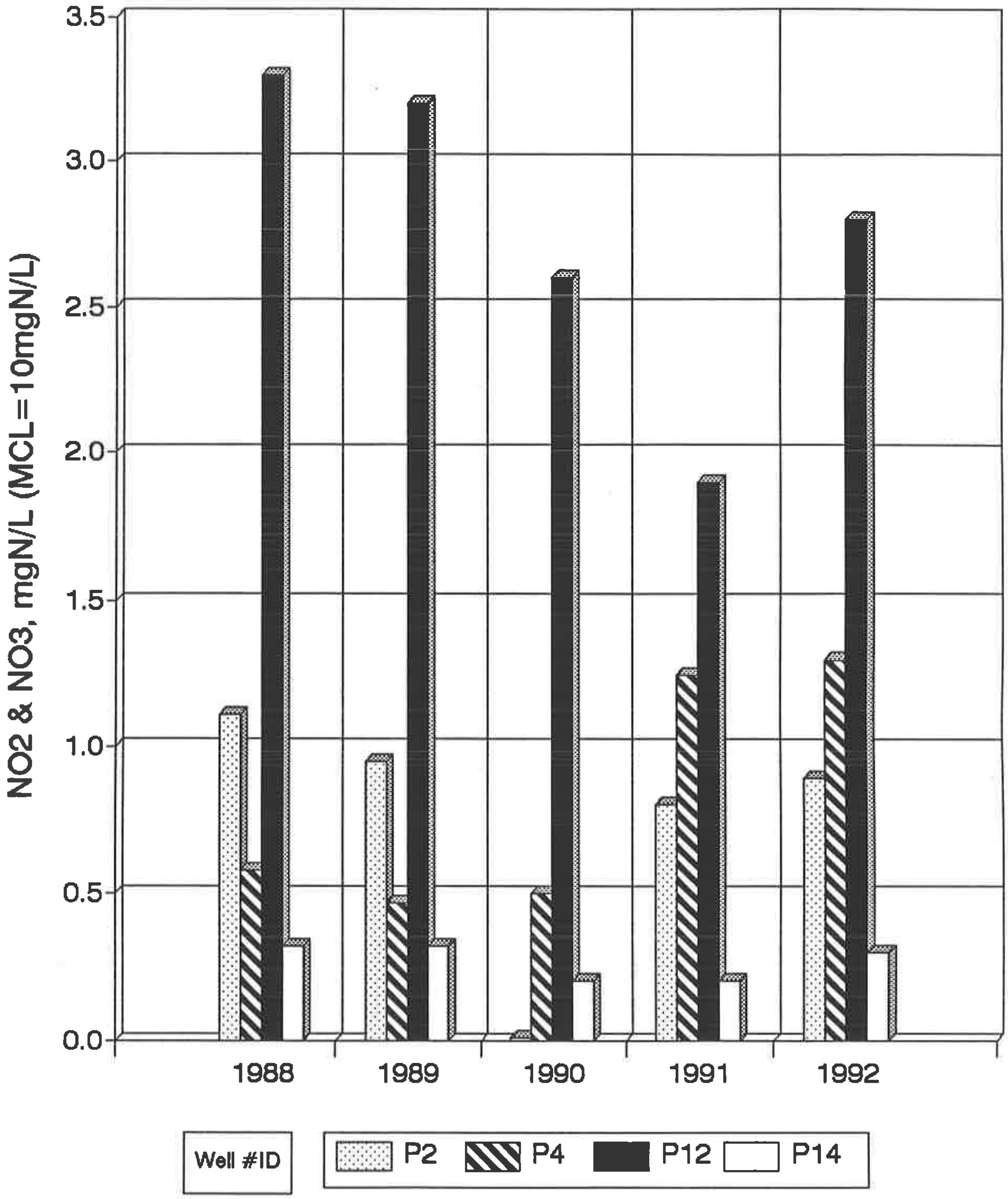


Figure 3-23. - Nitrite/nitrate concentrations in selected wells in the Piedmont aquifer system.

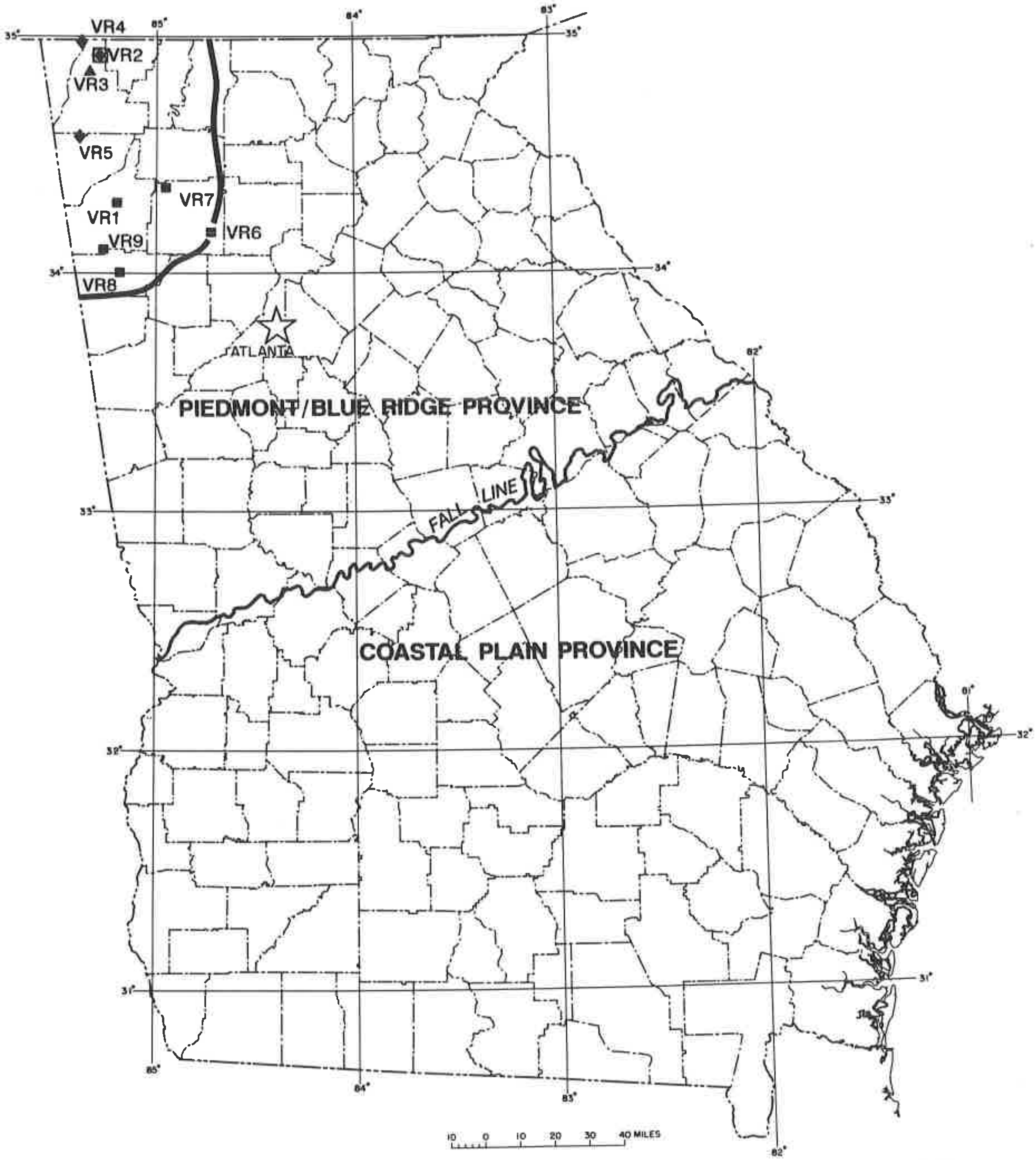
nitrite/nitrate concentrations in selected wells from the Piedmont aquifer.

3.10 VALLEY AND RIDGE UNCONFINED AQUIFERS

Soil and residuum form low-yield unconfined aquifers across most of the Valley and Ridge Province of northwestern Georgia. Valley bottom outcrops of dolostones and limestones of the Cambro-Ordovician Knox Group are the locations of most higher-yielding wells and springs that are suitable for municipal supplies.

Water quality in the Valley and Ridge unconfined aquifers was monitored in six wells and three springs located across the Province (see Figure 3-24). Three of these wells and all three springs produced water from Knox Group carbonates. The other wells were used to sample water in the Ordovician Chickamauga Group of Walker County and the Cambrian Shady Dolomite of Bartow County. Water from the Valley and Ridge monitoring stations was typically basic, ranging from 6.6 to 7.7. Iron and manganese concentrations were below detection limits in eight of the stations sampled and exceeded secondary MCL's in only one of the wells sampled (GWN-VR2). Aluminum exceeded the secondary MCL in one of the wells sampled (GWN-VR4). Calcium ranged from 26 to 83 parts per million. Barium and strontium were commonly detected trace metals. The highest barium concentration, 620 parts per billion, was measured in a sample from well GWN-VR6; this area, however, contains naturally occurring barite. Chloride ranged in concentration from 1.2 to 23.2 parts per million, while sulfate ranged from undetectable to 60.6 parts per million. Detectable nitrite/nitrate levels were present in all wells and springs except GWN-VR1, GWN-VR2, and GWN-VR4. The highest nitrate/nitrite concentration occurred in a sample from well GWN-VR5 with a level of 3.0 parts per million nitrogen. Figures 3-25 and 3-26 shows iron and nitrite/nitrate levels, respectively, for selected wells in the Valley and Ridge Aquifer.

Volatile organic compounds were found in samples from three wells (GWN-VR2, GWN-VR4, and GWN-VR6), all located in urban or industrial settings. The samples from well GWN-VR2 were polluted with motor fuel



▲ Moderately hard water
■ Hard water
◆ Very hard water
○ Manganese exceeds MCL
□ Iron exceeds MCL

Figure 3-24. Water quality of the Valley and Ridge unconfined aquifers.

