GROUND-WATER QUALITY IN GEORGIA FOR 1995

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GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION
GEORGIA GEOLOGIC SURVEY

ATLANTA
1997

CIRCULAR 12L

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This report for calendar year 1995 is the twelfth 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. EPD has implemented a comprehensive statewide 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. The Geologic Survey Branch of EPD maintains this program, which is designed to evaluate the ambient ground-water quality of nine aquifer systems throughout the State of Georgia. The data collected from sampling on the Ground-Water Monitoring Network form the basis for this report.

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 the residents of Georgia are using.

3. Special studies addressing specific water quality issues. A survey of nitrite /nitrate levels in shallow wells located throughout the State of Georgia (Shellenberger, et al., 1996; Stuart, et al., 1995) and the operation of a Pesticide Monitoring Network, currently conducted jointly by the Geologic Survey Branch and the Georgia Department of Agriculture (GDA), (Webb, 1995) are examples of these types of studies. Another special study addressing bacterial contamination of the Floridan aquifer in the aftermath of Tropical Storm Alberto continued into 1995 and concluded that coliform-contaminated water in the aquifer had largely flushed out by early 1995 (McLemore, 1995, letter to Representative Robert Hanner).

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

5. The development of a wellhead protection program (WHP), which is designed to protect the area surrounding a municipal drinking water well from contaminants. The U.S. Environmental Protection Agency (EPA) approved Georgia's WHP Plan on September 30, 1992. The WHP Plan became a part of the Georgia Safe Drinking Water Rules, effective July 1, 1993. The protection of public water supply wells from contaminants is important not

only for maintaining ground-water quality but also for ensuring that public water supplies meet health standards.

Analyses of water samples collected for the Georgia Ground-Water Monitoring Network during calendar year 1995 and from previous years form the data base for this summary. The Georgia Ground-Water Monitoring Network comprises 128 wells and springs. Though sampled at various frequencies in the past, all stations on the network switched to an annual sampling frequency during 1994. In 1995, EPD personnel collected 141 samples from 111 wells and 6 springs. Certain stations not visited in 1994 were visited twice during 1995. A review of the 1995 data and comparison of these data with those for samples collected as early as 1984 indicate 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 drawn for sampling is the result of complex physical, chemical, and biological processes. Among 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 discharged to a surface-water body (e.g., stream, river, lake, or ocean). The initial water chemistry, the amount of recharge, and the attenuation capacity of soils have a strong influence on the quality of ground water in recharge areas. Chemical interactions between the water and the aquifer host rocks have 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. An improperly constructed well can present a conduit that allows local pollutants to enter the ground-water flow system.

1.3 HYDROGEOLOGIC PROVINCES OF GEORGIA

This report defines three hydrogeologic provinces in Georgia by their general geologic and hydrologic characteristics (Figure 1-1). These provinces consist of:

1. the Coastal Plain Province of south Georgia;

Figure 1-1. - The Hydrogeologic Provinces of Georgia.

2. the Piedmont/Blue Ridge Province, which includes all but the northwest corner of Georgia; and
3. the Valley and Ridge Province of northwest Georgia.

1.3.1 Coastal Plain Province

Georgia's Coastal Plain Province generally comprises 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.

The Coastal Plain contains Georgia's major confined (artesian) aquifers. Confined aquifers are those in which a layer of impermeable material (i.e., clay or shale) holds the top of the water column at a level below that to which it would normally rise. Water enters the aquifers in their up-dip outcrop areas, where the more permeable sediments of the aquifer tend to be exposed. Many 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 the dip of the rocks.

The sediments forming the seven major 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 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. The Floridan aquifer system (primarily carbonates) serves most of south-central and southeastern Georgia. The Miocene aquifer system (primarily sands) is the principal "shallow" unconfined aquifer system occupying much of the same broad area underlain by the Floridan aquifer system. It becomes confined in the coastal counties and locally in the Grady, Thomas, Brooks and Lowndes County area of south Georgia.

1.3.2 Piedmont/Blue Ridge Province

Crystalline rocks of metamorphic and igneous origin (primarily Precambrian and Paleozoic in age) underlie the Piedmont and 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 toward discharge areas along streams. However, during prolonged dry periods or in areas of heavy pumpage, ground water may flow from the streams into the fracture and joint systems.

1.3.3 Valley and Ridge Province

Consolidated Paleozoic sedimentary formations characterize the Valley and Ridge Province. The principal permeable features of the Valley and Ridge Province are fractures and solution voids; intergranular porosity also is important in some places. Locally, ground-water and surface-water systems closely interconnect. Dolostones and limestones of the Knox Group are the principal aquifers where they occur in the axes of broad valleys. The greater hydraulic conductivities of the thick carbonate sections in this Province, in part due to solution-enlarged joints, permit development of higher yielding wells than in the Piedmont and Blue Ridge Province.

1.4 REGIONAL GROUND-WATER PROBLEMS

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

Only a few occurrences of polluted or contaminated ground waters are known from North Georgia (see Section 4). 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 both from the inability of the sandy aquifer sediments to neutralize acidic rainwater and from acid-producing reactions between infiltrating water and soils and sediments. Nitrite/nitrate concentrations in shallow ground water from the farm belt of southern Georgia are usually within drinking-water standards, but are somewhat higher than levels found in other areas of the State.

The Floridan aquifer system contains two areas of naturally-occurring reduced ground-water quality besides the karst plain area (Dougherty Plain) in southwest Georgia. The first is the area of the Gulf Trough, a narrow, linear geological feature extending from southwestern Decatur County through central Bulloch County. Here, ground water is typically high in total dissolved solids and contains elevated levels of barium, sulfate, and radionuclides. The second is the coastal area of Georgia, where influx of water with high dissolved solids contents presents problems. In the Brunswick area, ground-water withdrawal from the upper Floridan results in up-coning of water with high dissolved solids contents from deeper parts of the aquifer. In the Savannah region, a cone of depression caused by pumping in and around Savannah induces saline ground water to flow down-gradient from the Port Royal Sound area of South Carolina toward Savannah.

2.0 GEORGIA GROUND-WATER MONITORING NETWORK

2.1 MONITORING STATIONS

Stations of the 1995 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 (Table 2-1). Monitoring stations are located in three critical settings:

1. areas of surface recharge;
2. areas of potential pollution related to regional activities (e.g., agricultural and industrial areas); and
3. areas of significant ground-water use.

Most of the monitoring stations are municipal, industrial, and domestic wells that have reliable well-construction data. The Monitoring Network also includes monitoring wells in specific areas where the State's aquifers are recognized to be especially susceptible to contamination or pollution (e.g., the Dougherty Plain of southwestern Georgia and the State's coastal area).

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. Non-point source pollution arises from broad-scale phenomena such as acid rain deposition and 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 128 sites located throughout Georgia provides an indication of ground-water quality at the locality sampled and at the horizon corresponding to the screened interval in the well or to the head of the spring 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 intentionally are 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

Table 2-1. Georgia Ground-Water Monitoring Network, 1995

AQUIFER SYSTEM	NUMBER OF MONITORING STATIONS VISITED & SAMPLES TAKEN IN 1995	PRIMARY STRATIGRAPHIC EQUIVALENTS	AGE OF AQUIFER FORMATIONS
Cretaceous	15 stations (21 samples)	Ripley Formation, Cusseta Sand, Blufftown Formation, Eutaw Formation, Tuscaloosa Formation, and Gaillard Formation	Late Cretaceous
Providence	1 station (2 samples)	Providence Sand	Late Cretaceous
Clayton	5 stations (8 samples)	Clayton Formation	Paleocene
Claiborne	5 stations (8 samples)	Tallahatta Formation	Middle Eocene
Jacksonian	8 stations (8 samples)	Barnwell Group	Late Eocene
Floridan	47 stations (50 samples)	Predominantly Suwannee Limestone and Ocala Group	Predominantly Middle Eocene to Oligocene
Miocene	8 stations (8 samples)	Predominantly Altamaha Formation and Hawthorne Group	Miocene-Recent
Piedmont/Blue Ridge	20 stations (26 samples)	Various igneous and metamorphic complexes	Predominately Paleozoic and Precambrian
Valley and Ridge	8 stations (10 samples)	Shady Dolomite, Knox Group, and Chickamauga Group	Paleozoic, mostly Cambrian and Ordovician

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 wide spacing of monitoring stations does not permit equal characterization of water-quality processes in these settings. The quality of water from monitoring wells completed in unconfined aquifers represents only the general nature of ground water in the vicinity of the monitoring wells. 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 141 water samples collected during 1995 from 111 wells and 6 springs. In 1984, the first year of the Ground-Water Monitoring Network, hydrogeologists sampled water from 39 wells in the Piedmont/Blue Ridge and Coastal Plain Provinces. Two of these wells have been sampled each year since 1984. Since 1984, the Ground-Water Monitoring Network has been expanded through addition of further wells and springs to cover all three hydrogeologic provinces, with most of the 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 (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, for instance, volatile organic compounds, are tested. The additional parameters are listed in the Appendix (Table A-2). The pH measurements are performed in the field, whereas, other parameters are measured in the laboratory. Tables 2-2 (cations) and 2-3 (anions) summarize the significance of the common major constituents found in ground water.

The Drinking Water Program of the EPD's Water Resources Management Branch has established Maximum Contaminant Levels (MCL's) for certain parameters included in the analyses done on Ground-Water Monitoring Network samples (EPD, 1994). Primary MCL's pertain to parameters that may have adverse effects on human health when their values are exceeded. Secondary MCL's pertain to parameters that may give drinking water objectionable, though not health-threatening, properties that may cause persons served by public water systems to cease its use. Foul odor and unpleasant taste are examples of such properties. MCL's apply only to treated water offered for public consumption, nevertheless,

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

PARAMETER(S)	SIGNIFICANCE
pH (Hydrogen ion concentration)	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 corrode metals. A pH range between 6.0 and 8.5 is considered acceptable.
Calcium and magnesium*	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 ppm of calcium by 2.5 and that of magnesium by 4.1.

Water Class	Hardness (parts per million)
Soft	Less than 60
Moderately Hard	60 to 120
Hard	121 to 180
Very Hard	More than 180

PARAMETER(S)	SIGNIFICANCE
Sodium and potassium*	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.
Iron and manganese	More than 300 ppb 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 promote growth of iron bacteria, but do not endanger health.

**Major metallic ions present in most ground waters.*

Table 2-3. The Significance of Parameters of a Basic Water Quality Analysis, Anions (after Wait, 1960).

PARAMETER(S)	SIGNIFICANCE
Chloride	Chloride salts in excess of 100 ppm 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 the chloride content should not exceed 250 ppm.
Nitrate/Nitrite	Excessive amounts of nitrate/nitrite in drinking water or formula water for infants may cause a type of methemoglobinemia ("blue babies"). Nitrate/nitrite in concentrations greater than 10 ppm (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 ppm have a laxative effect, but concentrations up to 500 ppm are not considered unhealthful.

they are useful guidelines for evaluating the quality of untreated (raw) water. Tables A-1 and A-2 in the Appendix list the Primary and Secondary MCL's for Ground Water Monitoring Network parameters.

Most of the wells originally on the Monitoring Network had in-place pumps. Using such pumps to purge the wells and collect samples reduces the potential for cross-contamination of wells. For those wells that lacked in-place pumps, EPD personnel used portable pumps for purging and sampling. In recent years, however, all wells that lacked in-place pumps were dropped from the Monitoring Network, except for a flowing well tapping the lower Floridan, GWN-PA9C (see Appendix, Table A-8).

Sampling procedures are adapted from techniques used by the USGS and the EPA. Hydrogeologists purge the wells (three to five times the volume of the water column in the well) before 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 30 to 45 minutes of purging before sample collection.

EPD personnel monitor certain water quality parameters prior to sample collection. The personnel observe and record pH, dissolved oxygen content, specific conductivity, and temperature using field instruments. A manifold captures flow at the pump system discharge point before the water is exposed to the atmosphere and conducts it past the instrument probes. With increased purging time, typical trends include a lowering of pH, dissolved oxygen content, and specific conductivity, and a transition toward the mean annual air temperature. The hydraulic flow characteristics of unconfined aquifers, the depth of withdrawal, and pump effects may 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 Geologic Survey Branch contain the records of the field measurements taken during sampling (i.e., pH, dissolved oxygen content, specific conductivity, and temperature). EPD personnel fill the sample bottles and then promptly place them on ice to preserve the water quality. The personnel next transport the samples to the laboratories for analysis on or before the Friday of the week in which they were collected.

During 1995, various laboratories performed the chemical analyses of water samples for the Ground-Water Monitoring Network. EPD laboratories did the following standard water quality tests on all regular samples: a specific conductance test, tests for metals using ICP and AAS, a nitrate/nitrite test (results reported as ppm nitrogen), and an ion chromatography test for chloride, fluoride, and sulfate. EPD laboratories also did optional tests on various samples for semivolatile organic compounds. The conductance test is a standard one listed in <u>Standard Methods for the Evaluation of Water and Waste Water</u> (1995), and the remaining tests used various EPA methods listed in Tables A-1 and A-2 in the Appendix.

The Cooperative Extension Service Laboratories at the University of Georgia tested for pesticides and PCB's on several samples collected early in January of 1995, using a series of tests called organic screens #1, #2, #3, #4, and #5. During the remainder of the year, the Georgia Department of Agriculture laboratory performed analyses for pesticides and PCB's using EPA methods 507.0, 508.1, 515.1, and 531.1. The first three of these EPA methods correspond to screens #1, #2, and combined #3 and #4, respectively. EPA method 531.1 and screen #5 are both used to test for carbamate pesticides. However, while screen #5 can additionally be used for urea-derivative pesticides, it does not give acceptable results for the carbamate, aldicarb (and its oxidation derivatives). EPA has not designated an approved testing method for the urea derivatives. Appendix Table A-2 contains a list of pesticides and test methods.

3.0 GROUND-WATER QUALITY IN GEORGIA

3.1 OVERVIEW

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

The Coastal Plain Province comprises seven major aquifers or aquifer systems that are restricted to specific regions and depths within the province (Figure 3-1). These major aquifer systems, in many cases, incorporate smaller aquifers that are locally confined. Ground-Water Monitoring Network wells in the Coastal Plain aquifers are generally located in three settings:

1. Recharge (or outcrop) areas that 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 that 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.

Small-scale, localized ground-water flow patterns characterize the two hydrogeologic provinces of north Georgia, the Piedmont/Blue Ridge Province and the Valley and Ridge Province. Deep regional flow systems are unknown in northern Georgia. Geologic discontinuities (such as fractures) and compositional changes within the aquifer generally control ground-water flow in the Piedmont/Blue Ridge Province. 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 also apply in the Valley and Ridge Province. The Valley and Ridge Province additionally possesses widespread karst features, which significantly enhance porosity and permeability in localized areas and exert a strong influence on local ground-water flow patterns.