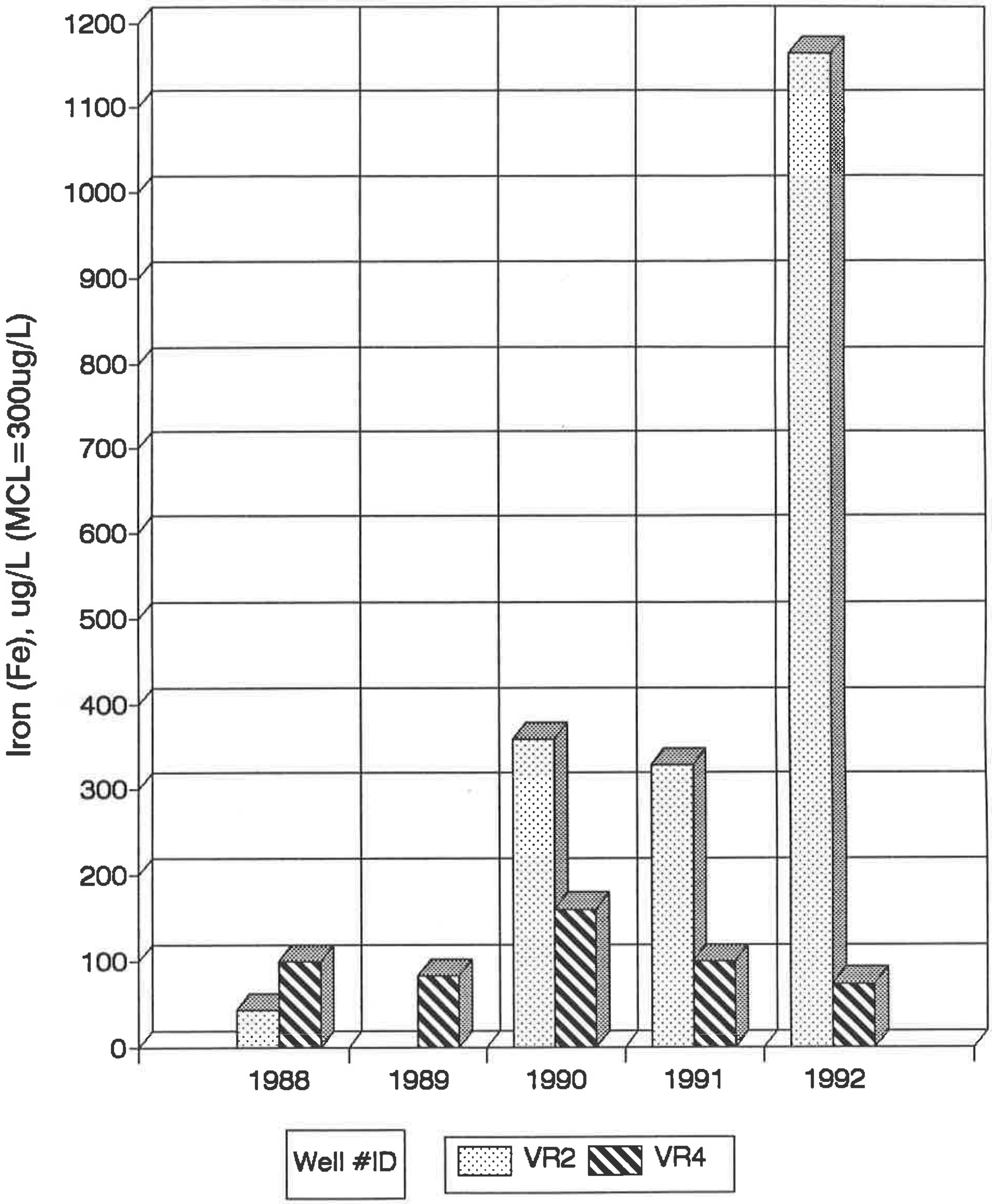


Figure 3-25. - Iron concentrations in selected wells in the Valley and Ridge aquifer system.

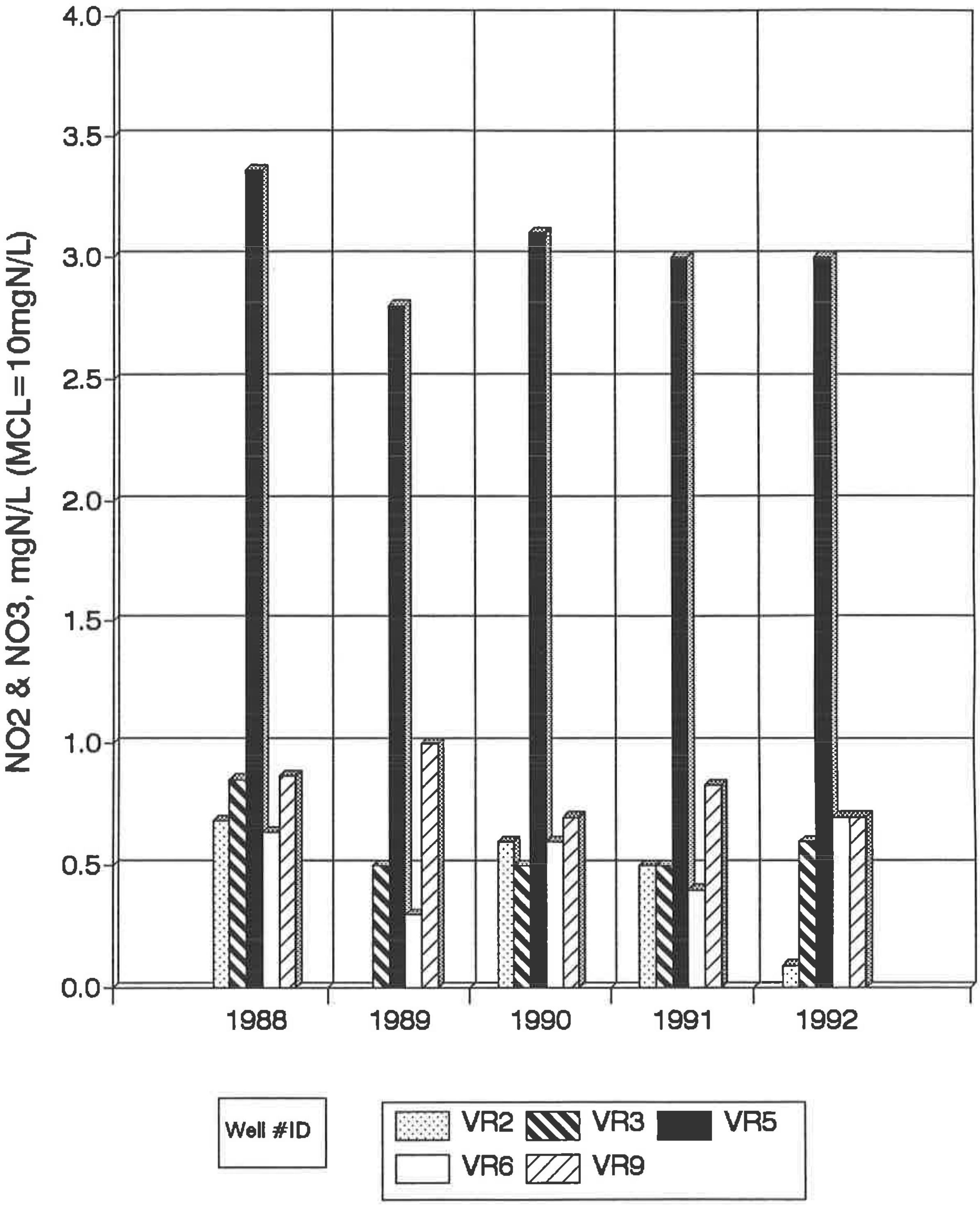


Figure 3-26. - Nitrite/nitrate concentrations in selected wells in the Valley and Ridge aquifer system.

components. The benzene concentrations in the samples greatly exceeded the primary MCL in force at the time (see Table 4-1). The two other wells yielded non-quantifiable traces of chlorinated ethanes and ethylenes. As areas in the Province that see the heaviest ground-water use are karstic and subject to pollution from the surface, testing for volatile organic compounds has been instituted for all sampling stations in this Province.

4.0 SUMMARY AND CONCLUSIONS

One hundred and sixty three raw water samples were collected for analysis from 123 wells and 5 springs for the Ground-Water Monitoring Network in 1992. These wells and springs are used to sample ten aquifer systems in Georgia:

Cretaceous aquifer system,
Providence aquifer system,
Clayton aquifer system,
Claiborne aquifer system,
Jacksonian aquifer system,
Floridan aquifer system,
Miocene aquifer system,
Piedmont/Blue Ridge unconfined aquifers,
Valley and Ridge unconfined aquifers.

Analyses of water samples collected in 1992 were compared with analyses for the Ground-Water Monitoring Network dating back to 1984, permitting the recognition of temporal trends. Table 4-1 lists the major contaminants and pollutants that were detected at the stations of the Ground-Water Monitoring Network during 1992. New MCL's that became effective in 1992 are also noted. Although isolated water quality problems were documented during 1992 at specific localities, the quality of water from the majority of the Ground-Water Monitoring Network stations remains excellent.

Nitrate/nitrite are the most common substances present in ground water in Georgia that can have adverse health effects. Three wells, two shallow domestic wells tapping the Miocene aquifer system (MI7 and MI8A, see Table 4-1) and a shallow USGS monitoring well (PA47, see Table 4-1) tapping the Floridan aquifer system in the Dougherty Plain area yielded water samples in 1992 with nitrite/nitrate concentrations exceeding the primary MCL of 10 parts per million as nitrogen. Samples from the Coastal Plain aquifers with the highest nitrate/nitrite levels were from shallow wells in recharge areas.

Spatial and temporal limitations of the Ground-Water Monitoring Network preclude the identification of the exact sources of the increasing levels of nitrogen compounds in some of Georgia's ground water. Nitrite/nitrate originates in ground water from direct sources and through oxidation of other forms of dissolved nitrogen. Some nitrite/nitrate may come from natural sources, amd some may be man made. The most common sources of man-made dissolved nitrogen in Georgia usually are derived from septic systems, agricultural wastes, and storage or application of fertilizers (Robertson, et. al, 1993). Dissolved nitrogen is also present in rainwater, derived form terrestrial vegetation and volatilization of fertilizers (Drever, 1988). The conversion of other nitrogen species to nitrate occurs in aerobic environments (i.e. recharge areas). Anaerobic conditions in ground water, as are commonly developed along the flow path of ground water, foster the dentrification process. However, this process may be inhibited by the lack of denitrifying bacteria in ground water (Freeze and Cherry, 1979).

Iron, manganese, and aluminum are the three naturally occurring substances responsible for the greatest incidence of ground-water quality problems in Georgia (see Table 4-1). Although minor increases or decreases in iron, manganese, and aluminum were noted for some stations, no long-term trends in concentrations of these metals were documented for the majority of the wells and springs sampled. A secondary MCL of 200 parts per billion was established for aluminum, effective July 30, 1992 (see Table A-5 in appendix.)

The presence of organic compounds was again documented in water from a few of the wells sampled. Because of the sporadic nature of the occurrence of organic compounds in most of these wells, spatial and temporal trends in levels of organic pollution cannot be defined at this time.

Table 4-1. Pollution and contamination incidents, 1992.