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 (Figure 3-2). Overlying Tertiary 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

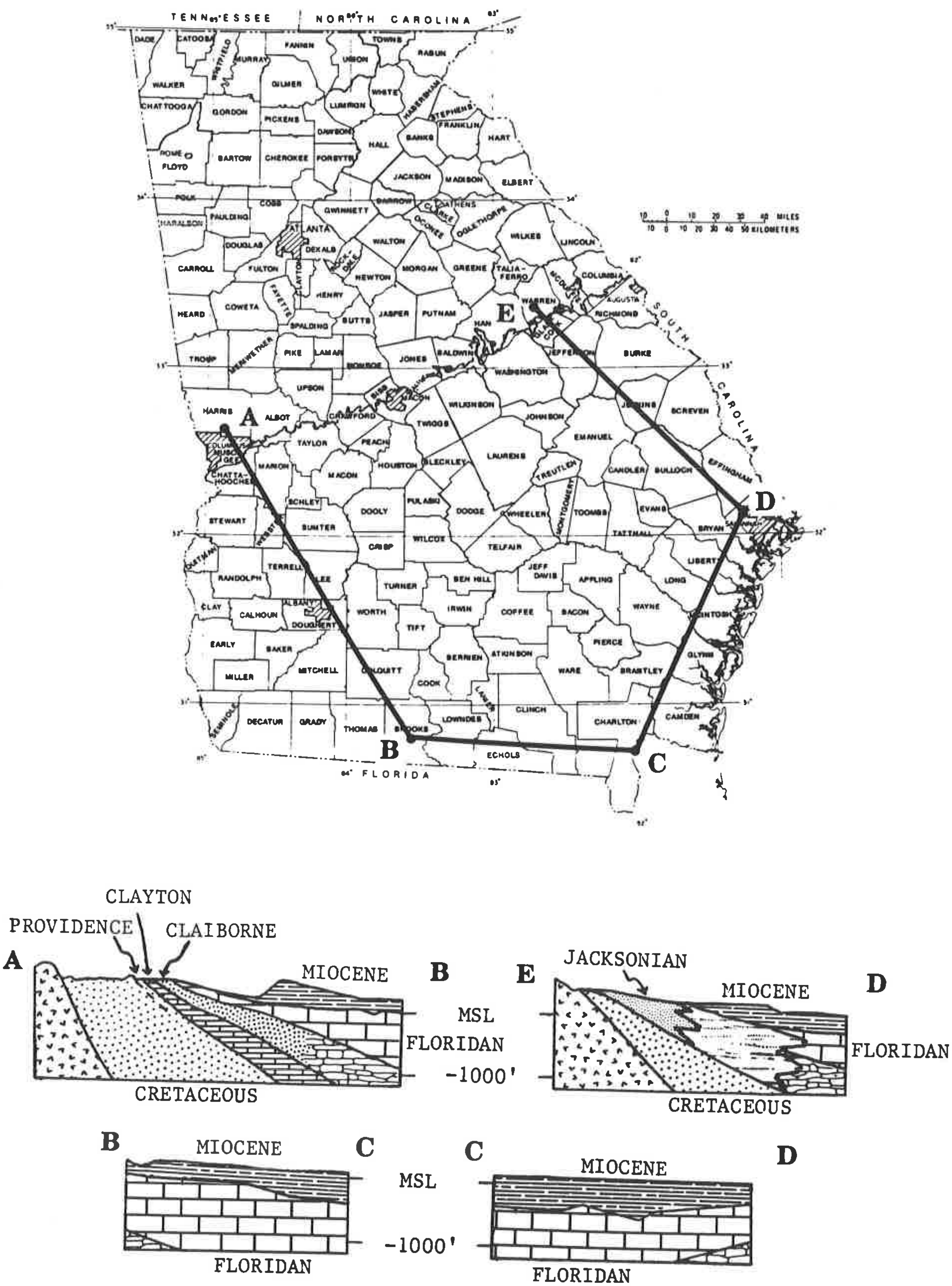
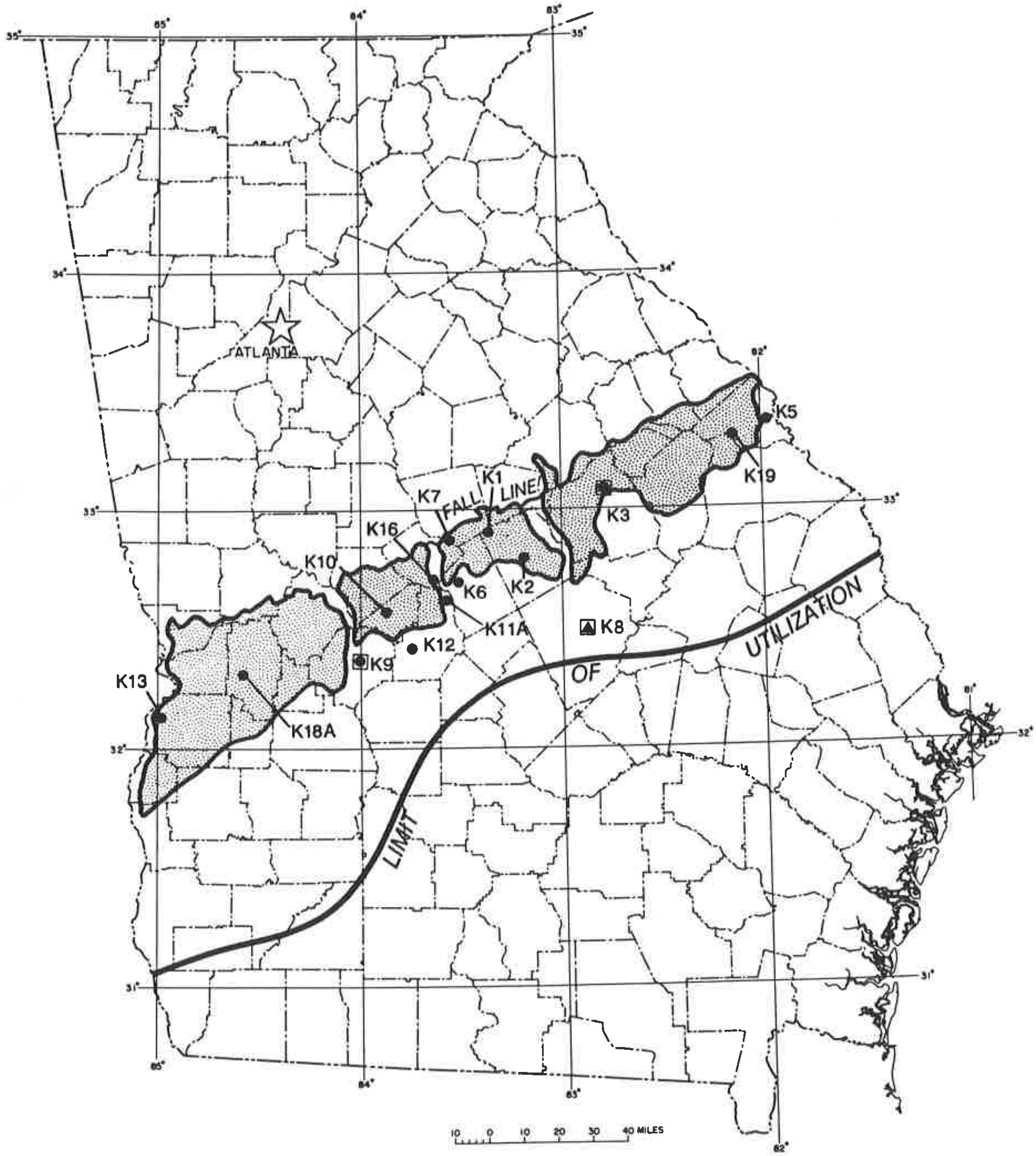


Figure 3-1. - The Seven Major Aquifer Systems of the Coastal Plain Province.



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

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

Figure 3-2. Water Quality of Selected Wells in the Cretaceous Aquifer System.

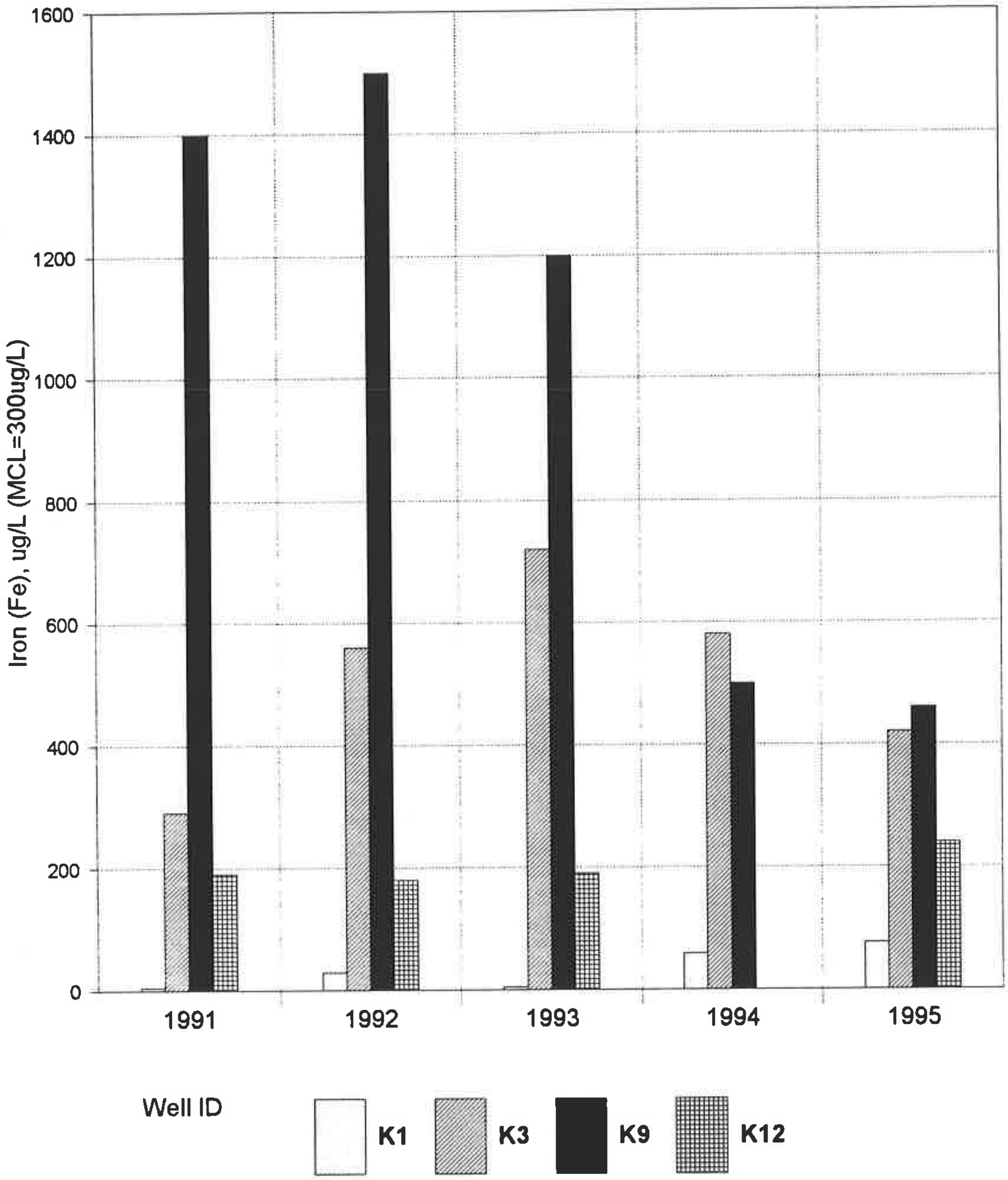
east (Clarke, et al., 1985). Aquifer sands thicken southward from the Fall Line, from where they pinch out against crystalline Piedmont rocks, to a sequence of sand and clay approximately 2,000 feet thick at the southern limits of the main aquifer-use area (limit of utilization, Figure 3-2). Vertical leakage from overlying members of the aquifer system provides significant recharge in down-dip areas.

EPD sampled 15 wells in 1995 to monitor the water quality of the Cretaceous aquifer system, exclusive of the Providence aquifer system (Figure 3-2). Two of the sampled wells, GWN-K8 and GWN-K12, are located away from the Cretaceous outcrop and recharge area, while the remainder lie within the general recharge area. Thirteen of the wells yielded soft, acidic water. Well GWN-K13 in Stewart County contained basic water and well GWN-K8 in Laurens County) had moderately hard water. Well GWN-K13, though lying in the general outcrop area, draws water from the deeper parts of the aquifer system (apparently the A_6 subsystem of Pollard and Vorhis, 1980) and well GWN-K8 taps a downdip portion of the aquifer.

Iron concentrations exceeded the State secondary MCL of 300 parts per billion (ppb) in three wells: GWN-K3 in Washington County (420 ppb), GWN-K8 (2600 ppb and 3900 ppb), and GWN-K9 in Macon County (460 ppb). Well GWN-K1 yielded a sample with a manganese concentration of 50 ppb, which equals the applicable secondary MCL of 50 ppb. Figure 3-3 shows trends in iron concentrations for selected wells in the Cretaceous aquifer system.

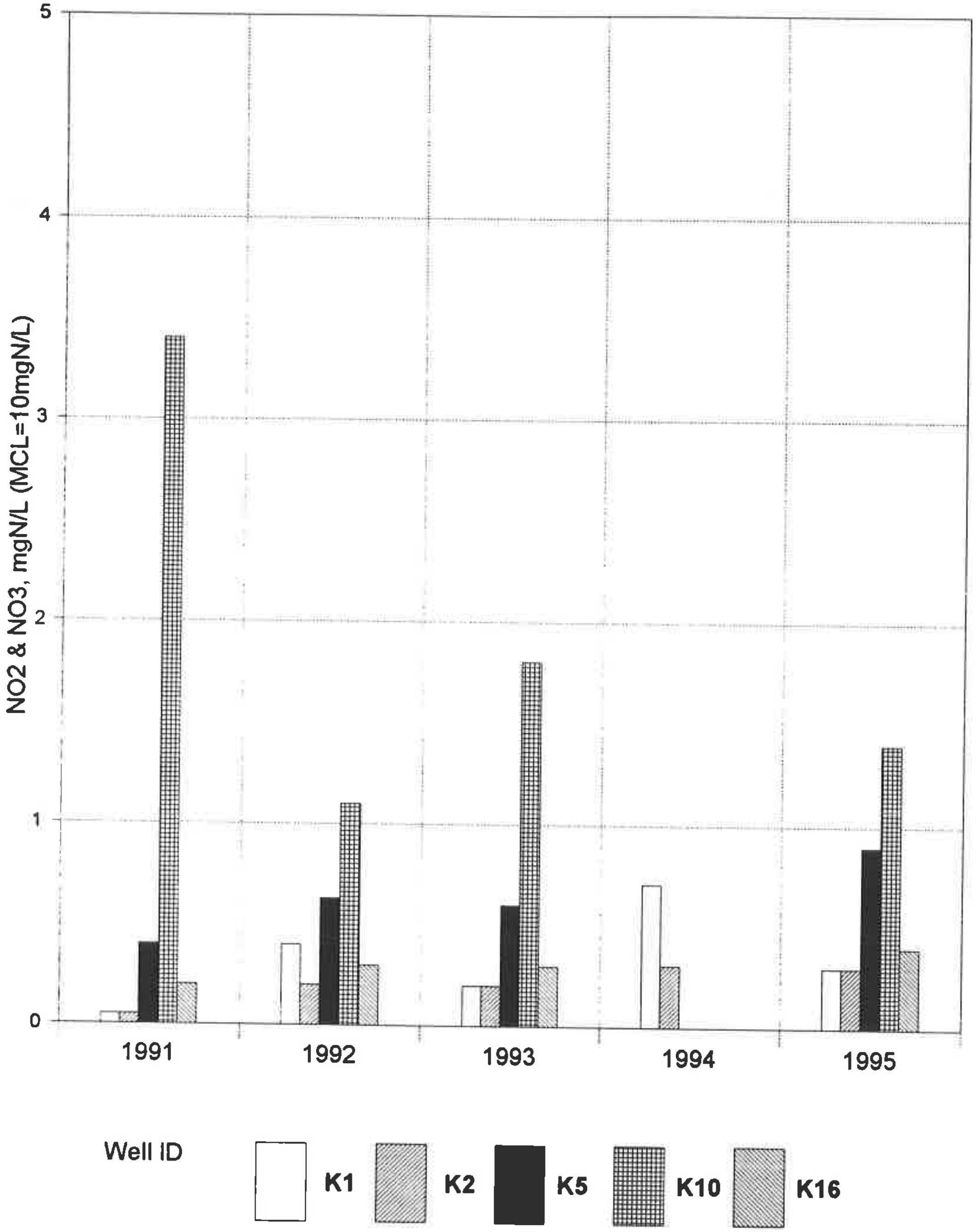
Aluminum concentrations exceeded the secondary MCL of 200 ppb in samples from three wells: GWN-K1 in Wilkinson County (1800 ppb), GWN-K9 in Macon County (470 ppb), and GWN-K12 in Houston County (350 ppb and 400 ppb). Most samples contained low or undetectable levels of major alkali and alkaline earth metals (potassium, sodium, calcium, and magnesium). The exceptions consisted of samples from wells GWN-K3 and GWN-K8 (elevated calcium) and from well GWN-K13 (elevated sodium). Water samples from various wells also had detectable levels of the following trace elements: copper, barium, strontium, zinc, beryllium, yttrium, and fluorine (fluoride).

Water samples from six wells contained detectable levels of nitrite/nitrate, with the highest concentration, 1.4 ppm as nitrogen, occurring in a sample from well GWN-K10. Figure 3-4 shows trends in levels of nitrite/nitrate (reported as parts per million [ppm] nitrogen) for selected wells. All of the samples contained detectable chloride; the majority of the samples also had measurable sulfate. A sample from well GWN-K5 contained 22.7 ppb of dimethyl phthalate. This compound has not occurred in any previous sample going back to 1984. Table A-3 in the Appendix lists the analytical results for samples collected from the Cretaceous aquifer system.



Iron levels below the detection limit are assigned a value of 5.1 ppb. A missing bar indicates that data are not available for that year.

Figure 3-3. - Iron Concentrations for Selected Wells in the Cretaceous Aquifer System.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-4. - Nitrate/Nitrite Concentrations for Selected Wells in the Cretaceous Aquifer System

3.3 PROVIDENCE AQUIFER SYSTEM

Sand and coquinoid limestones 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 (Figure 3-5). At 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. The aquifer system also generally thickens downdip, with an area where the thickness exceeds 300 feet existing in Pulaski County and an area of similar thickness indicated in the Baker/Calhoun/Early county region (Clarke, et al., 1983). Figure 3-5 also shows the down-dip limit of the area in which the aquifer system is utilized.

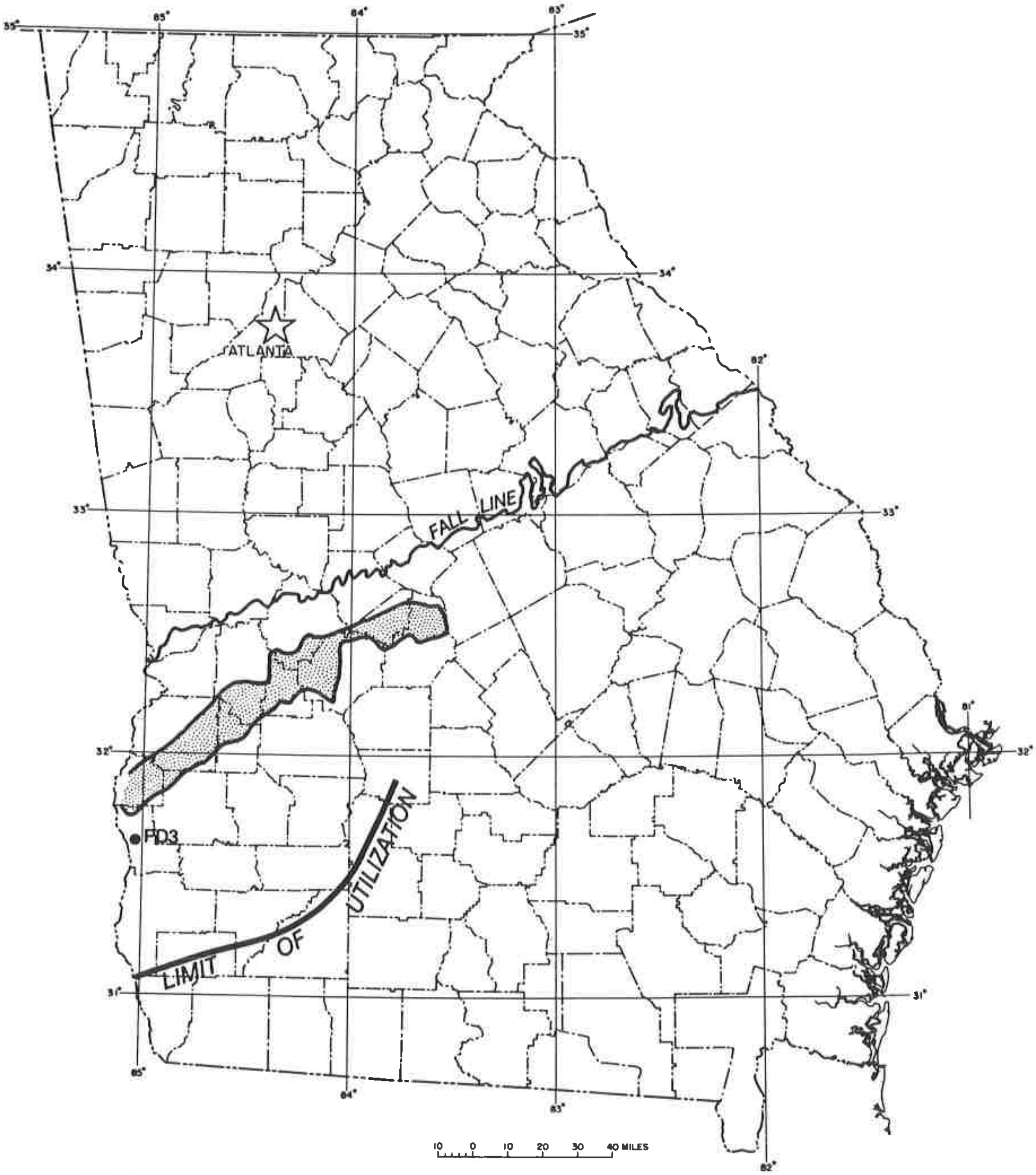
The permeable Providence Formation-Clayton Formation interval forms a single aquifer in the up-dip areas (Long, 1989) and to the east of the Flint River (Clarke, et al., 1983). This same interval is recognized as the Dublin aquifer system to the east of the Ocmulgee River (Clarke, et al., 1985). Outcrop 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.

EPD sampled one well in the Providence aquifer sytem during 1995 (Figure 3-5). The sample water was soft and basic, with an elevated sodium content. Table A-4 in the Appendix gives the analytical results.

3.4 CLAYTON AQUIFER SYSTEM

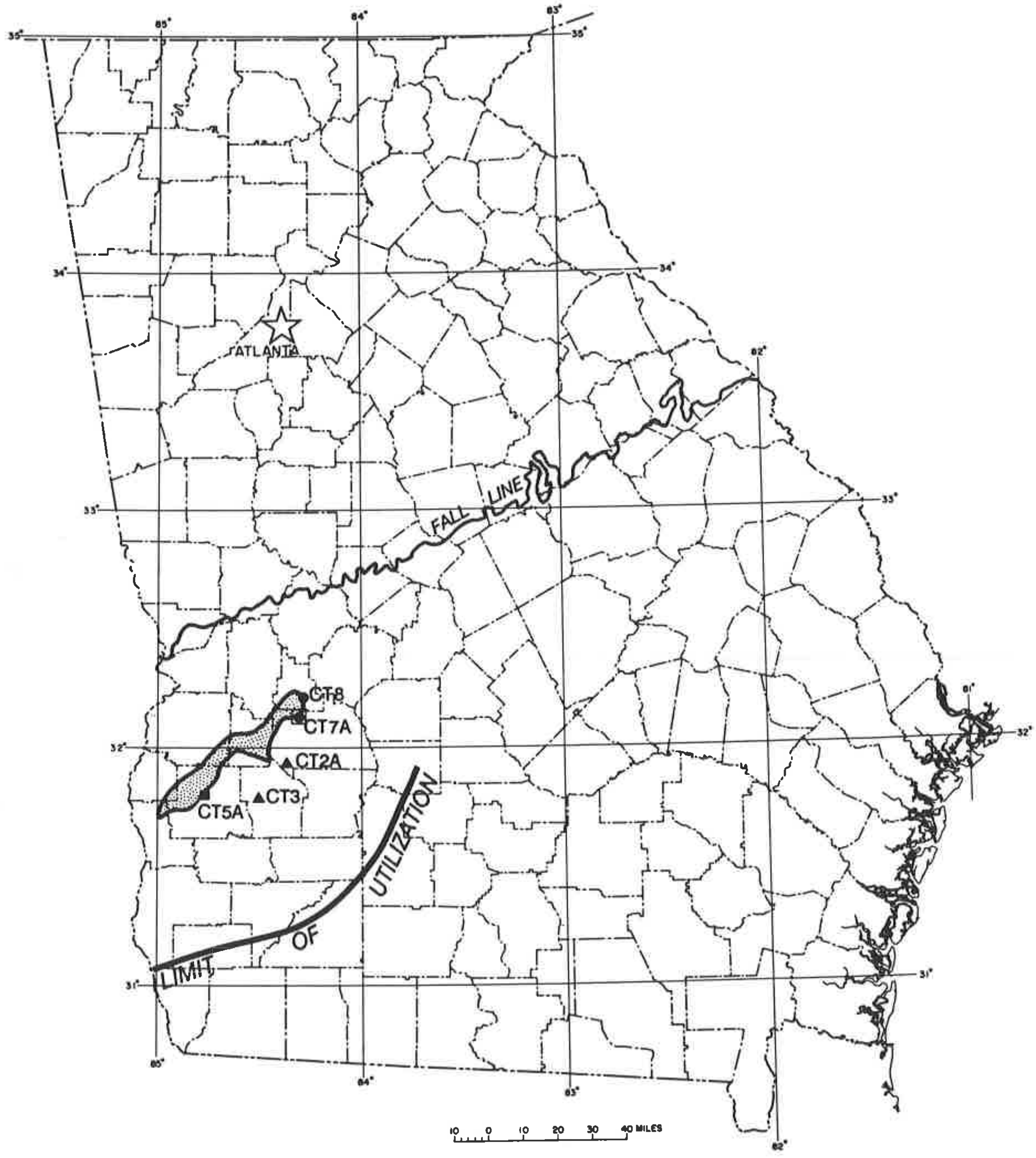
The Clayton aquifer system of southwestern Georgia is developed mainly in the middle limestone unit of the Paleocene Clayton Formation. Limestones and calcareous sands of the Clayton aquifer system crop out in a narrow belt extending from northeastern Clay County to southwestern Schley County (Figure 3-6). Aquifer thickness varies, 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 from permeable units in the overlying Wilcox confining zone provides significant recharge 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) as well as east of the Flint River (Clarke, et al., 1983). 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). Figure 3-6 also shows the down-dip limit of the area in which the aquifer system is utilized.

During 1995, EPD used five wells to monitor the water quality in the Clayton aquifer system (Figure 3-6). Three wells (GWN-CT5A, GWN-CT7A, GWN-CT8) are located in or near the recharge area, with the latter two wells being less than 100 feet deep. The other two



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

Figure 3-5. - Water Quality of a Well in the Providence Aquifer System.



General recharge area (after Davis, et al., 1988)
● Soft water
▲ Moderately hard water
■ Hard water
□ Iron exceeds MCL

Figure 3-6. - Water Quality for Selected Wells in the Clayton Aquifer System.

wells (GWN-CT2A and GWN-CT3) were used to sample downdip portions of the aquifer system.

The hardness class of the samples ranged from soft to hard, and, the pH ranged from acidic to slightly basic. Samples from all wells contained sodium and chloride. Calcium and sulfate concentrations were lowest in the samples from the two shallow updip wells (GWN-CT7A and GWN-CT8). These same two wells contained detectable nitrate/nitrite, at 7.4 and 0.8 mgN/L. Iron concentrations exceeded the secondary MCL of 300 ppb in samples from two wells, GWN-CT2A and GWN-CT7A. The sample from the latter well also contained excessive aluminum (secondary MCL is 200 ppb). The other elements detected in samples from various wells consisted of barium, magnesium, manganese, strontium, and zinc. No samples contained synthetic organic compounds. Figures 3-7 and 3-8, respectively, show trends in iron and nitrate/nitrite concentrations for selected wells in the Clayton aquifer system. Table A-5 in the Appendix lists analyses for water samples from these Clayton wells.

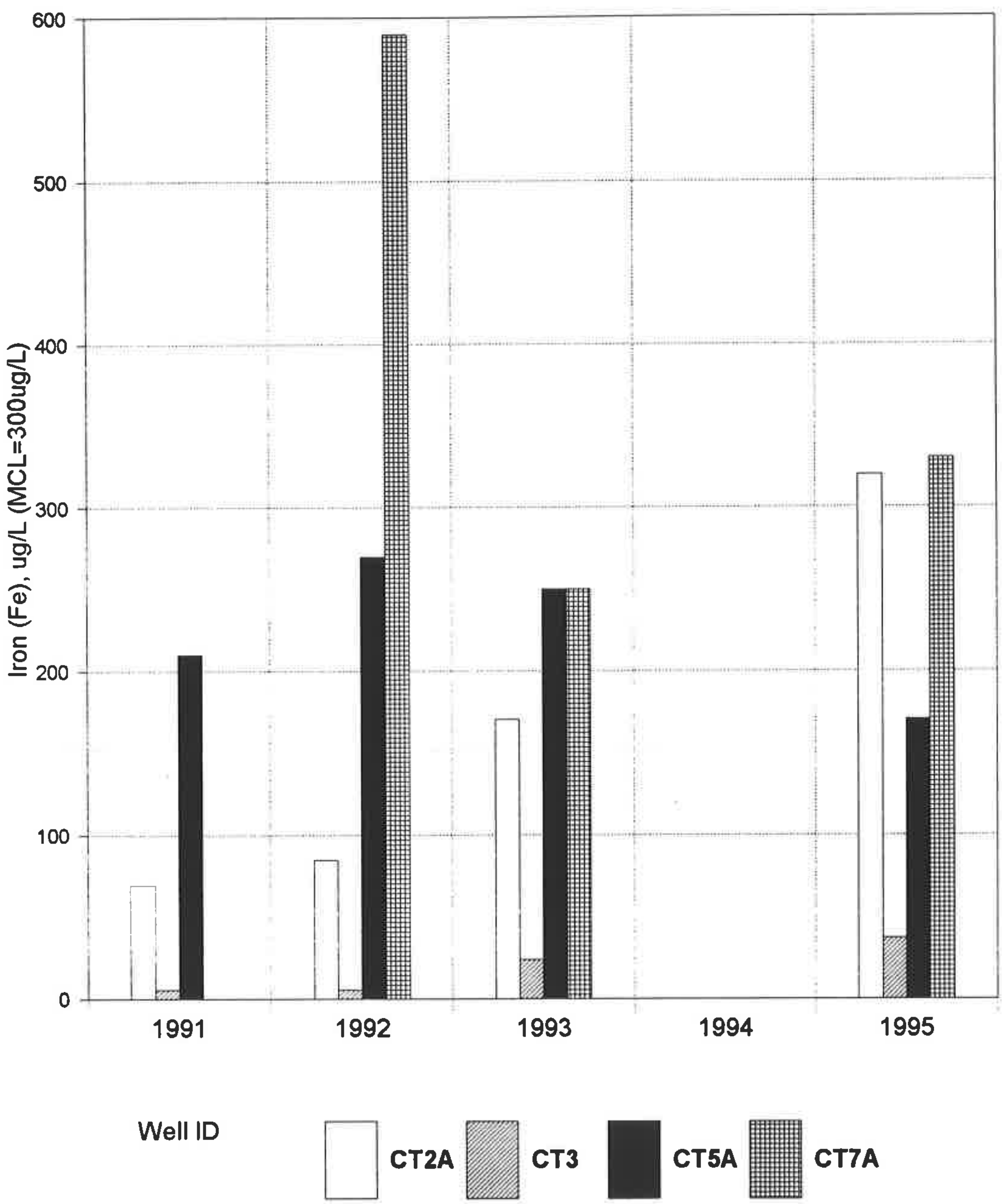
3.5 CLAIBORNE AQUIFER SYSTEM

Sands of the Middle Eocene Claiborne Group are the primary units of the Claiborne aquifer system of southwestern Georgia (Figure 3-9). Claiborne Group sands crop out in a belt extending from northern Early County through western Dooly County. Recharge to the aquifer system occurs both as direct infiltration of precipitation in the recharge area and as leakage from the overlying Floridan aquifer system (Hicks, et al., 1981; Gorday, et al., 1997). Discharge boundaries of the aquifer system are the Ocmulgee River, to the east, and the Chattahoochee River, to the west. Figure 3-9 shows the down-dip limit of utilization.