Station	Contaminant/ Pollutant**	Primary MCL	Secondary MCL
GWN-K1	Al=490ppb		Al=200ppb*
GWN-K3	Fe=560ppb		Fe=300ppb
GWN-K4	Fe=5400ppb Mn=170ppb		Fe=300ppb Mn=50ppb
GWN-K9	Fe=1500ppb		Fe=300ppb
GWN-K11	Fe=310ppb		Fe=300ppb
GWN-K12	Al=420ppb		Al=200ppb*
GWN-PD1	Fe=4300ppb Al=3800ppb		Fe=300ppb Al=200ppb*
GWN-CT1	Fe=2000ppb		Fe=300ppb
GWN-CT7A	Fe=590ppb Al=1400ppb		Fe=300ppb Al=200ppb*
GWN-CL1	Fe=390ppb		Fe=300ppb
GWN-CL3	Fe=1500ppb		Fe=300ppb
GWN-CL4	Mn=59ppb benzene=tr.	benzene=5ppb	Mn=50ppb
GWN-CL5	Mn=590ppb		Mn=50ppb
GWN-J3	Mn=120ppb		Mn=50ppb
GWN-PA9B	Fe=380ppb		Fe=300ppb
GWN-PA9C	Fe=370ppb Al=280ppb Cl=616ppm Cd=22ppb Pb=56ppb SO4=512ppm	Cd=10ppb (5ppb*) Pb=50ppb	Fe=300ppb Al=200ppb* Cl=250ppm SO4=250ppm
GWN-PA18	Mn=57ppb		Mn=50ppb
GWN-PA19	toluene=tr	toluene= 1000ppb*	
GWN-PA32	toluene=tr	toluene= 1000ppb*	
GWN-PA33	Ba=2000ppb toluene=tr	Ba=2000ppb* toluene= 1000ppb*	
GWN-PA34	Mn=80ppb		Mn=50ppb
GWN-PA39	Al=220ppb		Al=200ppb*
GWN-PA41	Al=260ppb trichloroethylene=1ppb tetrachloroethylene=7.7ppb	trichloroethylene=5ppb tetrachloroethylene=5ppb*	Al=200ppb*

GWN-PA44	toluene=tr	toluene= 1000ppb*	
GWN-PA47	Al=210ppb NOx=13.9ppm as N	NOx=10ppm as N	Al=200ppb*
GWN-PA48	Al=210ppb		Al=200ppb*
GWN-MI4	Fe=940ppb Mn=120ppb		Fe=300 ppb
GWN-MI6A	silvex=0.11ppb	silvex=10ppb (50ppb)	
GWN-MI7	NOx=10.5ppm as N Al=650ppb	NOx=10ppm as N	Al=200ppb*
GWN-MI8A	NOx=10.1ppm as N Mn=55ppb Al=1000ppb	NOx= 10 ppm as N	Mn=50ppb Al=200 ppb*
GWN-MI9A	Al=200ppb		Al=200ppb*
GWN-MI10B	Fe=1300ppb Mn=170ppb		Fe=300ppb Mn=50ppb
GWN-BR1A	Mn=200ppb		Mn=50ppb
GWN-BR3A	Mn=69ppb		Mn=50ppb
GWN-P1	Fe=2300ppb Mn=59ppb		Fe=300ppb Mn=50ppb
GWN-P3	Fe=2200ppb 1,2-dichloropropane=1.5ppb	1,2-dichloropropane=5ppb*	Fe=300ppb
GWN-P8	Al=1040ppb		Al=200ppb*
GWN-P9	Fe=940ppb Mn=160ppb		Fe=300ppb Mn=50ppb
GWN-P10A	Fe=17400ppb Mn=340ppb Al=700ppb		Fe=300ppb Mn=50ppb Al=200ppb*
GWN-P13A	chloroform=trace		chloroform=10ppb
GWN-P15A	Fe=470ppb Mn=80ppb		Fe=300ppb Mn=50ppb
GWN-P16C	Fe=990ppb Mn=80ppb		Fe=300ppb Mn=50ppb
GWN-VR2	Fe=1500ppb Mn=1900ppb benzene=660ppb toluene=1700ppb xylenes=1500ppb ethlybenzene=470ppb	benzene=5ppb toluene=1000ppb xylenes=10000ppb ethlybenzene=700ppb	Fe=300ppb Mn=50ppb
GWN-VR4	1,1-dichloroethane=trace 1,1,1-trichloroethane=trace	1,1-dichloroethane=5ppb 1,1,1-trichloroethane=200ppb	

GWN-VR6	1,1-dichloroethane=trace tetrachloroethylene=trace	1,1-dichloroethane=5ppb tetrachloroethylene=5ppb*	

* effective July 30, 1992.

** highest value reported if multiple samples taken.

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APPENDIX A

APPENDIX: ANALYSES OF SAMPLES COLLECTED DURING 1992 FOR THE GEORGIA GROUND-WATER MONITORING NETWORK

All water quality samples that are collected for the Georgia Ground-Water Monitoring Network are subjected to a Standard Analysis which includes tests for pH, specific conductance, certain common inorganic anions, and thirty metals. Analyses for additional parameters may be included for samples that are collected from areas where the possibility of ground-water pollution exists due to regional activities. These optional tests or screens include tests for agricultural chemicals, coal-tar creosote, phenols and anilines and volatile organic compounds (see Tables A-1 through A-4). Because parameters other than the two physical parameters, three of the major anions, and eight of the metals of the Standard Analysis were detected less commonly or rarely, other parameters are listed in the appendix only if they were detected.

For this appendix, the following abbreviations are used:

SU	= standard units
mg/L	= milligrams per liter (parts per million)
mgN/L	= milligrams per liter (parts per million), as nitrogen
ug/L	= micrograms per liter (parts per billion) and
umho/cm	= micromhos per centimeter
U	= less than (below detection limit). Where this abbreviation is used for a figure that is a calculated average, the average is below the typical detection limit for the parameter (Note: detection limits may change due to temporarily improved instrument performance or to use of different analytical methods by different laboratories)

On July 30, 1992, new Maximum Contaminant Levels (MCL's) became effective for certain parameters. Tables A-5 through A-7 list changes available; an addendum to correct previous MCL's is in progress.

Table A-1. Standard water quality analysis: Physical Parameters, Major Anions, and ICP Metals Screen

Parameter	Typical Detection Limit/MCL*
pH	NA (SU)
Spec. Cond.	1.0/NA umho/cm
ANIONS	
Chloride	0.1 / 250 mg/L 2
Sulfate	2.0 / 250 mg/L 2
Nitrite/ nitrate	0.02 / 10 mgN/L 1
Fluoride	0.1 / 4.0 mg/L 1
ICP SCREEN	
Calcium	1.0 / NA mg/L
Magnesium	1.0 / NA mg/L
Sodium	1.0 / NA mg/L
Potassium	5.0 / NA mg/L
Silver	30 / 50 ug/L 1
Aluminum	50 / NA ug/L
Arsenic **	10 / 50 ug/L 1
Gold	10 / NA ug/L
Barium	10 / 1000 ug/L 1
Beryllium	10 / NA ug/L
Bismuth	30 / NA ug/L

Parameter	Typical Detection Limit/MCL*
Cadmium	5.0 / 10 ug/L 1
Cobalt	10 / NA ug/L
Chromium	10 / 50 ug/L 1
Copper	20 / 1000 ug/L 2
Iron	10 / 300 ug/L 2
Molybdenum	10 / NA ug/L
Nickel	20 / NA ug/L
Lead	25 / 50 ug/L 1
Antimony	40 / NA ug/L
Selenium **	5 / 10 ug/L
Tin	20 / NA ug/L
Strontium	10 / NA ug/L
Titanium	10 / NA ug/L
Thallium	40 / NA ug/L
Vanadium	10 / NA ug/L
Yttrium	10 / NA ug/L
Zinc	20 / 5000 ug/L 2
Zirconium	10 / NA ug/L

** Analyzed by atomic absorption using graphite furnace

* MCL = Maximum Contaminant Level from the Georgia Rules for Safe Drinking Water, 1989 (1 = Primary, 2 = Secondary, NA = no MCL established)

Table A-2. Additional water-quality analyses: Cyanide, Mercury and Organic Screens #1, #2, #3, #4, #5 and #7

Parameter	Typical Detection Limit	Parameter	Typical Detection Limit
Cyanide	0.05 ug/L	Mercury	0.2 / 2.0 ug/L *

ORGANIC SCREEN #1

(Herbicides (H)/Insecticides (I))

Parameter		Limit	Parameter		Limit
Atrazine	H	0.30 ug/L	Malathion	I	1.40 ug/L
Azodrin	I	1.00 ug/L	Metolachlor	H	1.00 ug/L
Chlorpyrifos	I	0.80 ug/L	Metribuzin	H	0.90 ug/L
Dasanit	I	0.60 ug/L	Mevinphos	H	1.40 ug/L
DCPA	H	0.01 ug/L	Parathion (E)	I	0.08 ug/L
Demeton	I	1.00 ug/L	Parathion (M)	I	0.10 ug/L
Diazinon	I	1.00 ug/L	Pebulate	H	0.60 ug/L
Dimethoate	I	0.50 ug/L	Pendimethalin	H	0.80 ug/L
Di-Syston	I	1.00 ug/L	Phorate	I	1.00 ug/L
Eptam	H	0.50 ug/L	Profluralin	H	0.90 ug/L
Ethoprop	I	0.50 ug/L	Simazine	H	0.90 ug/L
Fonophos	I	0.50 ug/L	Sutan	H	0.70 ug/L
Guthion	I	2.00 ug/L	Trifluralin	H	1.00 ug/L
Isopropalin	H	1.00 ug/L	Vernam	H	0.50 ug/L

ORGANIC SCREEN #2

(Chlorinated Pesticides)

Dicofol	0.10 / NA	ug/L	
Endrin	0.03 / 0.2	ug/L	1
Lindane	0.008 / 4.0	ug/L	1
Methoxychlor	0.30 / 100	ug/L	1
PCB's	0.60 / NA	ug/L	
Permethrin	0.30 / NA	ug/L	
Toxaphene	1.20 / 5.0	ug/L	1

ORGANIC SCREEN #3

Dinoseb	0.10 ug/L	(Herbicide)

ORGANIC SCREEN #4

(Phenoxy Herbicides)

2,4-D	5.2 / 100	ug/L	1
Acifluorfen	0.2 / NA	ug/L	
Chloramben	0.2 / NA	ug/L	
Silvex	0.1 / 10	ug/L	1
Trichlorfon	2.0 / NA	ug/L	

ORGANIC SCREEN #5

(Herbicides (H)/Insecticides (I))

Carbaryl	I	10.0	ug/L	Linuron	H	1.0	ug/L
Carbofuran	I	2.0	ug/L	Methomyl	I	3.0	ug/L
Diuron	H	1.0	ug/L	Monuron	H	1.0	ug/L
Fluometuron	H	1.0	ug/L				

ORGANIC SCREEN #7

(fumigant, gasoline additive)

EDB	1.0	ug/L

* Primary Maximum Contaminant Level for Mercury.