The aquifer generally thickens from the outcrop area towards the southeast, attaining a maximum 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 generally lies within 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).

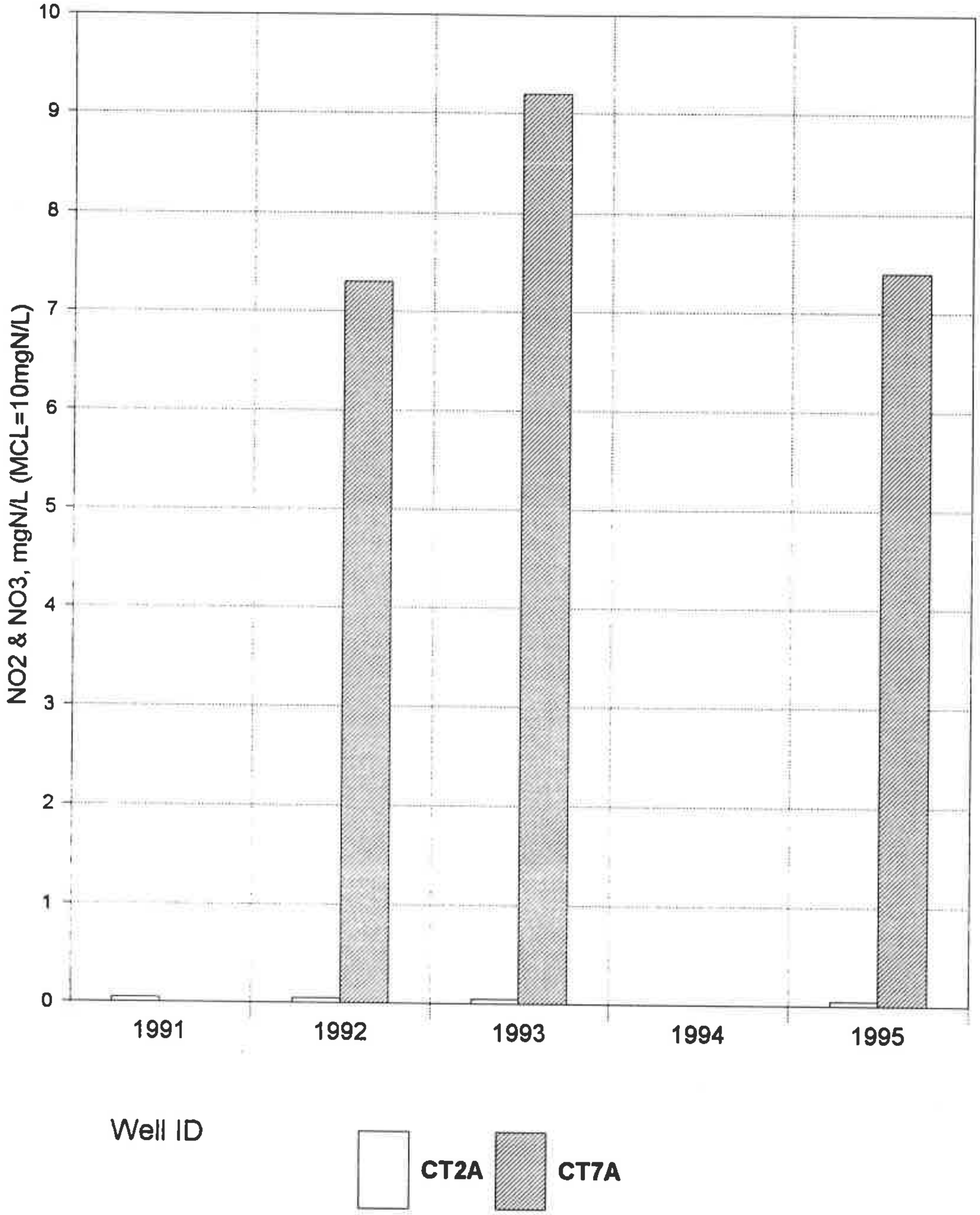
During 1995, EPD personnel used five wells to monitor the water quality of the Claiborne aquifer system. Wells GWN-CL4 and GWN-CL8 are relatively shallow (about 90 feet deep) and are located in the recharge area. Well GWN-CL2 is located near the recharge area and is deeper (315 feet). Wells GWN-CL6 and GWN-CL9 are deep and draw from down-dip portions of the aquifer, near the limit of utilization. The two recharge area wells yielded soft, acidic water, while the other wells yielded moderately hard, basic water.

Manganese levels in samples from wells GWN-CL4 and GWN-CL8 and iron in the sample from well GWN-CL8 exceeded the secondary MCL's for these elements (50 ppb for



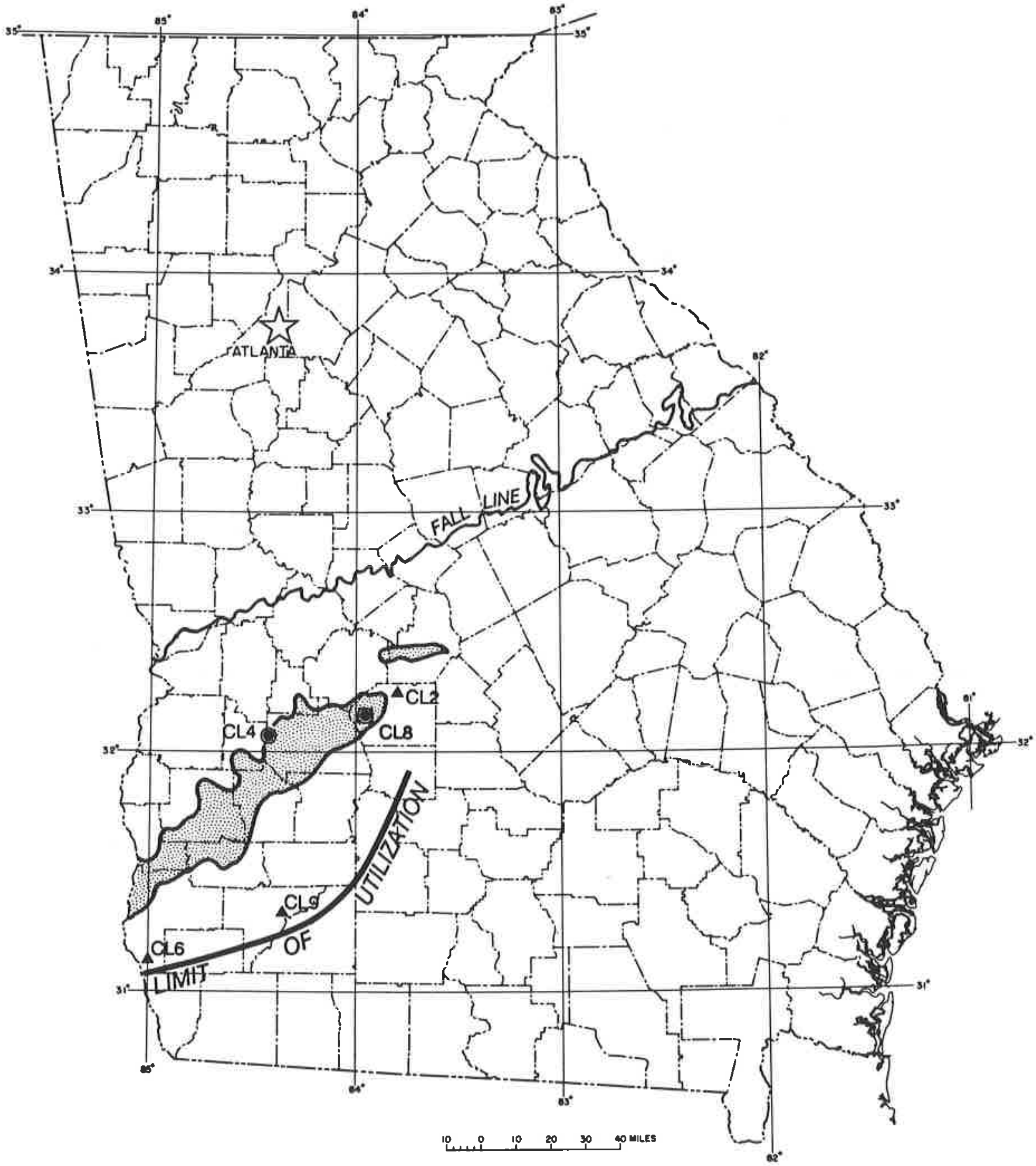
Iron levels below the detection limit are assigned a value of 5.1 ppb. A missing bar indicates data are not available for that year.

Figure 3-7. - Iron Concentrations for Selected Wells in the Clayton Aquifer System.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-8. - Nitrate/Nitrite Concentrations for Selected Wells in the Clayton Aquifer System.



General recharge area (from Davis, et al., 1988)
● Soft water
▲ **Moderately hard water**
○ Manganese exceeds MCL □ Iron exceeds MCL

Figure 3-9. - Water Quality of Selected Wells in the Claiborne Aquifer System.

Mn, 300 ppb for Fe). The sample from the near down-dip well GWN-CL2 had the highest calcium concentration. The far down-dip well GWN-CL9 yielded the sample with the highest sodium concentration. The calcium concentrations in the down-dip samples are consistent with ground waters derived from limestone. Other metals detected included barium, strontium, zinc, and copper. Figure 3-10 shows trends in iron concentrations for selected wells.

Samples from two wells (GWN-CL2 and GWN-CL4) contained detectable levels of nitrite/nitrate, with the sample from GWN-CL4 having the highest concentration (3.0 ppm as N). Figure 3-11 shows nitrite/nitrate concentrations for selected wells. Samples from all wells contained measurable chloride, with a maximum of 5.83 ppm in the sample from well GWN-CL4. Samples from all wells except GWN-CL4 contained detectable sulfate. Fluoride was present in samples from three wells. Well GWN-CL4 yielded samples containing two synthetic organic chemicals, benzene and methyl tert-butyl ether. A trace of chloroform was present in a sample from well GWN-CL9. Table A-6 in the Appendix gives the analytical results for the samples from Claiborne wells.

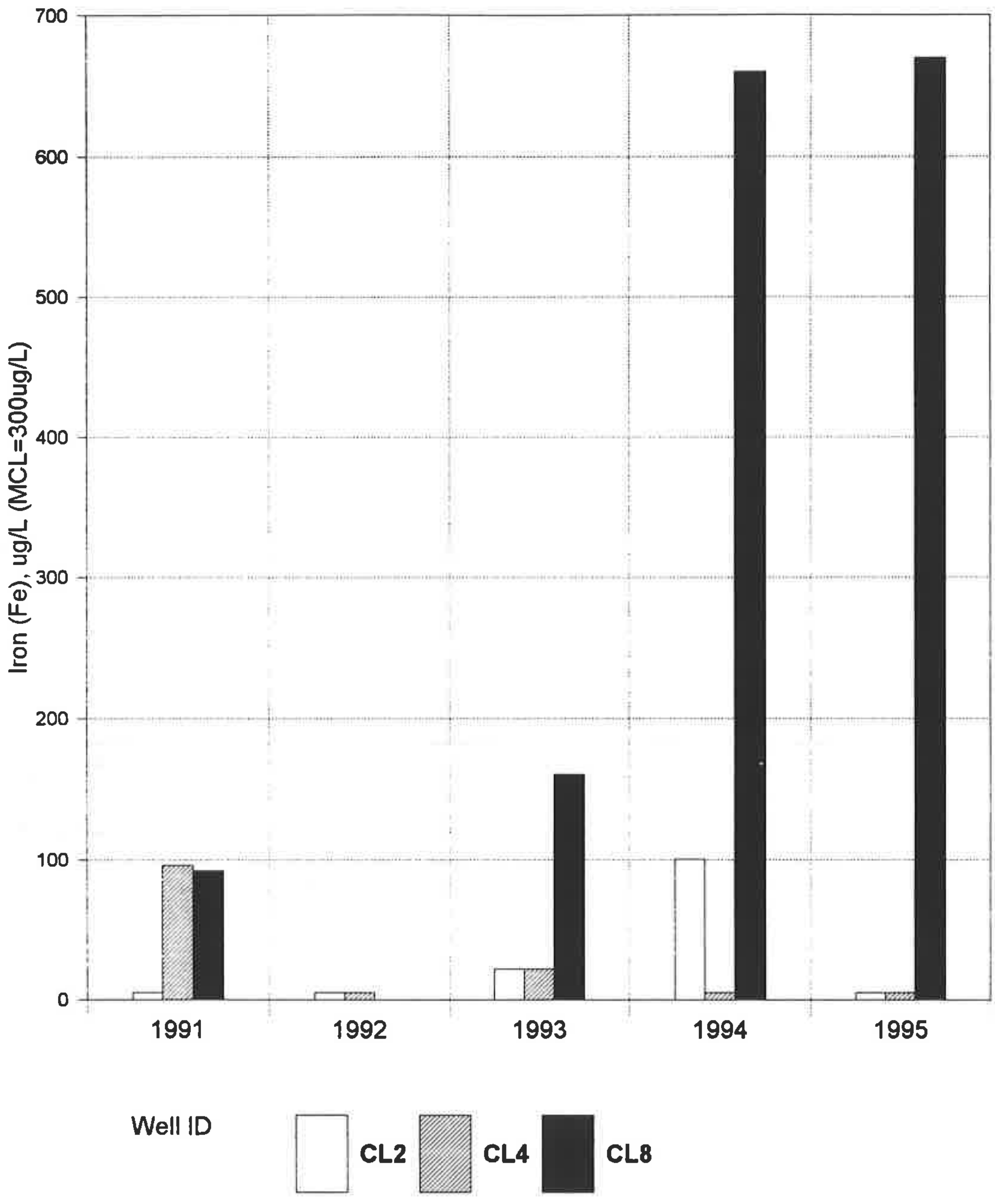
3.6 JACKSONIAN AQUIFER SYSTEM

The Jacksonian aquifer system of central and east-central Georgia comprises predominantly sands of the Eocene Barnwell Group, though, locally, isolated limestone bodies are important. Barnwell Group outcrops extend from Macon and Peach Counties eastward to Burke and Richmond Counties (Figure 3-12). Aquifer sands form a northern clastic facies of the Barnwell Group; the sands grade southward into less permeable silts and clays of a transition facies (Vincent, 1982). The water-bearing sands are relatively thin, 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.

EPD monitored the water quality of eight wells tapping the Jacksonian aquifer system in 1995. Six wells are in the clastic facies (one, GWN-J2A, drawing from an isolated limestone body), and, two wells are in the transition facies. The pH of the water samples ranged from 4.80 to 7.82. Water hardness ranged from soft (up-dip wells GWN-J7 and GWN-J8) to hard.

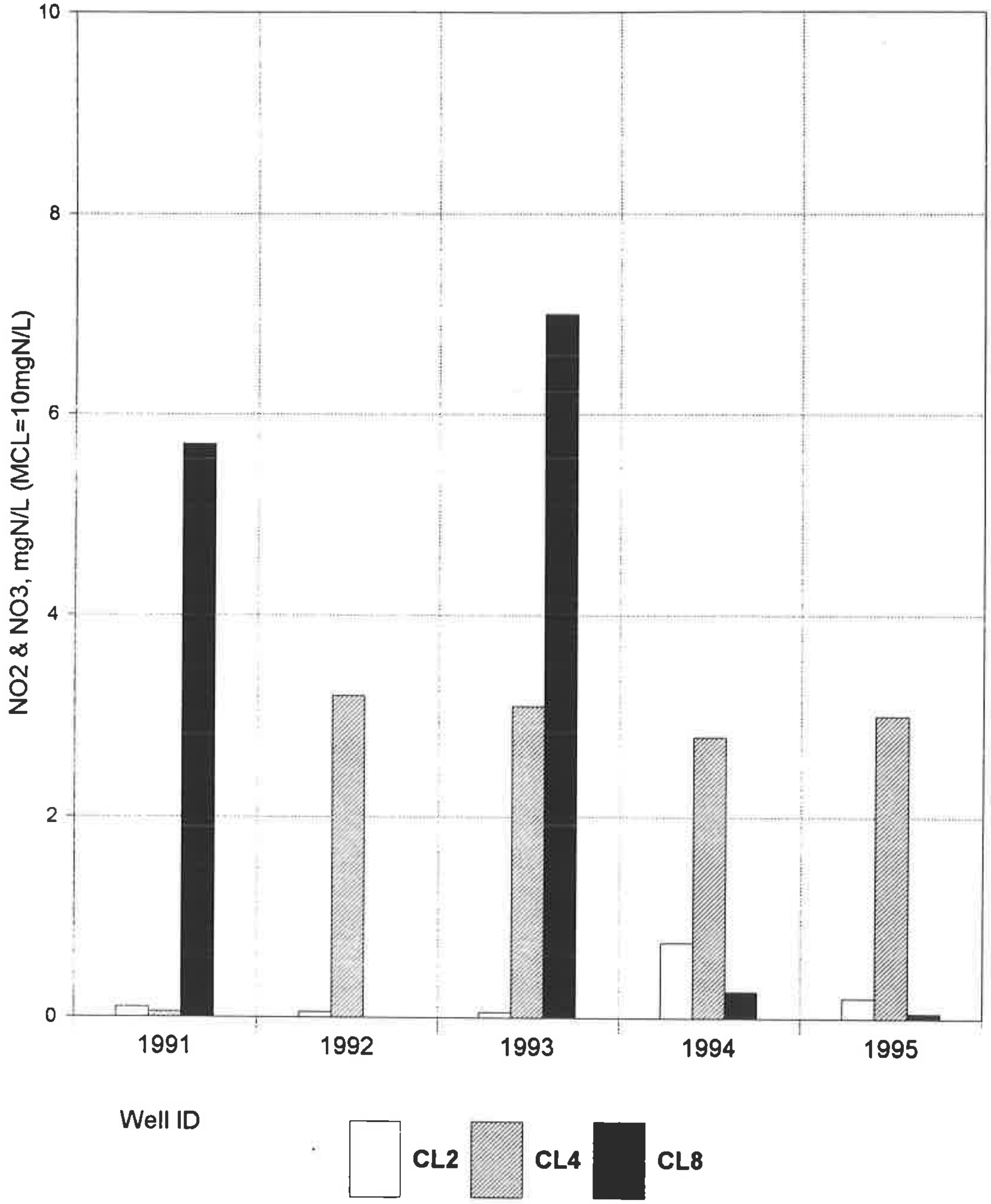
Concentrations of iron and aluminum fell below the secondary MCL's for drinking water in samples from all wells. Manganese exceeded the secondary MCL in wells GWN-J3 and GWN-J8 (130 ppb and 78 ppb, respectively). Beryllium exceeded the primary MCL in a sample from a domestic well, GWN-J8.

The samples tested generally low in sodium, with the highest concentration occurring in a sample from the transition well GWN-J3. Calcium concentrations ranged from 27 ppm



Iron levels below the detection limit are assigned a value of 5.1 ppb. A missing bar indicates data are not available for that year.

Figure 3-10. - Iron Concentrations for Selected Wells in the Claiborne Aquifer System.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-11. - Nitrate/Nitrite Concentrations for Selected Wells in the Claiborne Aquifer System.

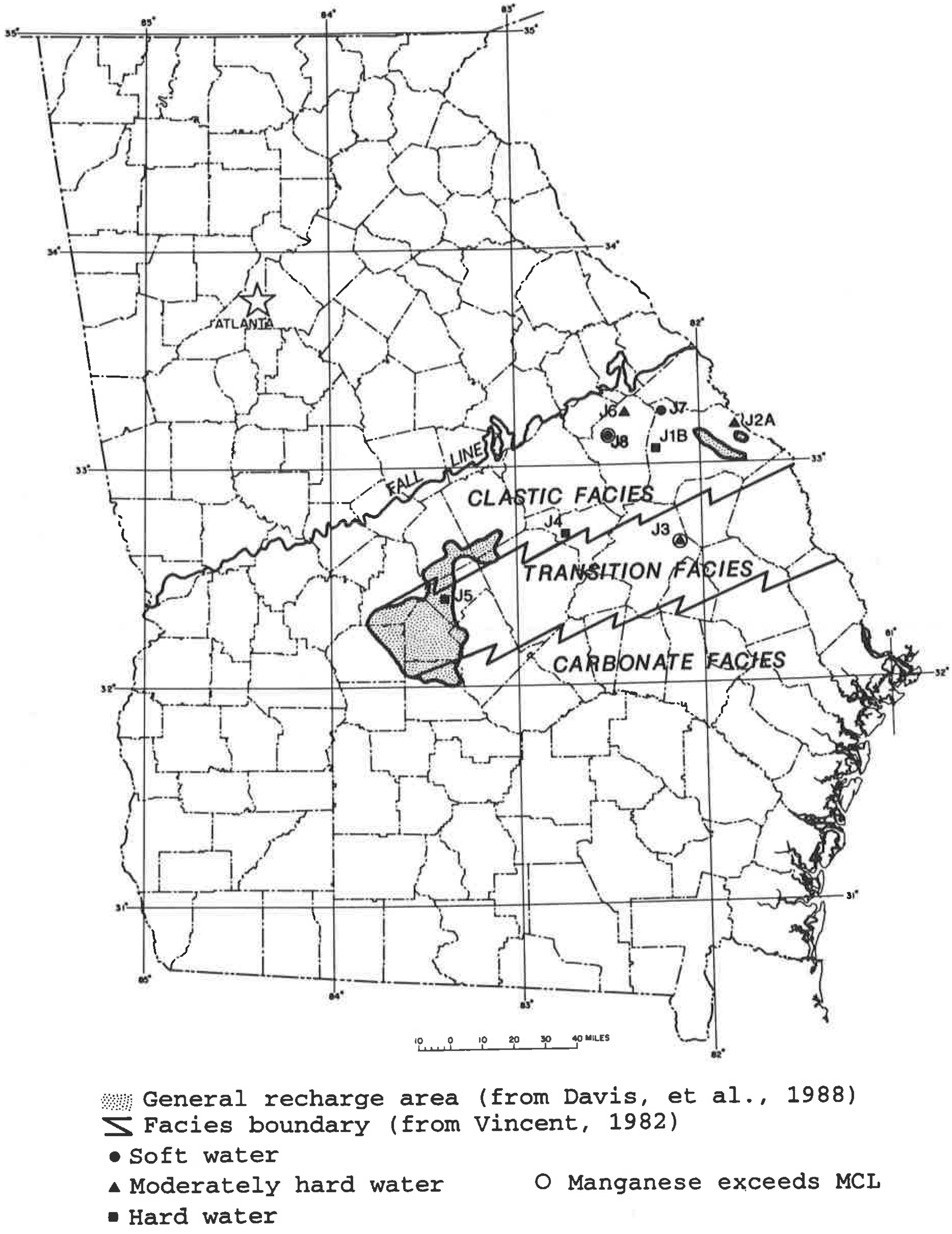


Figure 3-12. - Water Quality of Selected Wells in the Jacksonian Aquifer System.

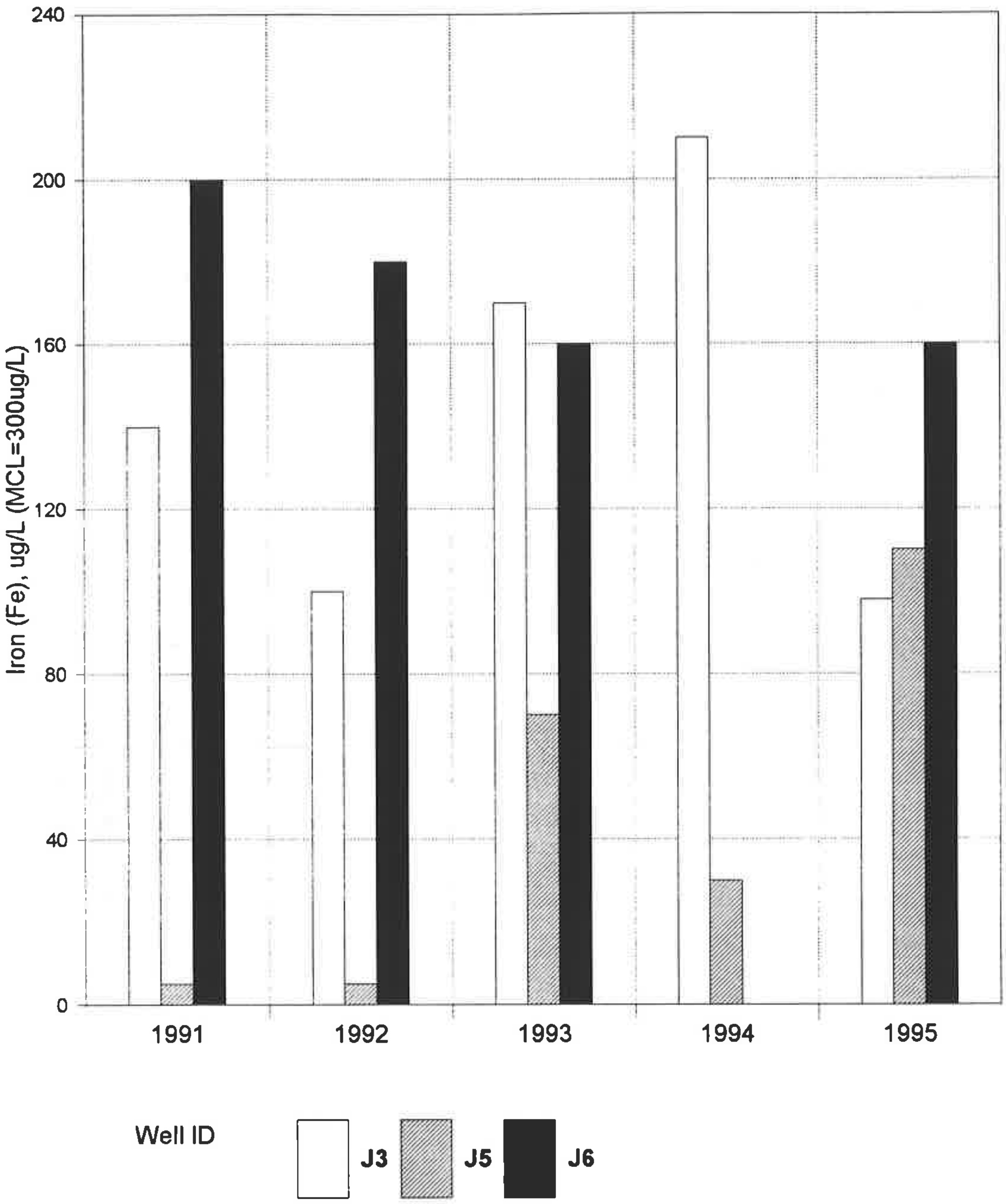
to 68 ppm in samples from five of the wells but fell below 10 ppm in samples from the up-dip wells GWN-J7 and GWN-J8. Samples from five of the wells contained magnesium, with the highest level of 5.7 ppm occurring in the sample from transition well GWN-J3. Other detected metals included barium, strontium, zinc, and cadmium. Higher nitrite/nitrate concentrations occurred in samples from the up-dip wells. Although no data exist for chloride, fluoride, and sulfate concentrations in two samples, these substances were below their respective MCL's in the remaining samples. None of the samples contained any quantifiable synthetic organic chemicals. Figures 3-13 and 3-14 depict trends in iron and nitrite/nitrate concentrations for selected wells. Table A-7 in the Appendix lists the analytical results for all the wells sampled.

3.7 FLORIDAN AQUIFER SYSTEM

The Floridan aquifer system consists predominantly of Eocene and Oligocene limestones and dolostones that underlie most of the Coastal Plain Province. The aquifer is a major source of ground water for much of its outcrop area and throughout its down-dip extent to the south and east.