Table A-3. Additional water-quality analyses: Organic Screens #8 and #9

ORGANIC SCREEN #8

(Extractable Organics: Coal-tar Creosote)

Parameter	Typical Detection Limit
Naphthalene	10 ug/L
2-Chloronaphthalene	10 ug/L
Acenaphthylene	10 ug/L
Acenaphthene	10 ug/L
Fluorene	10 ug/L
Phenanthrene	10 ug/L
Anthracene	10 ug/L
Fluoranthene	10 ug/L
Pyrene	10 ug/L
Benzo(A)Anthracene	10 ug/L
Benzo(B)Fluoranthene	10 ug/L
Benzo(K)Fluoranthene	10 ug/L
Benzo-A-Pyrene	10 ug/L
Indeno(1,2,3-CD)Pyrene	10 ug/L
Benzo(GHI)Perylene	10 ug/L

ORGANIC SCREEN #9

(Extractable Organics: Phenols and Aniline)

Parameter	Typical Detection Limit
Aniline	10 ug/L
2-Chlorophenol	10 ug/L
2-Nitrophenol	10 ug/L
Phenol	10 ug/L
2,4-Dimethylphenol	10 ug/L
2,4-Dichlorophenol	10 ug/L
2,4,6-Trichlorophenol	10 ug/L
Parachlorometa Cresol	10 ug/L
2,4-Dinitrophenol	50 ug/L
4,6-Dinitro-O-Cresol	50 ug/L
Pentachlorophenol	20 ug/L
4-Nitrophenol	50 ug/L

Table A-4. Additional water-quality analyses: Organic Screen #10

ORGANIC SCREEN #10

(Volatile Organics)

Parameter	Typical Detection Limit / Primary MCL
Methylene chloride	5 ug/L / NA
Trichlorofluoromethane	1 ug/L / NA
1,1-Dichloroethylene	1 ug/L / 7 ug/L
1,1-Dichloroethane	1 ug/L / NA
1,2-Trans-dichloroethylene	1 ug/L / NA
Chloroform *	1 ug/L / *
Dichlorobromomethane *	1 ug/L / *
Chlorodibromomethane *	1 ug/L / *
Bromoform *	1 ug/L / *
1,2-Dichloroethane	1 ug/L / 5 ug/L
1,1,1-Trichloroethane	1 ug/L / 200 ug/L
Carbon tetrachloride	1 ug/L / 5 ug/L
1,2-Dichloropropane	1 ug/L / NA
Trans-1,3-dichloropropene	1 ug/L / NA
Trichloroethylene	1 ug/L / 5 ug/L
Benzene	1 ug/L / 5 ug/L
1,1,2-Trichloroethane	1 ug/L / NA
Cis-1,3-dichloropropene	1 ug/L / NA
1,1,2,2-Tetrachloroethane	1 ug/L / NA
Tetrachloroethylene	1 ug/L / NA
Toluene	1 ug/L / NA
Chlorobenzene	1 ug/L / NA

ORGANIC SCREEN #10, CONTINUED

Parameter	Typical Detection Limit / Primary MCL
1,4-Dichlorobenzene**	NA / 75 ug/L
Ethylbenzene	1 ug/L / NA
Acetone	10 ug/L / NA
Methyl ethyl ketone	10 ug/L / NA
Carbon disulfide	1 ug/L / NA
Vinyl chloride	10 ug/L / 2 ug/L
Isopropyl acetate	1 ug/L / NA
2-Hexanone	1 ug/L / NA
Methyl isobutyl ketone	1 ug/L / NA
Styrene	1 ug/L / NA
Xylene (Total of o, m, and p-xylenes)	1 ug/L / NA

* indicates a trihalomethane compound. The primary MCL for total trihalomethanes is 100 parts per billion.

Table A-5. New Maximum Contaminant Levels (MCL's) for Inorganic Chemicals, Effective July 30, 1992.

Parameter	MCL*	Parameter	MCL*
Nitrite	1 mgN/L $_1$	Barium (MCL increased)	2000 ug/L $_1$
Nitrate	10 mgN/L $_1$	Cadmium (MCL lowered)	5 ug/L $_1$
Nitrite/ nitrate (combined) (MCL treats nitrite and nitrate separately as required.)	10 mgN/L $_1$	Chromium (MCL inceased)	100 ug/L $_1$
Silver (MCL increased and down-graded from primary to secondary.)	100 ug/L $_2$	Copper	action level**
Aluminum (new MCL)	200 ug/L $_2$	Lead	action level**
		Selenium (MCL increased)	50 ug/L $_1$

* MCL = Maximum Contaminant Level from the Georgia Rules for Safe Drinking Water, 1992. $_1$ = Primary MCL (contaminant adversely affects health); $_2$ = Secondary MCL (contaminant imparts unpleasant properties not health-related).

** Action level -- if, in a public water system, more than 10% of the stations on a user's end sampling network consisting principally of residences with lead or copper in the plumbing yield samples containing more than 15 ug/L lead or 1300 ug/L copper, the system operator must treat the water to lower the concentrations of either metal at the user's end back to its action level. Domestic and occasional-use type public water systems are excepted.

Table A-6. New Maximum Contaminant Levels (MCL's) for Pesticides and Polychlorinated Biphenyls, Effective July 30, 1992 .

Parameter	Primary MCL
Alachlor	2 ug/L
Aldicarb	3 ug/L
Aldicarb Sulfone	2 ug/L
Aldicarb Sulfoxide	4 ug/L
Atrazine	3 ug/L
Carbofuran	40 ug/L
Chlordane	2 ug/L
Dibromochloro-propane	0.2 ug/L
2,4-D (MCL lowered)	70 ug/L
Ethylene Dibromide	0.05 ug/L
Heptachlor	0.4 ug/L
Heptachlor Epoxide	0.2 ug/L
Lindane (MCL lowered)	0.2 ug/L
Methoxychlor (MCL lowered)	40 ug/L
Polychlorinated Biphenyls (PCB's)	0.5 ug/L
Pentachloro-phenol	1 ug/L
Toxaphene (MCL lowered)	3 ug/L
2,4,5-TP (Silvex)(MCL increased)	50 ug/L

Table A-7. New Maximum Contaminant Levels (MCL's) for Volatile Organic Compounds (VOC's), Effective July 30, 1992.

Parameter	Primary MCL
1,2-Dichlorobenzene	600 ug/L
Cis-1,2-Dichloroehylene	70 ug/L
Trans 1-2-Dichloroehtylene	100 ug/L
1,2 Dichloropropane	5 ug/L
Ethlybenzene	700 ug/L
Monochlorobenzene	100 ug/L
Styrene	100 ug/L
Tetrachloroethylene	5 ug/L
Toluene	1000 ug/L
Xylenes (total)	10000 ug/L

1992 Ground-Water Quality Analyses of the Cretaceous Aquifer System

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-K1	4.5	1.6	1 U	1.6	5 U	29	19	1 U	7.1	0.4	10	11	38	Al= 490	2,4
Well Name: Englehard Kaolin Company #2, Gordon County: Wilkinson Date Sampled: 1992/04/29															
GWN-K2	4.3	1.3	1 U	1.3	5 U	46	10 U	2.0	3.7	0.2	10 U	10 U	43	Al=61	2,4,10
Well Name: Irwinton #2 County: Wilkinson Date Sampled: 1992/05/27															
GWN-K3	6.0	19	1.4	1.8	5 U	560	33	2.2	7.3	0.1 U	24	24	57	Al=42	1,2,4 5,10
Well Name: Sandersville #7B County: Washington Date Sampled: 1992/04/30															
GWN-K4	7.2	8.7	1.7	13	5 U	5400	170	2.3	8.1	0.1 U	590	150	229	Zn=33	
Well Name: Midville Experiment Station TW#1 County: Burke Date Sampled: 1992/01/29															
GWN-K5	6.5	1 U	1 U	1 U	5 U	20 U	10 U	1.4	2 U	0.5	10 U	10 U	52		2,4,8 9,10,Hg
Well Name: Richmond County #101, Augusta County: Richmond Date Sampled: 1992/06/09															
GWN-K5	5.9	0.63	0.32	2.04	0.4 U	10 U	10 U	1.8	0.5 U	0.63	10 U	--	19	Hg=0.2	2,4,8,9
Well Name: Richmond County #101, Augusta County: Richmond Date Sampled: 1992/12/09															

1992 Ground-Water Quality Analyses of the Cretaceous Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-K6	5.5	4.2	1 U	3.0	5 U	20 U	10 U	2.5	4.2	0.1 U	14	50	49		10
Well Name: J.M. Huber Corporation County: Twiggs Date Sampled: 1992/04/29															
GWN-K7	5.2	1.9	1 U	1.6	5 U	20 U	10 U	2.3	8.7	0.1 U	14	12	24		2,4
Well Name: Jones County #4, Macon County: Jones Date Sampled: 1992/04/29															
GWN-K9	4.1	1 U	1 U	1 U	5 U	1500	33	1.4	7.5	0.1 U	10 U	10 U	44		
Well Name: Marshallville #1 County: Macon Date Sampled: 1992/04/28															
GWN-K10	4.9	1.3	1 U	2.8	5 U	20 U	10 U	3.2	2 U	1.1	10 U	10 U	30		10
Well Name: Fort Valley #1 County: Peach Date Sampled: 1992/05/27															
GWN-K10	6.3	1.25	0.5	2.7	0.4 U	10 U	10 U	0.72	1.49	0.2 U	10 U	--	33	Mo=20	10
Well Name: Fort Valley #1 County: Peach Date Sampled: 1992/11/19															
GWN-K11	5.8	1 U	1 U	1 U	5 U	270	10 U	1.1	2 U	0.2	10 U	10 U	13		10
Well Name: Warner Robins #1A County: Houston Date Sampled: 1992/05/27															
GWN-K11	5.6	0.6	0.25	1.09	0.4 U	310	10 U	1.10	1.11	0.2 U	10 U	--	16		2,4,10
Well Name: Warner Robins #1A County: Houston Date Sampled: 1992/11/18															

1992 Ground-Water Quality Analyses of the Cretaceous Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-K12 Well Name: Perry, Holiday Inn Well County: Houston Date Sampled: 1992/05/27	4.1	1 U	1 U	1.0	5 U	180	12	1.5	7.7	0.1 U	10 U	10 U	48	Al=420 Zn=59	1,5,10
GWN-K12 Well Name: Perry, Holiday Inn Well County: Houston Date Sampled: 1992/11/19	4.2	0.61	0.28	1.1	0.4 U	130	10 U	5.00	8.9	0.2 U	10 U	--	64	Al=40 Zn=40 Mo=10 Cu=20	1,2,4, 5,10
GWN-K13 Well Name: Omaha #1 County: Stewart Date Sampled: 1992/04/22	8.7	2.2	1 U	45	5 U	20 U	10 U	9.4	8.1	0.1 U	10 U	40	199	F=0.3mg/L	
GWN-K14 Well Name: Ft. Benning TW County: Muscogee Date Sampled: 1992/04/28	7.9	13	1 U	25	5 U	120	11	7.7	6.8	0.1 U	16	220	159	F=0.2mg/L Al=30	2,4,10
GWN-K15 Well Name: Georgetown #2 County: Quitman Date Sampled: 1992/04/22	9.2	1 U	1 U	84	5 U	20 U	10 U	8.5	2 U	0.1 U	10 U	15	329	F=0.4mg/L	
GWN-K16 Well Name: Packaging Corporation of America, North Well County: Bibb Date Sampled: 1992/05/27	6.0	1 U	1 U	4.9	5 U	45	10 U	2.2	2.3	0.3	10 U	10 U	27	Zn=20 F=0.1mg/L	10
GWN-K16 Well Name: Packaging Corporation of America, North Well County: Bibb Date Sampled: 1992/11/18	7.3	0.58	0.2	5.12	0.4 U	20	10 U	2.4	2.71	0.2 U	10 U	--	32	Zn=10	2,4,10

1992 Ground-Water Quality Analyses of the Cretaceous Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-K17	7.7	3.4	1 U	38	5 U	160	10 U	1.8	3.0	0.1 U	24	43	160	F=0.5mg/L	
Well Name: Georgia Power #1															
County: Burke															
Date Sampled: 92/02/12															
GWN-K18A	4.4	1.9	1 U	1.8	5 U	140	10 U	2.5	5.4	0.1 U	10 U	10 U	37	F=0.4mg/L	10
Well Name: Buena Vista #6															
County: Marion															
Date Sampled: 1992/04/22															
GWN-K19	5.0	1 U	1 U	1 U	5.6	20 U	10 U	1.6	2 U	0.1 U	10 U	10 U	19	V=11	10
Well Name: Hephzibah, Murphy Street Well (#3)															
County: Richmond															
Date Sampled: 1992/06/09															

1992 Ground-Water Quality Analyses of the Providence Aquifer System

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
WELL ID#															
GWN-PD1 Well Name: Albany TW#10 County: Dougherty Date Sampled: 1992/08/05	8.8	9.0	1 U	77	5 U	4300	44	2.1	2.6	0.1 U	10 U	10 U	325	Al=3800 Ti=64 Zr=10 F=0.6mg/L	
GWN-PD2A Well Name: Preston #2 County: Webster Date Sampled: 1992/08/12	5.8	5.9	1 U	1.5	5 U	10 U	10 U	2.0	2 U	0.3	18	10 U	61	F=0.3mg/L	
GWN-PD3 Well Name: Fort Gaines #3 County: Sumter Date Sampled: 1992/08/12	8.2	6.8	1.1	88	5 U	20 U	10 U	10.9	10.0	0.1 U	10 U	11	345	F=0.8mg/L	
GWN-PD4 Well Name: Americus #3 County: Sumter Date Sampled: 1992/08/12	7.4	43	2.4	2.9	5 U	270	18	1.4	16.2	0.1 U	10 U	23	216	Al=93 Cu=51 F=0.2mg/L	

1992 Ground-Water Quality Analyses of the Clayton Aquifer System

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-CT1	8.3	10.5	5.0	37.2	2.9	2000	20	2.02	11.8	1.6	10 U	--	214	Al=30 Mo=60	10
Well Name: Turner City Monitoring Well County: Dougherty Date Sampled: 1992/12/01															
GWN-CT2A	7.6	42	3.1	5.8	5 U	85	10 U	1.1	16.0	0.1 U	10 U	32	229	Al=73 Zn=21	1,3,5 2,4
Well Name: Burton Thomas Residence Well County: Sumter Date Sampled: 1992/10/15															
GWN-CT3	7.6	42	4.5	7.1	5 U	20 U	10 U	1.7	12.2	0.1 U	10 U	49	244	Al=100 F=0.2mg/L	10
Well Name: Dawson, Crawford Street Well County: Terrell Date Sampled: 1992/10/15															
GWN-CT4	7.3	45	3.4	4.8	5 U	210	10 U	1.5	9.0	0.1 U	10 U	250	206	Al=84	
Well Name: C.T. Martin TW#2 County: Randolph Date Sampled: 1992/10/28															
GWN-CT5A	7.3	46	4.1	1.6	5 U	270	35	--	--	--	17	18	238	Al=110 F=0.1mg/L	1,3,5 2,4,10
Well Name: Cuthbert #3 County: Randolph Date Sampled: 1992/10/15															
GWN-CT7A	4.7	4.6	6.2	1.5	5 U	590	13	11.0	2 U	7.3	29	10 U	104	Al=1400 Zn=460 Ti=25 F=0.1mg/L	1,3,5 2,4
Well Name: St. John Farm Well County: Sumter Date Sampled: 1992/10/15															

1992 Ground-Water Quality Analyses of the Claiborne Aquifer System

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-CL1 Well Name: Albany TW#5 County: Dougherty Date Sampled: 1992/08/05	7.4	55	8.7	8.1	5 U	390	10 U	3.4	2.8	0.1U	10 U	39	322	Al=120 F=0.1mg/L	
GWN-CL2 Well Name: Unadilla #3 County: Dooly Date Sampled: 1992/08/04	7.3	43	1 U	1.9	5 U	20 U	10 U	1.5	7.3	0.1 U	14	12	198	F=0.1mg/L	3,4
GWN-CL3 Well Name: Pete Long TW#2 County: Lee Date Sampled: 1992/08/11	5.4	1.6	1 U	1 U	5 U	1500	15	1.8	2 U	0.1	10 U	10 U	23	F=0.1mg/L Zn=31	1,2,3 4,5
GWN-CL4 Well Name: Plains #3 County: Sumter Date Sampled: 1992/10/28	4.7	2.5	1.4	4.9	5 U	20 U	59	6.8	2 U	3.2	20	10 U	56	C6H6=tr Cu=82 Y=12 Zn=46	1,2,3 4,5,10
GWN-CL5 Well Name: Shellman #2 County: Randolph Date Sampled: 1992/08/12	4.3	5.8	2.7	2.0	5 U	20 U	590	9.4	2 U	8.4	64	10 U	119	Al=310 Co=29 Y=71 F=0.1mg/L	2,4
GWN-CL6 Well Name: Georgia Tubing Co. Well County: Early Date Sampled: 1992/08/12	7.6	39	8.3	23	5 U	75	10 U	3.9	3.3	0.1 U	10 U	51	285	Al=89 F=0.3mg/L	
GWN-CL7A Well Name: Veterans Memorial State Park County: Crisp Date Sampled: 1992/09/23	7.5	61	2.1	2.7	5 U	230	12	2.4	5.6	0.1 U	10 U	21	290	Al=150	2,4,10

1992 Ground-Water Quality Analyses of the Jacksonian Aquifer System

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-J1B Well Name: K. Hudlow Residence Well County: Burke Date Sampled: 1992/06/10	7.2	56	1 U	3.0	5 U	20 U	10 U	8.8	0.2 U	1.9	22	26	292	Al=150 Zn=27 Tl=62? V=14 F=0.1mg/L	1,2,3 4,5
GWN-J1B Well Name: K. Hudlow Residence Well County: Burke Date Sampled: 1992/12/09	7.5	51.1	0.7	4.1	0.4 U	40	10 U	8.0	0.6	1.9	20	--	288	Al=50 V=8 Zn=30 Hg=0.5	1,3,5
GWN-J2A Well Name: Oakwood Village MHP #2 County: Burke Date Sampled: 1992/06/10	7.4	53	1.0	1 U	5 U	20 U	10 U	1.7	2 U	0.3	66	61	260	Al=35 V=13	1,2,3 4,5,10
GWN-J2A Well Name: Oakwood Village MHP #2 County: Burke Date Sampled: 1992/12/09	7.9	47.2	0.94	2.0	0.75	20	10 U	1.5	0.94	0.53	60	--	255	V=10 Zn=10 Hg=0.6	1,3,5 10
GWN-J3 Well Name: J. W. Black Residence Well County: Emanuel Date Sampled: 1992/06/09	7.7	38	6.2	9.6	5.3	100	120	7.5	2 U	0.1 U	720	300	276	Al=110 V=11 Zn=35 F=0.2mg/L	1,2,4 5,10
GWN-J4 Well Name: Wrightsville #4, North Myrtle Street Well County: Johnson Date Sampled: 1992/06/22	7.6	49	2.4	3.9	5 U	20 U	13	2.4	6.4	0.1 U	10	190	248	Al=90 F=0.2mg/L	1,2,4 5
GWN-J4 Well Name: Wrightsville #4, North Myrtle Street Well County: Johnson Date Sampled: 1992/12/09	7.8	45.6	2.3	3.1	1.5	80	20	1.7	6.2	0.28	10 U	--	262	V=3 Hg=0.8	1,3,5 10

1992 Ground-Water Quality Analyses of the Jacksonian Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-J5	7.4	71	2.5	3.6	5 U	20 U	26	2.1	11.1	0.1 U	10	220	353	Al=150 F=0.2mg/L	1,2,3 4,5,10
Well Name: Cochran #3 County: Bleckley Date Sampled: 1992/06/23															
GWN-J6	6.7	29	1.0	1 U	5 U	180	13	1.6	7.5	0.1 U	13	94	158	Al=78 V=11 F=0.1mg/L	1,2,4 5,10
Well Name: Wrens #4 County: Jefferson Date Sampled: 1992/06/10															
GWN-J6	7.3	26	0.99	1.9	0.6	180	10 U	1.1	8.9	0.2 U	10 U	--	155	As=0.8 V=3 Hg=0.5	1,5,10
Well Name: Wrens #4 County: Jefferson Date Sampled: 1992/12/10															
GWN-J8	6.6	9.0	1.8	5.3	0.51	20	40	7.8	0.72	5.3	40	--	106	Al=60 Cu=10 Zn=10 Hg=0.5	1,2,4
Well Name: Kahn Residence Well County: Jefferson Date Sampled: 1992/12/10															