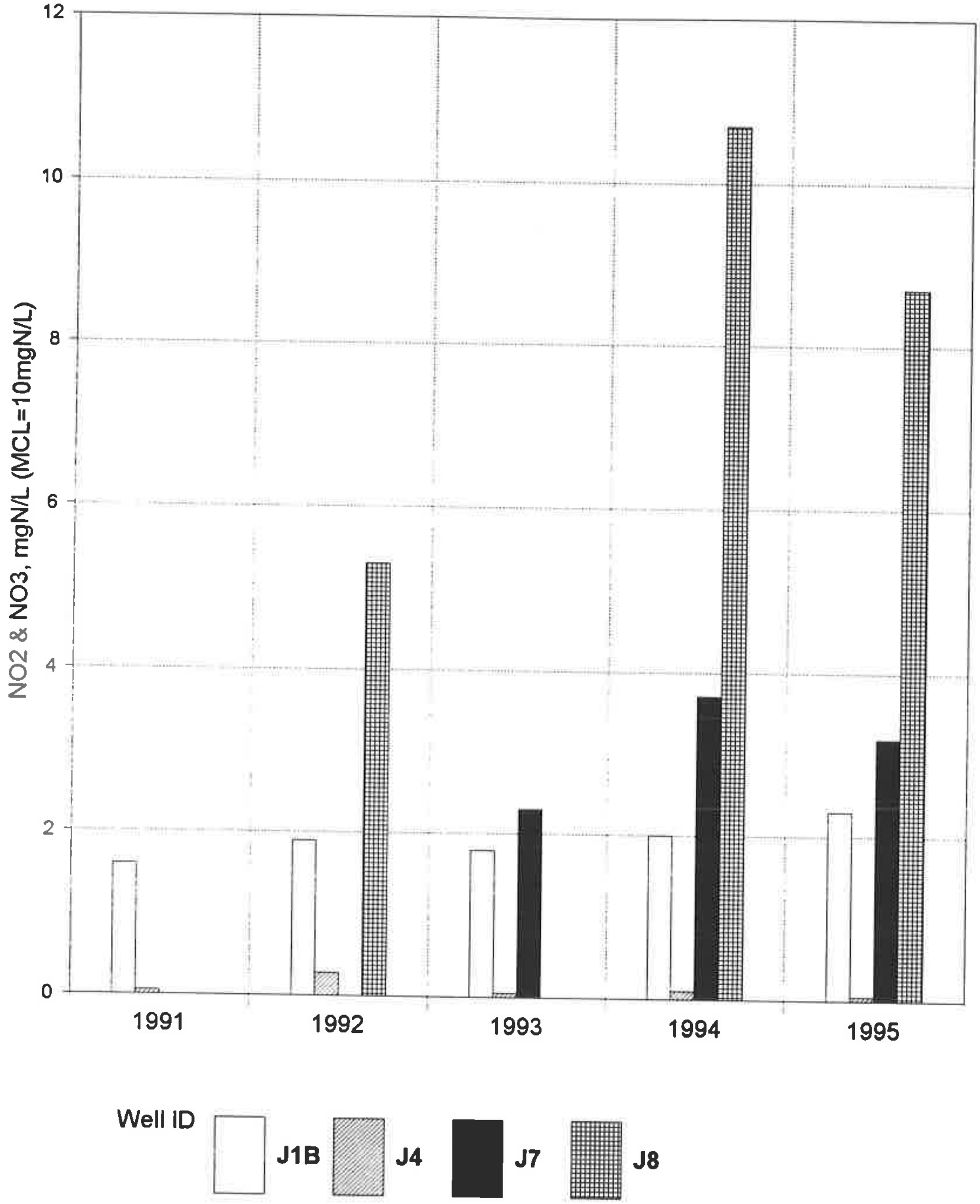
The upper water-bearing units of the Floridan are the Eocene Ocala Group and the Oligocene Suwanee Limestone (Crews and Huddlestun, 1984). These limestones crop out in the Dougherty Plain (a karstic area in southwestern Georgia) and in adjacent areas along a strike to the northeast. In Camden and Wayne 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 consists mainly of dolomitic limestone of middle and early Eocene age and pelletal, vuggy, dolomitic limestone of Paleocene age but extends into the late Cretaceous in Glynn County. The lower Floridan 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 Coastal Plain that extends from southwestern Decatur County through central Bulloch County.

A ground-water divide separates a smaller southwestwardly flow regime in the Floridan aquifer system in the Dougherty Plain from the larger southeastwardly flow regime in the remainder of Georgia. Rainfall infiltration in outcrop areas and downward leakage from extensive surficial residuum 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 area of Brooks, Echols and Lowndes counties, where the Withlacoochee River and numerous sinkholes breach upper confining beds (Krause, 1979).



Iron levels below the detection limit are assigned a value of 5.1 ppb. A missing bar indicates data are not available for that year.

Figure 3-13. - Iron Concentrations for Selected Wells in the Jacksonian Aquifer System.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-14. - Nitrate/Nitrite Concentrations for Selected Wells in the Jacksonian Aquifer System.

In 1995, EPD collected 50 samples from 47 wells in the Floridan aquifer system (Figure 3-15). The pH levels in all samples were basic, and, water hardness ranged from moderately hard to very hard. Iron concentrations exceeded the secondary MCL only in samples from GWN-PA9C and GWN-PA15. Trends in iron levels from selected wells in the Floridan aquifer are shown on Figure 3-16. Aluminum concentrations fell below the secondary MCL in all samples. Most wells yielding water with detectable manganese fall within the Gulf Trough area (wells GWN-PA14, GWN-PA18, GWN-PA19, GWN-PA29, GWN-PA32, GWN-PA33, GWN-PA34, GWN-PA35, and GWN-PA36). The manganese concentration in samples from wells GWN-PA9C, GWN-PA18, and GWN-PA34 exceeded the secondary MCL of 50 ppb.

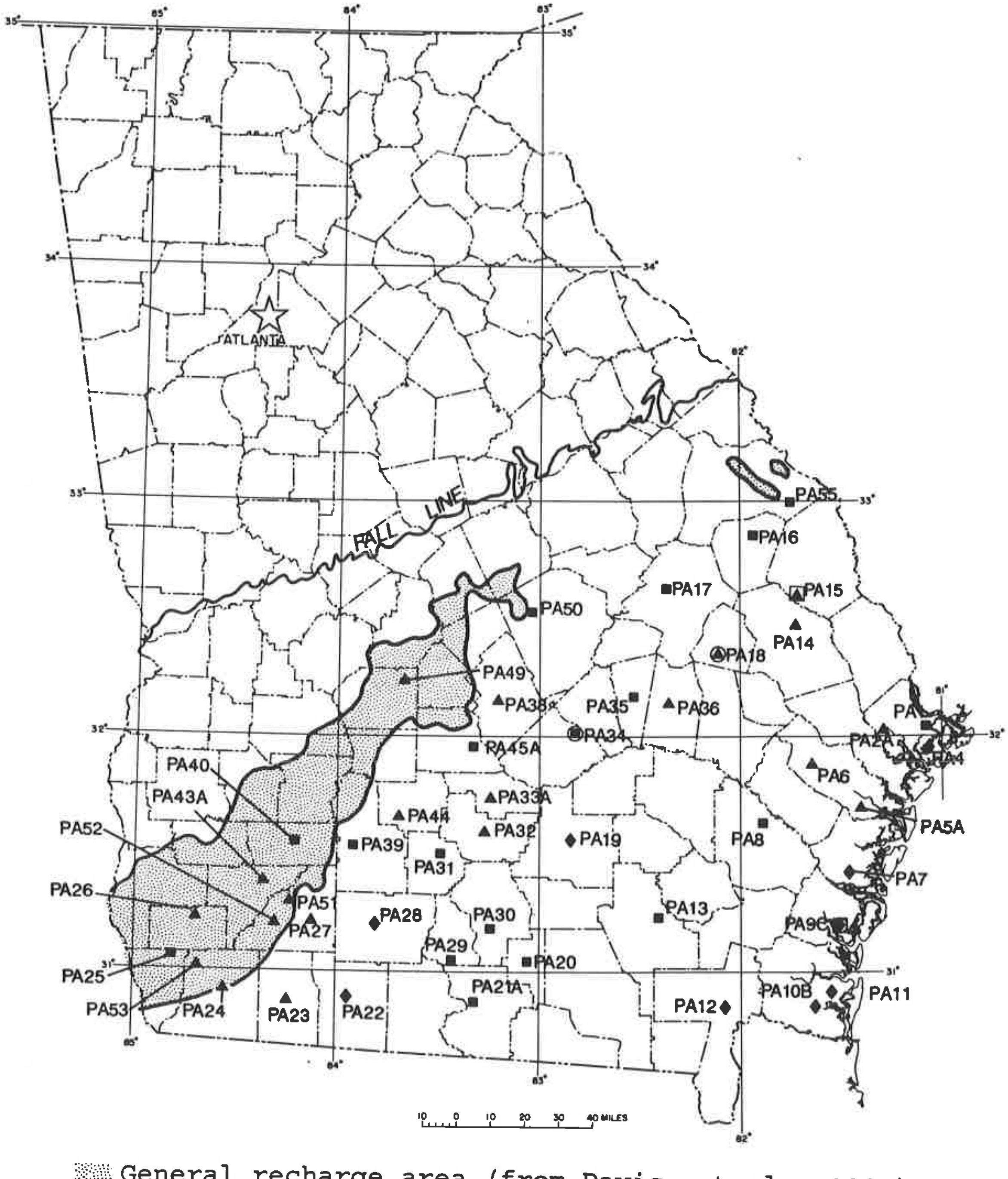
Sodium concentrations ranged from 1.9 to 725 parts per million (ppm), and, magnesium ranged from undetected to 84 ppm. Both elements are most abundant in samples from wells in the coastal area, with the highest concentrations of these elements occurring in a sample from well GWN-PA9C in Brunswick. Calcium ranged from 24 ppm in samples from wells GWN-PA2A and GWN-PA6 to 94 ppm in well GWN-PA9C. Other metals detected in measurable concentrations included potassium, barium, molybdenum, strontium, copper, and zinc. None of these substances exceeded applicable MCL's.

All water samples underwent tests for the anions: chloride, sulfate, fluoride, and nitrate/nitrite. Chloride levels ranged from 1.98 ppm to 1385 ppm. The 1385 ppm level occurred in well GWN-PA9C in the coastal area and was the only value to exceed the secondary MCL (250 ppm) for chloride. Sulfate ranged from undetected to 284 ppm. This high sulfate level occurred in the sample from well GWN-PA9C and exceeds the secondary MCL (250 ppm). The concentrations of fluoride ranged from undetected to 0.88 ppm. Detected synthetic organic compounds consisted of tetrahydrofuran, dimethyl phthalate, chloroform, and bromodichloromethane. None of the compounds exceeded any MCL's.

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 detectable concentrations of nitrite/nitrate. The highest level, 4.6 ppm as nitrogen, was in a sample collected from well GWN-PA53 in the Dougherty Plain. Trends in nitrate levels from selected wells in the Floridan Aquifer are presented in Figure 3-16. The Appendix (Table A-8) gives the analytical results for samples from 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).