1992 Ground-Water Quality Analyses of the Miocene Aquifer System

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-MI1 Well Name: McMillan Residence Well County: Cook Date Sampled: 1992/04/17	7.9	25	14	6.8	5 U	100	29	3.0	3.9	0.1 U	20	120	241	Al=57 F=0.5mg/L	1,3,5 10,CN
GWN-MI1 Well Name: McMillan Residence Well County: Cook Date Sampled: 1992/10/14	7.8	25	14	7.0	5 U	22	27	2.6	3.8	0.1 U	23	14	226	Al=61 Zn=27 F=0.6mg/L	1,2,4 5,10,CN
GWN-MI2 Well Name: Boutwell Residence Well County: Lowndes Date Sampled: 1992/04/27	5.6	3.2	1.0	2.4	5 U	20 U	10 U	2.9	2 U	0.1 U	10 U	10 U	35	F=0.5mg/L	1,5,10
GWN-MI2 Well Name: Boutwell Residence Well County: Lowndes Date Sampled: 1992/10/14	5.9	3.3	1.0	3.1	5 U	20 U	10 U	2.5	2 U	0.1 U	10 U	10 U	35	F=0.6mg/L Zn=69	1,2,3 4,5,10
GWN-MI3 Well Name: Coffin Park TW#3 County: Glynn Date Sampled: 1992/01/15	7.5	70	10	22	5 U	260	18	17.5	35.0	0.1 U	11	460	482	Al=110 F=0.4mg/L	2,4,10
GWN-MI3 Well Name: Coffin Park TW#3 County: Glynn Date Sampled: 1992/06/02	7.4	73	11	23	5 U	180	21	36.4	40.7	0.1 U	11	450	512	Al=150 F=0.4mg/L	2,4,10
GWN-MI4 Well Name: Hopulikit TW#2 County: Bulloch Date Sampled: 1992/01/28	7.4	17	5.2	6.1	5 U	940	110	3.3	4.3	0.1 U	82	94	154	F=0.5mg/L	2,4

1992 Ground-Water Quality Analyses of the Miocene Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-MI4	7.4	18	5.5	5.3	5.8	720	120	2.8	4.1	0.1 U	87	96	164	F=0.4mg/L Al=88 Tl=63? V=11	2,4
Well Name: Hopulikit TW#2 County:Bulloch Date Sampled: 1992/06/10															
GWN-MI6A	5.8	1.10	0.80	3.02	2.4	60	10	7.6	1.5	0.45	40	--	33	Al=90 Zn=50 Hg=0.5 Silvex=0.11	2,4
Well Name: Williams Old House Well County: Coffee Date Sampled: 1992/12/09															
GWN-MI7	4.27	5.2	5.1	5.5	5 U	20 U	13	11.8	2 U	10.5	85	10 U	131	Al=650 F=0.2mg/L	1,2,4
Well Name: Chaudoin Residence Well County: Irwin Date Sampled: 1992/10/14															
GWN-MI8A	4.5	6.6	4.6	4.6	5 U	20 U	55	13.9	2 U	10.1	120	10 U	140	Al=1000 F=0.2mg/L Zn=57	1,2,4 5
Well Name: Barry Residence Well County: Colquitt Date Sampled: 1992/10/15															
GWN-MI9A	6.4	12	6.0	5.7	5 U	210	25	10.0	6.5	8.8	74	10	149	Al=200 F=0.2mg/L Zn=72	1,2,4
Well Name: Murphy Garden Well County: Thomas Date Sampled: 1992/10/15															
GWN-MI10B	6.8	10	6,8	7.8	5 U	1300	170	2.6	2 U	0.1 U	240	10	122	Zn=170 F=0.4mg/L	1,2,4 5
Well Name: Calhoun Residence Well County: Colquitt Date Sampled: 1992/04/17															
GWN-MI12	7.5	49	1.4	2.4	5 U	140	13	3.4	2 U	0.1	12	10 U	228	Al=130 F=0.2mg/L Zn=41	1,2,4 5
Well Name: Herzog Nursery Well County: Brooks Date Sampled: 1992/10/16															

1992 Ground-Water Quality Analyses of the Floridan Aquifer System

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA1	7.7	30	12	48	5 U	20 U	10 U	93.1	12.9	0.1 U	12	380	496	F=0.4mg/L Al=65	
Well Name: Thunderbolt #1 County: Chatham Date Sampled: 1992/06/24															
GWN-PA2A	7.8	25	8.0	12	5 U	20 U	10 U	3.8	14.9	0.1 U	12	290	236	Al=53 F=0.4mg/L	
Well Name: Savannah #6 County: Chatham Date Sampled: 1992/06/24															
GWN-PA3	7.8	29	7.2	9.5	5 U	48	10 U	6.3	6.0	0.1 U	21	300	281	F=0.4mg/L	8,9
Well Name: Layne-Atlantic Office Well Counnty: Chatham Date Sampled: 1992/01/30															
GWN-PA4	7.6	35	24	52	5 U	20 U	10 U	48.8	143.3	0.1 U	10 U	1200	595	Al=70 F=0.7mg/L	
Well Name: Tybee Island #1 County: Chatham Date Sampled: 1991/06/25															
GWN-PA9A	7.7	45	24	15	5 U	45	10 U	13.1	94.0	0.1 U	45	440	443	Al=76 F=0.7mg/L	10
Well Name: Brunswick Pulp & Paper Co. TW#2 South County: Glynn Date Sampled: 1992/01/14															
GWN-PA9B	7.6	95	53	150	5 U	380	10 U	142.9	250	0.1 U	98	1100	1665	Al=180 Bi=160 Cd=8 F=0.6mg/L	10
Well Name: Brunswick Pulp & Paper TW#1 South County: Glynn Date Sampled: 1992/01/14															
GWN-PA9C	7.5	170	85	790	13	370	10 U	616	512	1.3	63	2300	5150	Al=280 Bi=400 Cd=22 Pb=56 Zr=11 F=0.7mg/L	10
Well Name: Miller Ball Park TW#25 County: Glynn Date Sampled: 1992/01/15															

1992 Ground-Water Quality Analyses of the Floridan Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA10B	7.4	77	37	66	5 U	21	10 U	85	192	0.1 U	37	770	975	Al=170 Bi=140 Cd=7 F=0.7mg/L	
Well Name: Gilman Paper Co. #1 County: Camden Date Sampled: 1992/01/16															
GWN-PA11	7.4	72	33	25	5 U	42	10 U	38	189.5	0.1 U	33	640	688	Al=130 Bi=120 Cd=6 F=0.7mg/L	10
Well Name: St. Marys #2 County: Camden Date Sampled: 1992/01/16															
GWN-PA12	7.4	68	26	24	5 U	54	10 U	38.5	140.5	0.1 U	31	510	649	Al=110 Bi=79 F=0.7mg/L	10
Well Name: Folkston #3 County: Charlton Date Sampled: 1992/01/16															
GWN-PA13	7.8	44	17	17	5 U	30	10 U	13.0	50.0	0.1 U	71	350	391	Al=98 Bi=110 Cd=7 Zr=19 F=0.5mg/L	10
Well Name: Waycross #3 County: Ware Date Sampled: 1992/01/16															
GWN-PA14	7.8	34	5.0	6.9	5 U	20 U	10 U	3.2	5.8	0.1 U	37	190	229	Al=92 F=0.3mg/L	10
Well Name: Statesboro #7 County: Bulloch Date Sampled: 1992/01/28															
GWN-PA15	7.7	28	8.5	9.0	5 U	29	10 U	2.8	7.2	0.1 U	10 U	410	238	F=0.4mg/L	10
Well Name: King Finishing Company, Fire Pump Well, Dover County: Screven Date Sampled: 1992/01/28															
GWN-PA16	7.6	48	3.1	6.7	5 U	24	12	7.8	7.6	0.1 U	10 U	200	121	Al=120 F=0.2mg/L	10
Well Name: Millen #1 County: Jenkins Date Sampled: 1992/01/29															

1992 Ground-Water Quality Analyses of the Floridan Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA16 Well Name: Millen #1 County: Jenkins Date Sampled: 1992/06/10	7.6	50	3.2	4.1	5 U	31	38	5.9	7.0	0.1 U	10 U	200	292	Al=120 V=11 F=0.2mg/L	
GWN-PA17 Well Name: Swainsboro #7 County: Emanuel Date Sampled: 1992/01/27	7.6	49	1.6	3.9	5 U	31	10 U	3.6	2 U	0.1 U	170	130	251	Al=160 F=0.2mg/L	10
GWN-PA17 Well Name: Swainsboro #7 County: Emanuel Date Sampled: 1992/06/09	7.5	49	1.7	2.2	5.2	20 U	10 U	3.0	2 U	0.1 U	180	130	248	Al=130 V=15 F=0.1mg/L	
GWN-PA18 Well Name: Metter #2 County: Candler Date Sampled: 1991/01/17	7.8	32	3.3	11	5 U	20 U	57	4.4	3.4	0.1 U	25	250	219	F=0.3mg/L	10
GWN-PA19 Well Name: Douglas #4 County: Coffee Date Sampled: 1992/02/92	7.6	46	18	12	5 U	35	26	8.6	56.7	0.1 U	55	460	405	Al=90 Bi=89 F=0.4mg/L toluene=tr	10
GWN-PA20 Well Name: Lakeland #2 County: Lanier Date Sampled: 1992/02/26	7.5	44	15	5.1	5 U	20 U	10 U	3.2	50.6	0.1 U	26	180	359	Al=69 F=0.4mg/L	10
GWN-PA20 Well Name: Lakeland #2 County: Lanier Date Sampled: 1992/08/26	7.2	49	17	5.2	5 U	20 U	10 U	3.3	75.3	0.1 U	27	22	348	Al=120 F=0.3mg/L	

1992 Ground-Water Quality Analyses of the Floridan Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA21	7.5	36	4.1	3.8	5 U	20 U	10 U	4.2	34.6	0.1 U	41	52	228	Al=84 F=0.2mg/L	
Well Name: Valdosta #1; County: Lowndes; Date Sampled: 1992/02/26															
GWN-PA21	7.2	48	4.8	3.5	5 U	20 U	10 U	4.8	64.0	0.1 U	57	10 U	264	Al=110 F=0.2mg/L	
Well Name: Valdosta #1; County: Lowndes; Date Sampled: 1992/08/26															
GWN-PA22	7.6	45	19	8.1	5 U	20 U	10 U	7.4	53.7	0.1 U	23	330	385	Al=90 Bi=75 F=0.5mg/L	
Well Name: Thomasville #6; County: Thomas; Date Sampled: 1992/02/27															
GWN-PA23	7.7	35	15	12	5 U	20 U	10 U	6.1	35.6	0.1 U	120	320	326	Al=61 Bi=79 Mo=36 F=0.4mg/L	
Well Name: Cairo #8; County: Grady; Date Sampled: 1991/02/13															
GWN-PA24	7.5	41	3.4	2.0	0.5 U	20 U	40	0.3	2 U	1.2	10 U	37	211	Al=91 F=0.1mg/L	2,4,7 10
Well Name: Bainbridge #1; County: Decatur; Date Sampled: 1992/03/26															
GWN-PA24	7.35	38.2	3.4	2.5	0.4 U	10	10 U	5.0	--	2.2	10 U	--	--		1,2,3 4,5,10
Well Name: Bainbridge #1; County: Decatur; Date Sampled: 1992/12/02															
GWN-PA25	7.4	60	1 U	3.6	5 U	20 U	10 U	0.2	2 U	1.2	10 U	25	271	Al=110	2,4,10 CN
Well Name: Donalsonville, East 7th Street; County: Seminole; Date Sampled: 1992/03/26															

1992 Ground-Water Quality Analyses of the Floridan Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA25	7.5	61	1 U	3.6	5 U	20 U	10 U	5.0	2 U	1.2	10 U	10 U	269	Al=120	10,CN
Well Name: Donalsonville, East 7th Street Well County: Seminole Date Sampled: 1992/09/17															
GWN-PA26	7.3	48	1 U	2.0	5 U	20 U	10 U	0.2	2 U	1.4	10 U	19	225	Al=140	2,4,10
Well Name: Colquitt #3 County: Miller Date Sampled: 1992/03/20															
GWN-PA26	7.5	50	1 U	1.7	5 U	20 U	10 U	3.2	2 U	1.5	10 U	10 U	220	Al=110 F=0.2mg/L	10
Well Name: Colquitt #3 County: Miller Date Sampled: 1992/09/17															
GWN-PA27	7.4	48	1.2	2.3	5 U	20 U	10 U	2.5	2 U	0.1 U	10	37	225	Al=99 F=0.1mg/L	2,4,8 9,10
Well Name: Camilla New Well (#4) County: Mitchell Date Sampled: 1992/03/25															
GWN-PA27	7.5	50	1.3	1.5	5 U	20 U	10 U	2.2	2 U	0.2	22	29	217	Al=130 F=0.1mg/L	10
Well Name: Camilla New Well (#4) County: Mitchell Date Sampled: 1992/09/17															
GWN-PA28	7.7	38	19	28	5 U	20 U	10 U	10.6	53.7	0.1 U	85	2000	476	Al=66 Bi=51 F=0.7mg/L toluene=tr	10
Well Name: Moultrie #1 County: Colquitt Date Sampled: 1992/02/27															
GWN-PA29	7.6	45	14	4.1	5 U	220	45	3.4	43.7	0.1 U	13	290	332	Al=83 Bi=72 F=0.3mg/L	
Well Name: Adel #6 County: Cook Date Sampled: 1992/02/26															

1992 Ground-Water Quality Analyses of the Floridan Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA29 Well Name: Adel #6 County: Cook Date Sampled: 1992/08/26	7.6	48	15	3.7	5 U	69	36	3.4	53.4	0.1 U	13	34	324	Al=120 F=0.4mg/L	
GWN-PA30 Well Name: Nashville Mills #2, Amoco Fabrics Company County: Berrien Date Sampled: 1992/02/26	7.7	41	15	5.1	5 U	20 U	10 U	4.5	51.2	0.1 U	51	220	334	Al=48 Bi=37 F=0.4mg/L	
GWN-PA30 Well Name: Nashville Mills #2, Amoco Fabrics Company County: Berrien Date Sampled: 1992/08/26	7.7	47	17	5.4	5 U	20	10 U	4.7	71.0	0.1 U	58	27	340	Al=100 F=0.3mg/L	
GWN-PA31 Well Name: Tifton #6 County: Tift Date Sampled: 1992/02/27	7.7	43	7.7	2.6	5 U	20 U	10 U	2.5	2 U	0.1 U	61	260	262	Al=60 F=0.2mg/L	
GWN-PA32 Well Name: Ocilla #3 County: Irwin Date Sampled: 1992/02/25	7.9	35	4.8	3.0	5 U	140	27	2.7	2 U	0.1 U	69	150	209	Al=69 F=0.2mg/L toluene=tr	10
GWN-PA33 Well Name: Fitzgerald Well C County: Ben Hill Date Sampled: 1992/02/25	7.8	23	8.0	3.7	5 U	20 U	14	2.3	2 U	0.1 U	2000	260	185	Al=46 F=0.3mg/L toluene=tr	10
GWN-PA34 Well Name: McRae #1 County: Telfair Date Sampled: 1992/12/09	8.0	47.2	10.0	5.0	2.0	170	80	5.0	3.7	0.33	250	---	311	As=0.6 Hg=0.6 V=6	10

1992 Ground-Water Quality Analyses of the Floridan Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA35	8.0	28.4	12.6	5.7	4.4	60	20	3.7	7.9	0.1 U	90	--	273	Hg=0.4 V=1 Zn=20	10
Well Name: Mount Vernon New Well County: Montgomery Date Sampled: 1992/12/10															
GWN-PA36	7.9	27.8	5.1	10.9	2.9	30	30	3.2	3.9	0.2 U	140	--	239		
Well Name: Vidalia #1 (Sixth Street Well) County: Toombs Date Sampled: 1992/12/10															
GWN-PA37	7.7	48	1 U	2.2	5 U	200	10 U	3.8	2 U	1.7	14	24	222	Al=110	
Well Name: Hogan Monitoring Well County: Laurens Date Sampled: 1991/12/19															
GWN-PA38	8.0	44.0	1.3	2.4	1.0	10 U	10 U	0.7	0.99	0.1 U	110	--	240	Hg=1 V=5	
Well Name: Eastman #4 County: Dodge Date Sampled: 1992/12/09															
GWN-PA39	7.3	48	6.8	3.6	5 U	20 U	10 U	2.5	2 U	0.1 U	180	350	288	Al=61 F=0.2mg/L	10
Well Name: Sylvester #1 County: Worth Date Sampled: 1992/03/25															
GWN-PA39	7.6	54	7.6	3.6	5 U	20 U	10 U	2.3	2 U	0.1 U	210	43	274	Al=220 F=0.2mg/L	10
Well Name: Sylvester #1 County: Worth Date Sampled: 1992/09/17															
GWN-PA40	7.3	59	1.1	2.4	5 U	20 U	10 U	3.6	2 U	1.4	17	49	266	Al=96 F=0.1mg/L	10,CN
Well Name: Merck Chemical Co. #8 County: Dougherty Date Sampled: 1992/03/25															

1992 Ground-Water Quality Analyses of the Floridan Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA40	7.5	64	1.2	2.0	5 U	20 U	10 U	3.4	2 U	1.4	17	10 U	278	Al=130 F=0.1mg/L	
Well Name: Merck Chemical Co. #8 County: Dougherty Date Sampled: 1992/09/17															
GWN-PA41	6.9	98	2.4	17	5 U	20 U	10 U	13.5	22.4	1.7	40	70	536	Al=230 F=0.1mg/L trichloroethylene=1.0 tetrachloroethylene=7.7	1,3,5 8,9,10 CN
Well Name: Albany TW#13 County: Dougherty Date Sampled: 1992/03/19															
GWN-PA41	7.0	120	3.0	22	5 U	38	10 U	18.5	30.1	2.0	47	10 U	573	Al=260 F=0.2mg/L trichloroethylene=tr tetrachloroethylene=tr	2,4,10 CN
Well Name: Albany TW#13 County: Dougherty Date Sampled: 1992/09/16															
GWN-PA42	7.2	32	1 U	2.3	5 U	48	10 U	8.0	2 U	0.1 U	10 U	14	171	Al=65 F=0.1mg/L	CN
Well Name: USGS Garrett Ob. Well County: Lee Date Sampled: 1992/04/16															
GWN-PA43	7.5	49	1 U	2.6	5 U	20	10 U	3.6	2 U	1.5	10 U	40	233	Al=140	2,4,10
Well Name: Newton #1 County: Baker Date Sampled: 1992/03/25															
GWN-PA43	7.6	50	1.0	2.3	5 U	20 U	10 U	3.3	2 U	1.6	10 U	10 U	227	Al=100 F=0.1mg/L	1,2,3 4,10
Well Name: Newton #1 County: Baker Date Sampled: 1992/09/17															
GWN-PA44	7.9	32	4.0	2.7	5 U	20 U	10 U	2.0	2 U	0.1	140	280	184	Al=64 F=0.3mg/L toluene=tr	10
Well Name: Sycamore #2 County: Turner Date Sampled: 1992/02/05															

1992 Ground-Water Quality Analyses of the Floridan Aquifer System (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-PA45A	7.3	57	1.0	1.8	5 U	20 U	10 U	2.5	2 U	0.2	65	67	256	Al=130 F=0.2mg/L	
Well Name: Abbeville #1 County: Wilcox Date Sampled: 1992/03/24															
GWN-PA46B	7.5	44	1 U	3.2	5 U	20 U	10 U	6.3	2 U	3.1 U	37	29	232	Al=65 F=0.1mg/L	
Well Name: Wenona MHP County: Crisp Date Samped: 1992/02/24															
GWN-PA47	7.5	66	1.1	2.8	5 U	27	10 U	0.2	2 U	6.5	12	52	335	Al=92	1,3,5 10
Well Name: USGS Haley Farms TW#19 County: Lee Date Sampled: 1992/03/18															
GWN-PA47	7.2	87	1.7	4.7	5 U	20 U	10 U	20.8	2 U	13.9	18	10 U	422	Al=210	1,2,3 4,5,10
Well Name: USGS Haley Farms TW#19 County: Lee Date Sampled: 1992/09/24															
GWN-PA48	7.3	53	1 U	2.1	5 U	20 U	10 U	0.3	2 U	2.1	10	24	238	Al=120	1,2,3 4,5,7 10,CN
Well Name: Doug Harvey TW#1 County: Early Date Sampled: 1992/03/26															
GWN-PA48	7.5	55	1 U	1.7	5 U	70	10 U	3.6	2 U	2.0	10 U	10 U	243	Al=210 F=0.1mg/L	1,2,3 4,5,7 10,CN
Well Name: Doug Harvey TW#1 County: Early Date Sampled: 1992/09/16															
GWN-PA50	7.8	57.0	1.35	2.9	0.70	80	10 U	3.6	5.0	1.0	10	--	311	As=0.9 V=10 Hg=1	1,2,3 4,5
Well Name: G. Reynolds Residence Well County: Laurens Date Sampled: 1992/12/10															