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

▲ Moderately hard water

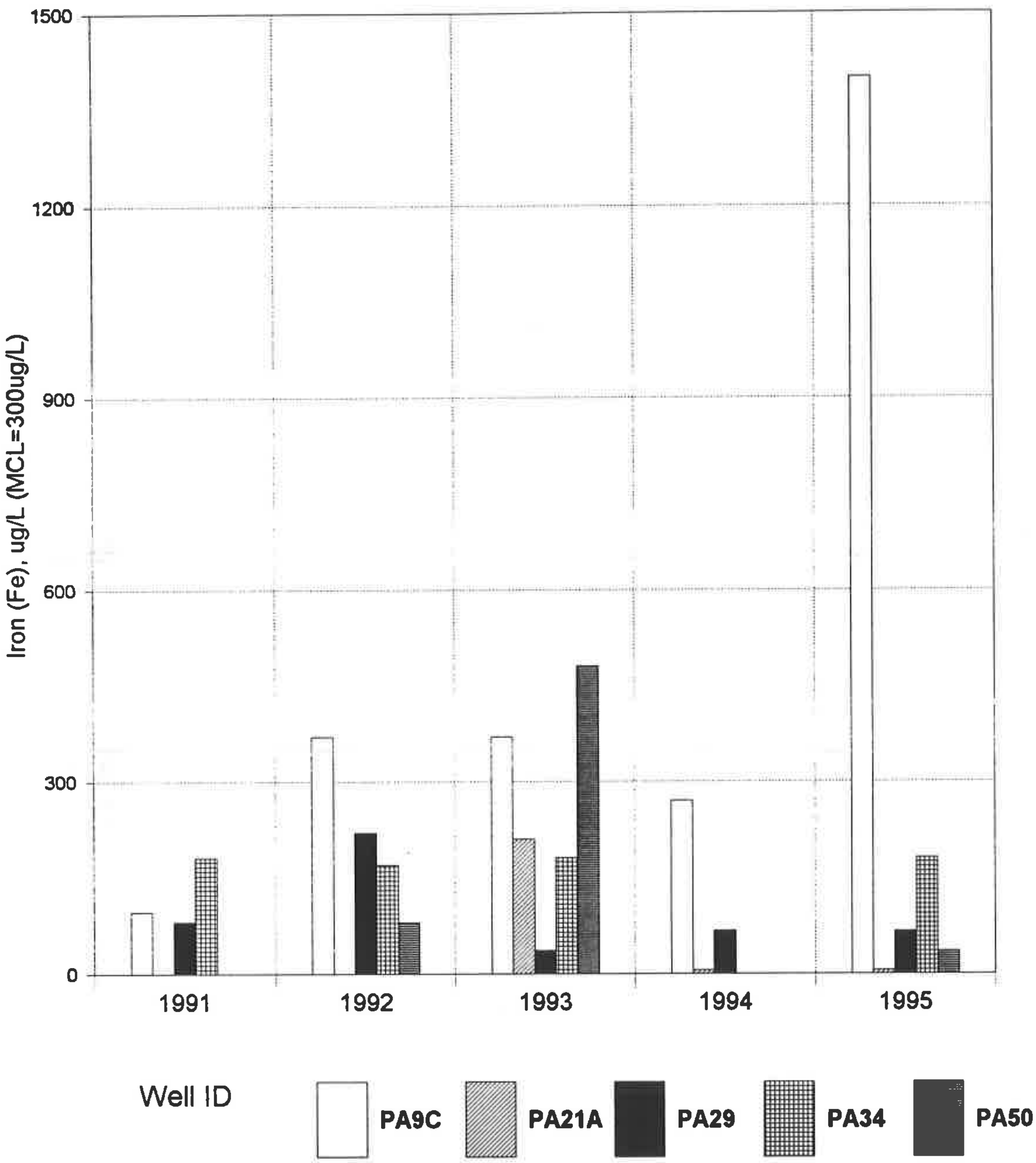
■ Hard water

◆ Very hard water

○ Manganese exceeds MCL

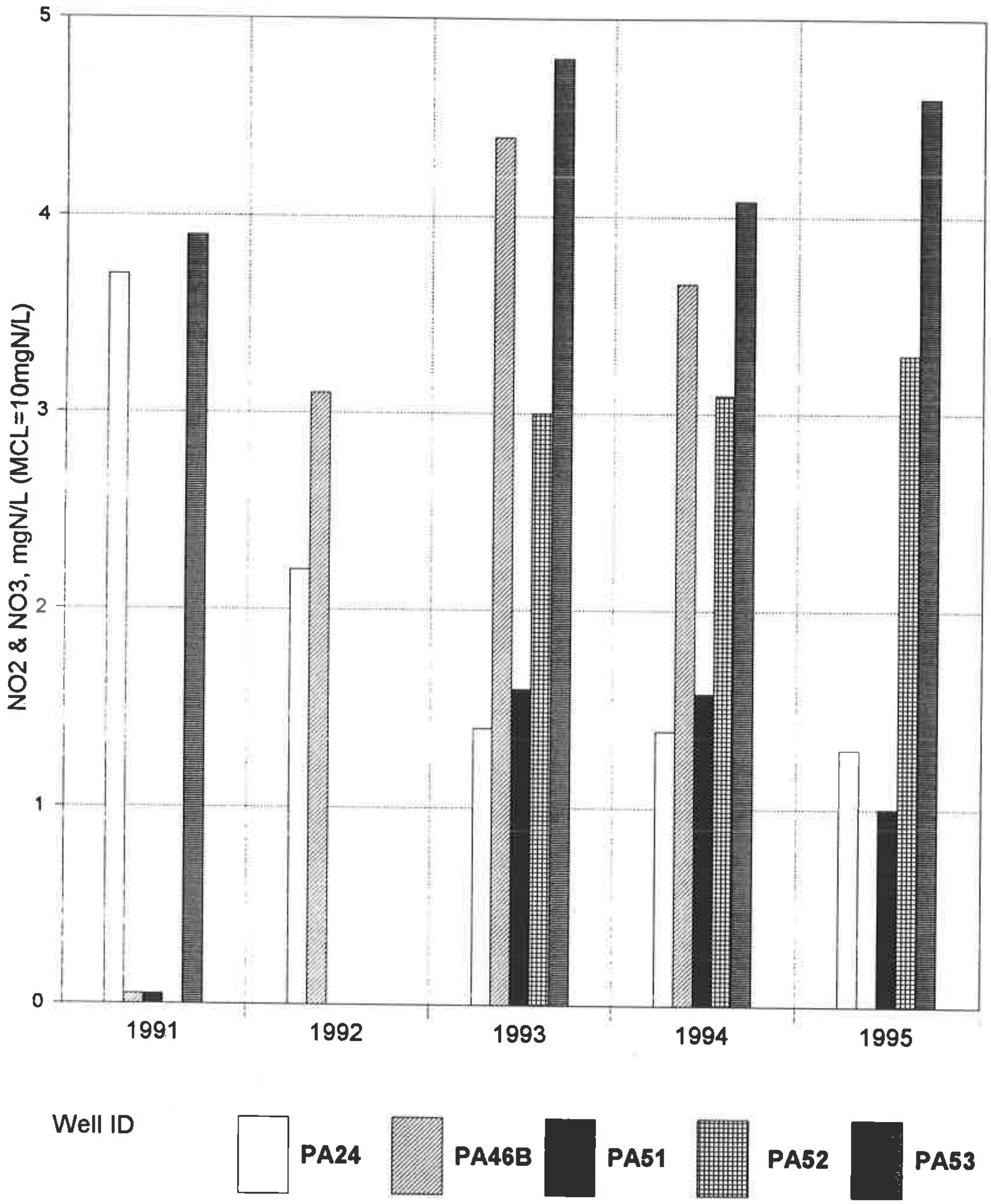
□ Iron exceeds MCL

Figure 3-15. - Water Quality of Selected Wells in the Floridan Aquifer System.



Iron levels below the detection limit are assigned a value of 5.1 ppb. A missing bar indicates data are not available for that year.

Figure 3-16. - Iron Concentrations for Selected Wells in the Floridan Aquifer System.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-17. - Nitrate/Nitrite Concentrations for Selected Wells in the Floridan Aquifer System.

Areas of confinement exist in 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). Here, two principal aquifer units are present (Joiner, et al., 1988). Clarke (et. al, 1990) use the names upper and lower Brunswick aquifers to refer to these two sandy aquifer units.

EPD collected water samples from eight wells to monitor the water quality in the Miocene aquifer system (Figure 3-18). The pH of the samples ranged from 4.26 to 8.03 and hardness from soft to moderately hard. Iron and manganese levels ranged from undetected to 320 and 150 ppb, respectively. The water sample from one well, GWN-MI10B contained iron in excess of the secondary MCL (300 ppb). Water samples from three wells, GWN-MI5, GWN-MI8A, and GWN-MI10B, exceeded the secondary MCL (50 ppb) for manganese. Figure 3-19 shows trends in iron concentrations in selected wells. Samples from three wells contained aluminum in excess of the secondary MCL, at levels of 220 ppb, 760 ppb, and 1400 ppb. Sodium ranged from 1.7 ppm to 8.4 ppm , and, calcium ranged from 3.1 ppm to 24 ppm. Other metals detected were magnesium, barium, strontium, zinc, bismuth, and titanium. None of these exceeded applicable MCL's.

Chloride concentrations ranged from 2.66 ppm to 17.2 ppm, and, sulfate levels ranged from undetected to 3.68 parts per million. The deeper domestic wells (GWN-MI1, GWN-MI2, and GWN-MI10B) yielded samples with the lowest chloride concentrations. Samples from three wells contained quantifiable concentrations of fluoride. Detectable levels of nitrite/nitrate, ranging from 0.1ppm to 14.1 ppm, occurred in samples from five wells (GWN-MI5, GWN-MI7, GWN-MI8A, GWN-MI9A, and GWN-MI15). Nitrate/nitrite concentrations in wells GWN-MI7, GWN-MI8A, and GWN-MI15 exceeded the primary MCL (10 ppm as N). Concentrations of nitrate/nitrite for selected wells are illustrated in Figure 3-20. Two wells yielded samples containing traces of the synthetic organic chemicals: chloroform in well GWN-MI8A and dimethyl phthalate in well GWN-MI2. Table A-9 in the Appendix gives analytical data for samples drawn from Miocene aquifer system wells.

3.9 PIEDMONT/BLUE RIDGE UNCONFINED AQUIFERS

Georgia's Piedmont and Blue Ridge Physiographic Provinces are developed on metamorphic and igneous rocks that are predominantly 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 water flow into wells completed in crystalline rocks. The permeability and thickness of soils and saprolite horizons determine the amount of well yield that can be sustained.

EPD used seventeen wells and three springs to monitor water quality in the Piedmont/Blue Ridge Province. Figure 3-21 shows the locations of the monitoring stations. Hardness ranged from soft to moderately hard. The pH of the water samples ranged from 4.95 to 7.55, with the majority of the stations yielding acidic water. Iron and manganese

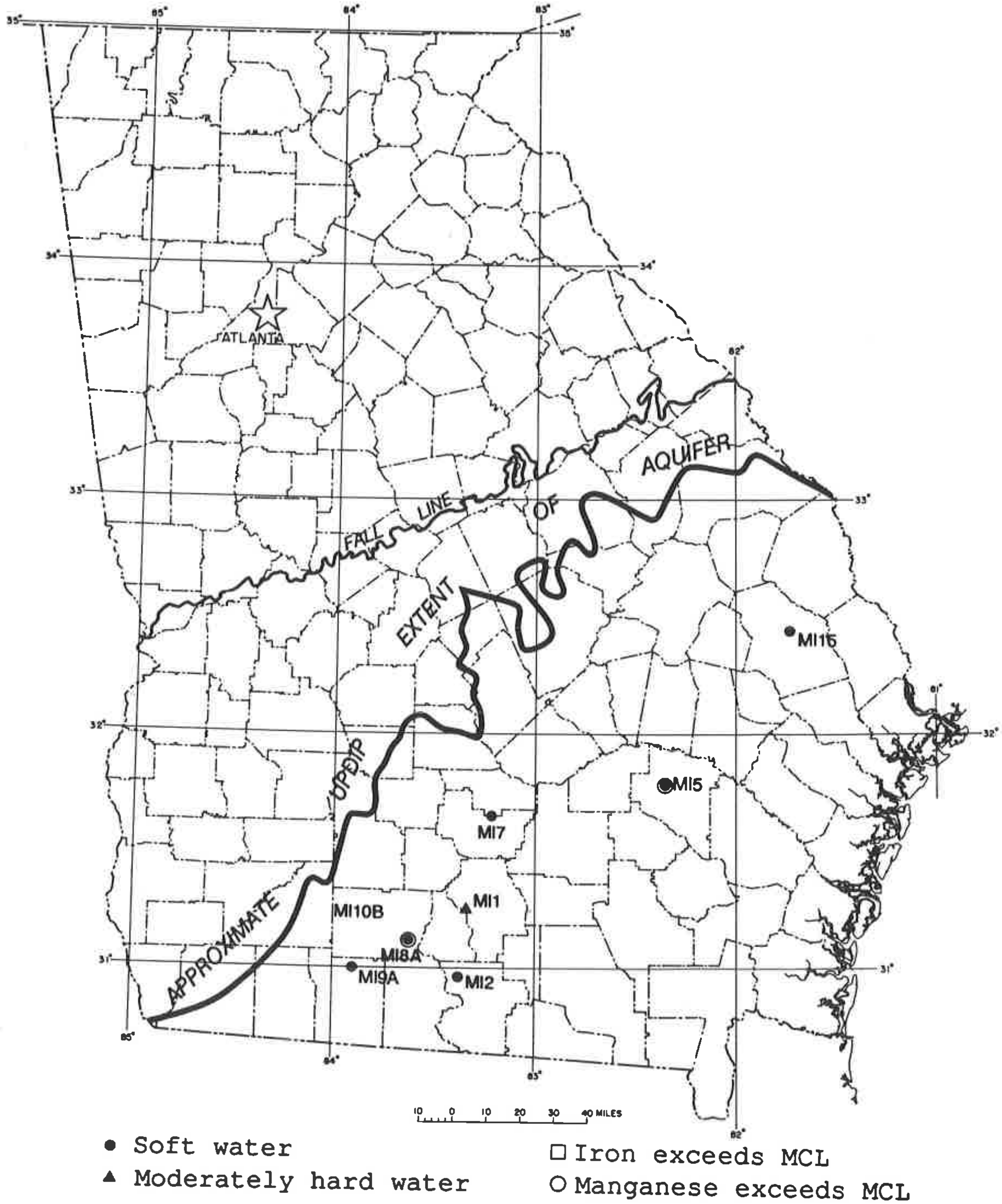
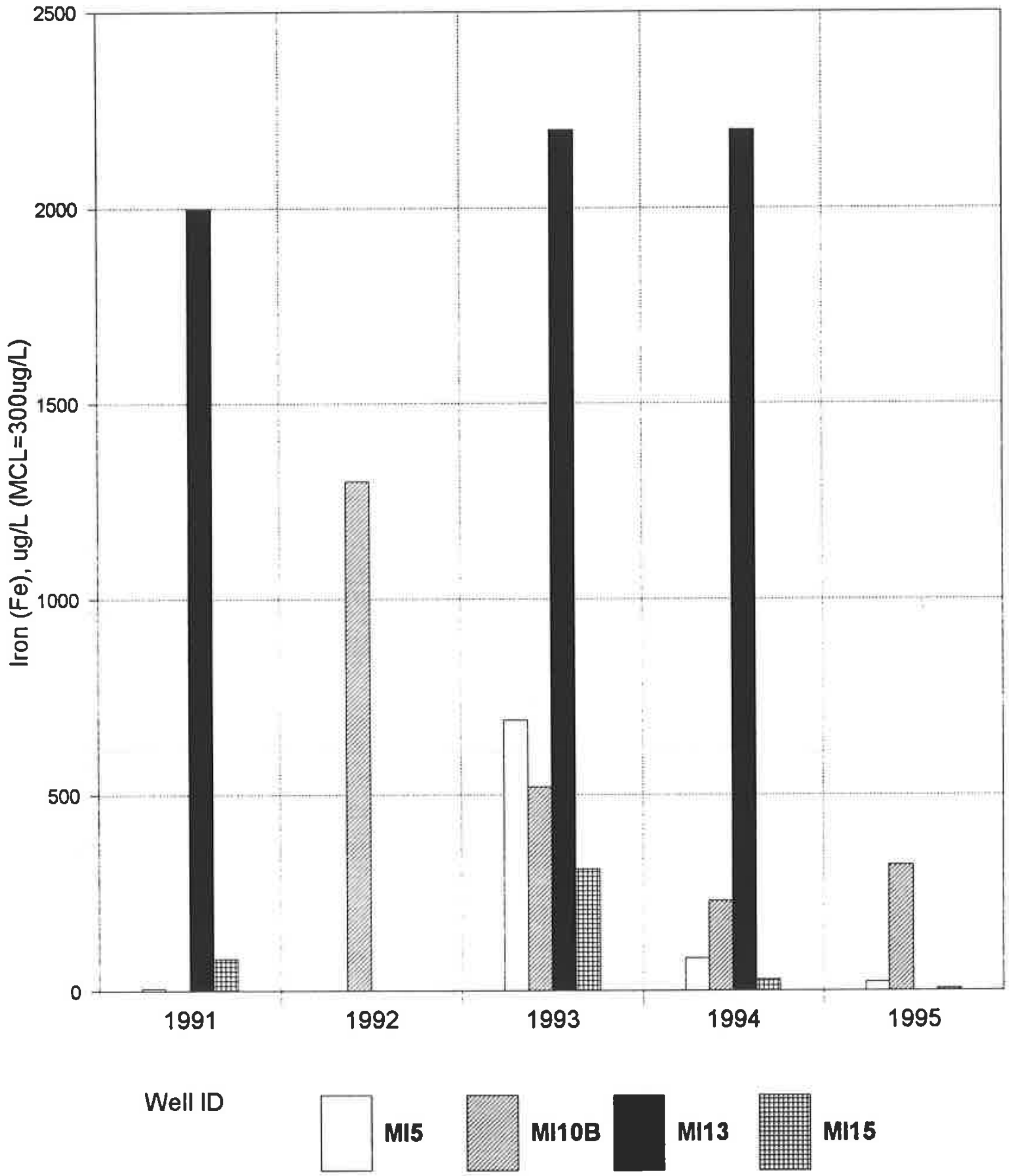
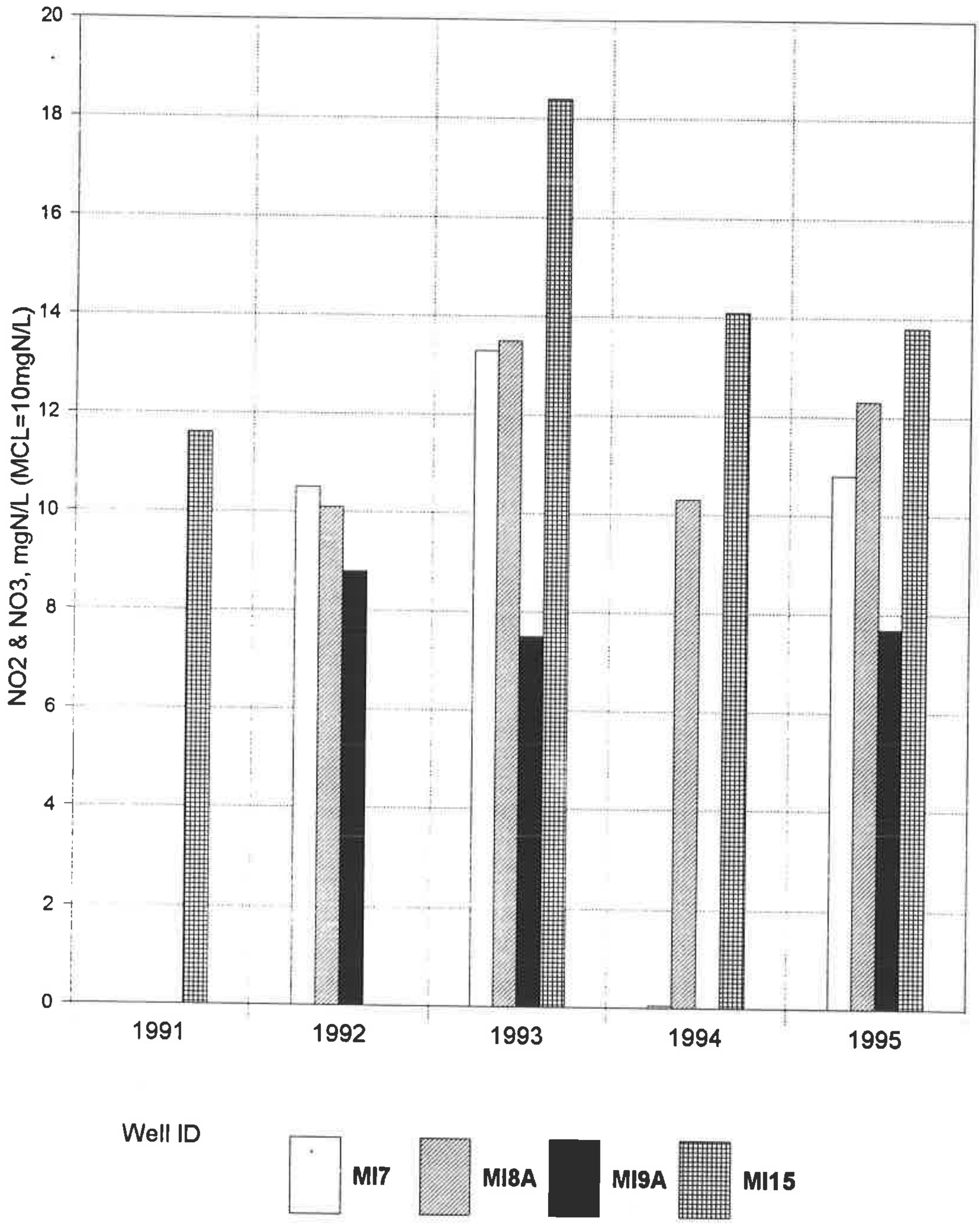


Figure 3-18. - Water Quality of Selected Wells in the Miocene Aquifer System.