1992 Groundwater Quality Analyses of the Piedmont/Blue Ridge Unconfined Aquifers

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
WELL ID#															
GWN-BR1A	6.9	27	2.1	6.5	5 U	76	200	1.4	3.1	0.1 U	24	25	164	Al=67 Zn=65 F=0.1mg/L	
Well Name: Hiawassee #7 County: Towns Date Sampled: 1992/07/22															
GWN-BR2	5.7	3.3	1.4	3.1	5 U	20 U	13	3.7	2 U	0.1 U	47	10 U	50		10
Well Name: Notla Water Authority #3 County: Union Date Sampled: 1992/07/22															
GWN-BR3A	5.5	3.3	1.6	3.8	5 U	20 U	69	4.9	2 U	0.1 U	27	10 U	56	Al=75	
Well Name: Dawsonville City Spring County: Dawson Date Sampled: 1992/07/21															
GWN-BR4		6.2	11	2.4	8.9	5 U	20 U	10 U	6.0	2 U	0.1 U	10 U	11	113	F=0.1mg/L
Well Name: Morganton Old Well County: Fannin Date Sampled: 1992/07/21															

1992 Ground-Water Quality Analyses of the Piedmont/Blue Ridge Unconfined Aquifers

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-P1	6.2	7.8	2.5	9.5	5 U	2300	59	5.3	17.5	0.1 U	10 U	94	106	F=0.2mg/L	
Well Name: Luthersville New Well County: Meriwether Date Sampled: 1992/05/28															
GWN-P2	6.8	14	1.5	11	5.2	100	16	2.6	2 U	0.9	24	79	149	Zn=36 F=0.3mg/L	10
Well Name: Riverdale, Delta Drive Well County: Clayton Date Sampled: 1992/06/02															
GWN-P2	7.2	12.7	1.5	9.3	2.0	120	10 U	1.6	2.3	0.88	20	--	139	Zn=30 V=9	10
Well Name: Riverdale, Delta Drive Well County: Clayton Date Sampled: 1992/11/13															
GWN-P3	7.0	9.1	2.3	9.1	5 U	2200	48	1.4	6.4	0.1 U	14	68	102	Al=480 Ti=34 F=0.2mg/L 1,2-Dichloropropane = 1.5	8,9,10
Well Name: Ft. McPherson TW County: Fulton Date Sampled: 1992/04/02															
GWN-P3	6.9	11	2.5	10	5 U	660	45	1.2	6.7	0.1 U	13	10 U	106	Al=63 F = 0.2mg/L	8,9,10
Well Name: Ft. McPherson TW County: Fulton Date Sampled: 1992/09/22															
GWN-P4C	6.3	6.6	1.0	7.8	5 U	20 U	10 U	1.4	2 U	1.3	22	67	75	F=0.3mg/L	
Well Name: Barton Brands, Inc. #3 County: Fulton Date Sampled: 1992/05/14															
GWN-P4C	6.9	6.5	1.0	6.9	2.6	13	10 U	0.3	1.1	1.3	20	--	87	Al=10	
Well Name: Barton Brands, Inc. #3 County: Fulton Date Sampled: 1992/11/12															

1992 Ground-Water Quality Analyses of the Piedmont/Blue Ridge Unconfined Aquifers (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-P5	7.2	23.4	4.1	2.1	1.7	10 U	10 U	1.22	1.75	0.23	30	--	170		10
Well Name: Flowery Branch #1 County: Hall Date Sampled: 1992/11/19															
GWN-P6B	7.4	18	2.4	8.7	5 U	45	93	2.3	5.5	0.1 U	10 U	45	136	Al=43 F=0.3mg/L	
Well Name: Shiloh #1 County: Harris Date Sampled: 1992/04/22															
GWN-P7	6.5	12	4.6	8.4	5 U	20 U	10 U	2.1	3.8	0.2	51	70	120	F=0.2mg/L	10
Well Name: Hampton #6 County: Henry Date Sampled: 1992/05/14															
GWN-P8	7.6	27.5	8.8	9.8	1.5	60	10	8.3	7.8	0.2 U	10 U	--	254	Al=1040	10
Well Name: Wayne Poultry Company #4, Pendergrass County: Jackson Date Sampled: 1992/11/18															
GWN-P9	6.2	19	8.6	15	6.0	940	160	8.9	43.8	0.1 U	41	130	220	F=0.1mg/L	
Well Name: Gray #4 County: Jones Date Sampled: 1992/04/29															
GWN-P10A	5.6	8.4	8.6	5.7	3.7	17,400	340	3.9	88.3	0.28	30	--	188	Al=700 Ni=40	10
Well Name: Franklin Springs #4 County: Franklin Date Sampled: 1992/11/18															
GWN-P11	7.3	11.7	5.9	6.7	2.3	190	20	2.1	6.2	0.2 U	10	--	146		
Well Name: Danielsville #2 County: Madison Date Sampled: 1992/11/18															

1992 Ground-Water Quality Analyses of the Piedmont/Blue Ridge Unconfined Aquifers (Continued)

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-P12	6.0	11	2.5	13	5 U	34	10 U	11.5	5.9	2.8	41	75	143	Zn=33 F=0.2mg/L	
Well Name: Nabisco Plant #1, Woodbury County: Meriwether Date Sampled: 1992/05/26															
GWN-P13A	6.2	4.9	1.3	6.4	5 U	20 U	10 U	1 U	2 U	0.9	33	39	66		10
Well Name: Academy Spring, Covington County: Newton Date Sampled: 1992/05/12															
GWN-P14	5.0	1 U	1 U	1.3	5 U	25	10 U	1.8	2 U	0.3	30	10 U	21	F=0.1mg/L	
Well Name: Sunset Village #1 County: Upson Date Sampled: 1992/05/27															
GWN-P15A	7.3	21	4.8	8.4	6.6	460	97	7.7	6.6	0.1 U	67	99	170	Al=67 Zn=25 F=0.2mg/L	10
Well Name: Bolton Garden Well County: DeKalb Date Sampled: 1992/05/20															
GWN-P15A	7.7	10	5.0	7.3	5.4	470	90	9.0	8.0	0.2 U	60	--	195	V=20 Zn=20	10
Well Name: Bolton Garden Well County: DeKalb Date Sampled: 1992/11/12															
GWN-P16C	7.5	8.6	1.9	2.9	1.8	990	80	1.2	9.2	0.2 U	10 U	--	86	Co=4 Cu=10 Mo=30 Zn=20 Hg=0.5	10
Well Name: Mt. Airy #4, Chase Road Well County: Habersham Date Sampled: 1992/11/19															

1992 Ground-Water Quality Analyses of the Valley and Ridge Aquifers

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS / WELL ID#	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
GWN-VR1	7.7	26	14	1 U	5 U	20 U	10 U	1.7	2 U	0.1 U	10 U	10 U	238		10
Well Name: Kingston Road Well, Rome; County: Floyd; Date Sampled: 1992/07/21															
GWN-VR2	6.6	54	19	19	5 U	1500	1900	18.4	20.1	0.1 U	35	72	439	Al=110 benzene=660 toluene=1700 ethylbenzene=470 xylenes=1500	10
Well Name: Hucheson Medical Center Cooling Well; County: Catoosa; Date Sampled: 1992/01/08															
GWN-VR2	6.8	63	21	13	5 U	830	1300	23.2	17.0	0.1 U	33	10 U	491	Al=180 benzene=510 toluene=1300 ethylbenzene=190 xylenes=1100	10
Well Name: Hucheson Medical Center Cooling Well; County: Catoosa; Date Sampled: 1992/07/22															
GWN-VR3	7.4	31	12	1.2	5 U	20 U	10 U	1.9	2.1	0.6	68	26	232	Al=73	10
Well Name: Chickamauga, Crawfish Springs; County: Walker; Date Sampled: 1992/01/08															
GWN-VR3	7.5	31	14	1 U	5 U	20 U	10 U	1.6	2.6	0.1 U	77	10 U	243	Al=77	10
Well Name: Chickamauga, Crawfish Springs; County: Walker; Date Sampled: 1992/07/22															
GWN-VR4	7.3	83	20	16	5 U	73	21	13.3	60.6	0.1 U	130	79	566	Al=420 1,1-dichloroethane=tr 1,1,1-trichloroethane=tr	10
Well Name: Coats-American #4; County: Walker; Date Sampled: 1992/07/22															
GWN-VR5	7.2	79	3.9	5.0	5 U	20 U	10 U	8.9	3.5	3.0	110	20	406	Al=160	10
Well Name: Chatooga County #4; County: Chattooga; Date Sampled: 1992/07/21															

1992 Ground-Water Quality Analyses of the Valley and Ridge Unconfined Aquifers

PARAMETER	pH	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	NO2 &NO3	Ba	Sr	Spec. Cond.	Other Parameters Detected	Other Screens Tested
UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mgN/L	ug/L	ug/L	umho/cm	ug/L	
WELL ID#															
GWN-VR6	7.6	28	16	4.0	5 U	20 U	10 U	4.0	4.0	0.7	620	19	254	Al=68 Tetrachloroethylene=tr 1,1-dichloroethane=tr F=0.1mg/L	10
Well Name: Chemical Products Corporation, East Well County: Bartow Date Sampled: 1992/07/15															
GWN-VR7	7.5	29	14	1 U	5 U	20 U	10 U	1.2	2 U	0.4	44	10 U	229	Al=61 F=0.1mg/L	10
Well Name: Adairsville, Lewis Spring County: Bartow Date Sampled: 1992/07/15															
GWN-VR8	7.4	34	15	1 U	5 U	20 U	10 U	2.3	2 U	0.6	14	22	255	Al=89	10
Well Name: Cedartown Spring County: Polk Date Sampled: 1992/07/15															
GWN-VR9	7.5	36	12	1 U	5 U	20 U	10 U	4.0	4.0	0.7	11	10 U	252	Al=110	10
Well Name: Polk County #2 County: Polk Date Sampled: 1992/07/15															

For convenience in selecting our reports from your bookshelves, they are color-keyed across the spine by subject as follows:

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Maroon	Coastal Plain mapping and stratigraphy
Lt. Green	Paleontology
Lt. Blue	Coastal Zone studies
Dk. Green	Geochemical and geophysical studies
Dk. Blue	Hydrology
Olive	Economic geology
	Mining directory
Yellow	Environmental studies
	Engineering studies
Dk. Orange	Bibliographies and lists of publications
Brown	Petroleum and natural gas
Black	Field trip guidebooks
Dk. Brown	Collections of papers

Colors have been selected at random, and will be augmented as new subjects are published.

Editor: Melynda Lewis