Iron levels below the detection limit are assigned a value of 5.1 ppb. A missing bar indicates data are not available for that year.

Figure 3-19. - Iron Concentrations for Selected Wells in the Miocene Aquifer System.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-20. - Nitrate/Nitrite Concentrations for Selected Wells in the Miocene Aquifer System.

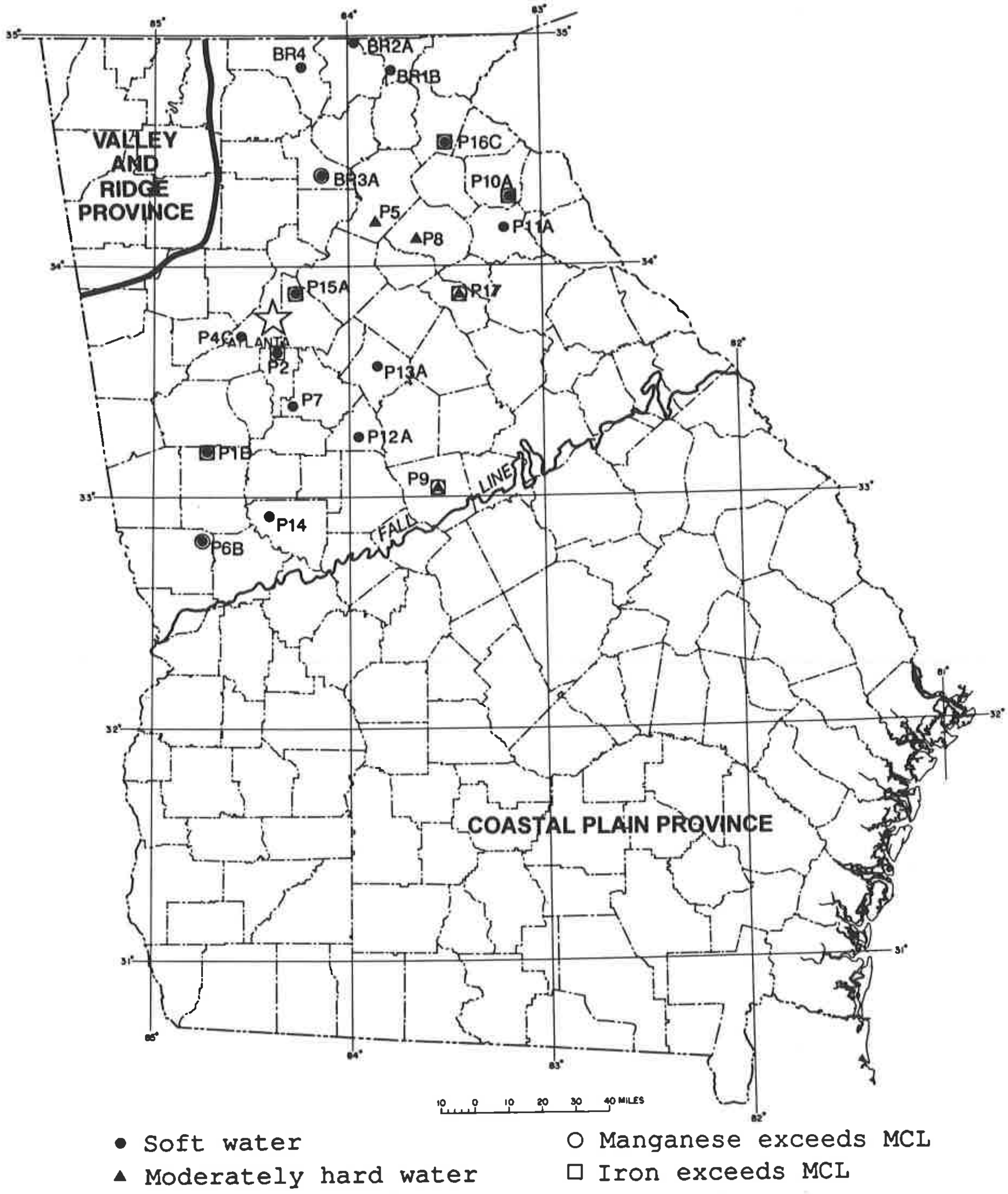


Figure 3-21. - Water Quality of Selected Wells in the Piedmont/Blue Ridge Unconfined Aquifers

ranged from undetected to 81000 ppb and 160 ppb, respectively. Iron exceeded the secondary MCL (300 ppb) in water samples taken at six stations, and, manganese exceeded the secondary MCL (50 ppb) at eight stations. Detectable aluminum occurred in samples from two stations and exceeded the secondary MCL (200 ppb) at one station. Figures 3-22 and 3-33 respectively show trends in iron concentrations for selected stations in the Piedmont and Blue Ridge sectors of the province.

Samples from all stations contained sodium, with concentrations ranging from 1.7 ppm to 36.0 ppm. All samples except the one from GWN-P14 contained calcium and magnesium. The other metals detected consisted of barium, strontium, bismuth, beryllium, cadmium, and zinc. Beryllium exceeded the primary MCL of 4 ppb in a sample from well GWN-P10A. No other metal concentrations exceeded any MCL's.

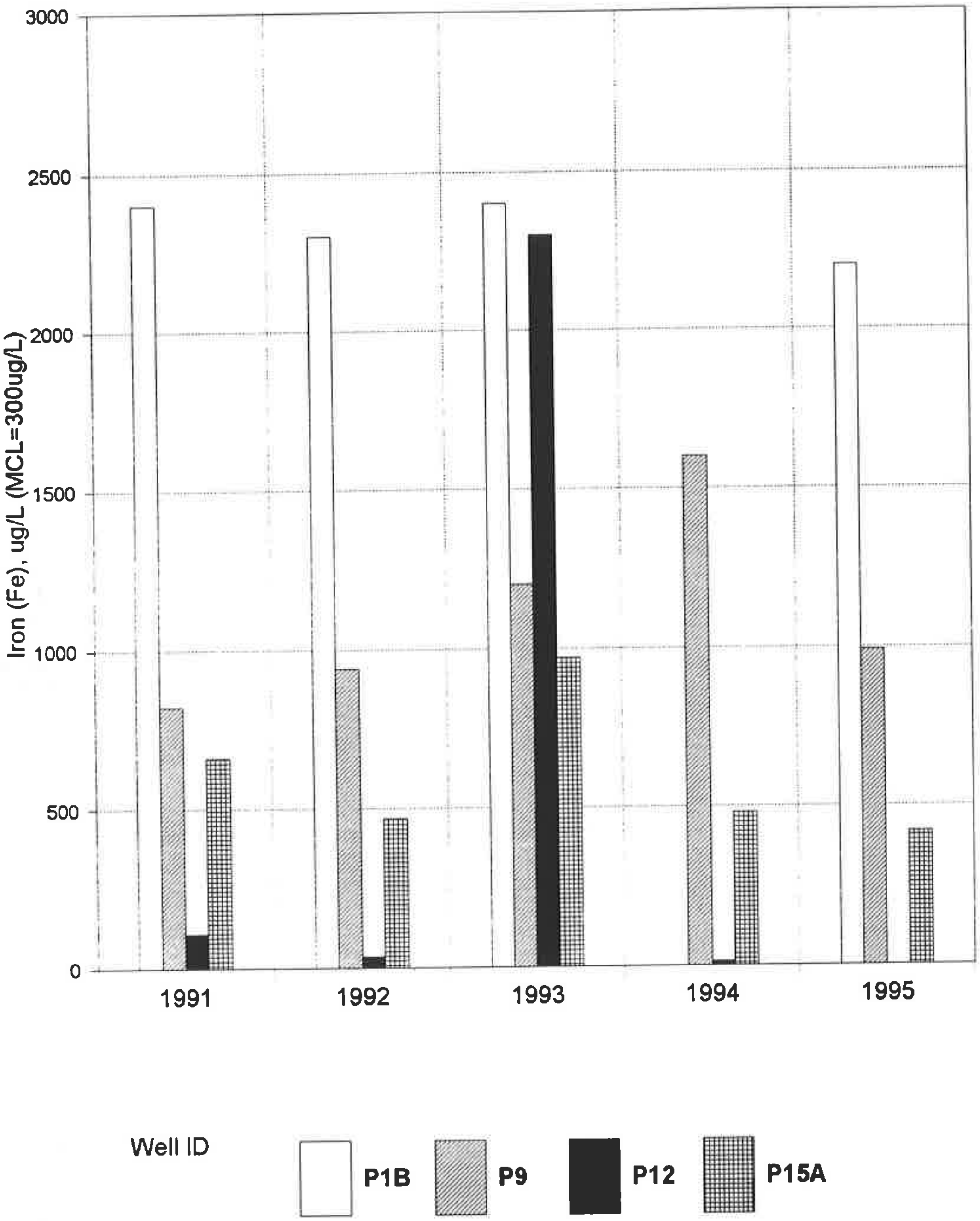
Chloride and sulfate concentrations in the water samples ranged from undetected to 17.1 ppm and 65.2 ppm, respectively. Samples from nine stations contained detectable fluoride with the concentration exceeding the primary MCL (4 ppm) in the sample from spring GWN-P12A. Concentrations of nitrite/nitrate, present in water samples from eleven stations, were below the primary MCL (10 ppm as N). Figures 3-24 and 3-25 show nitrite/nitrate concentrations in selected stations from the Piedmont and Blue Ridge sectors, respectively. A sample drawn from well GWN-P16C contained vinyl chloride and 1,1,2-trichloroethane in excess of the Primary MCL's (2 ppb and 5 ppb, respectively). The well is located in a mixed rural/residential/light industrial setting. An analytical summary for the Piedmont/Blue Ridge sampling stations is in Appendix Table A-10.

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 bottoms underlain by 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.

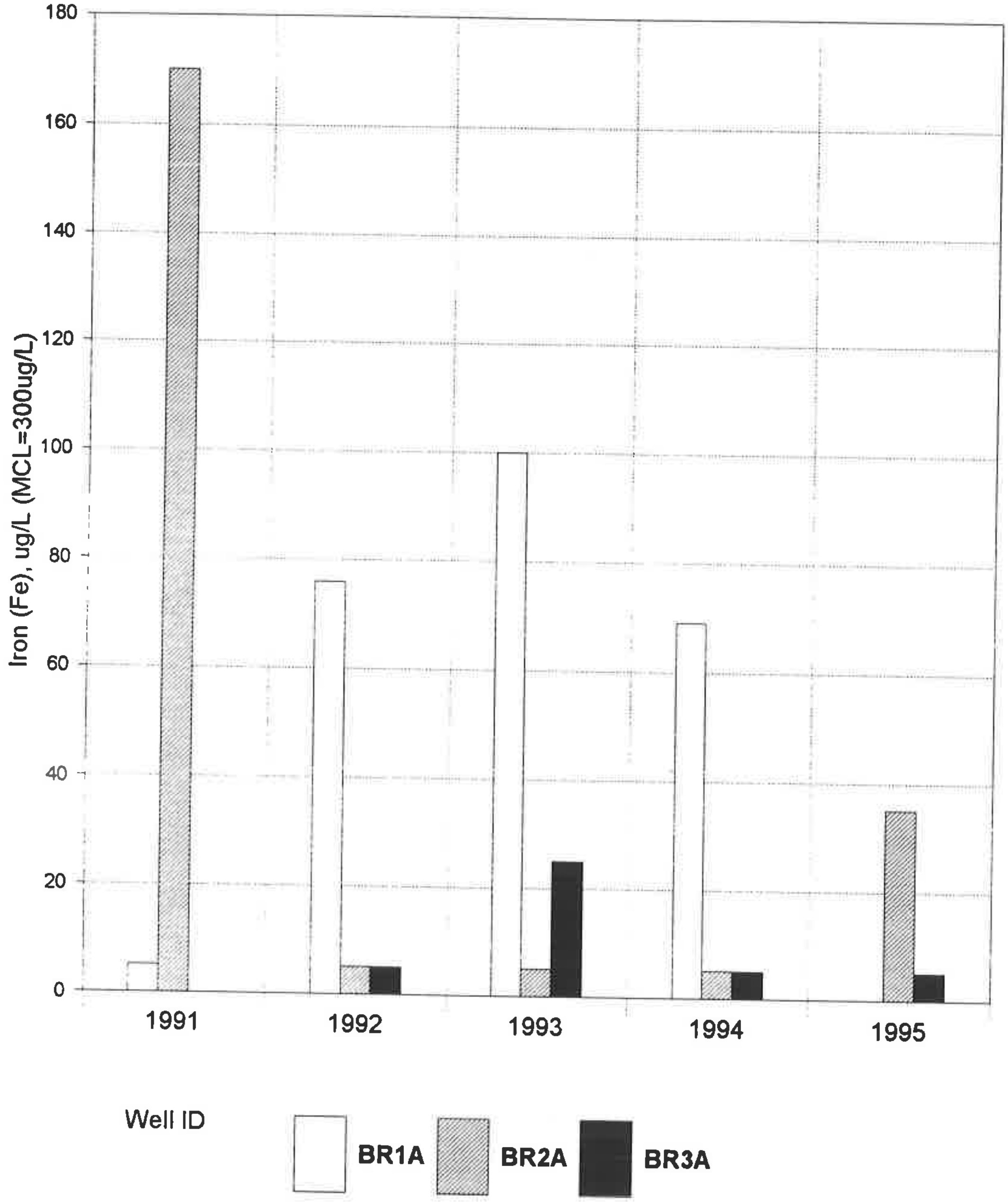
EPD collected water samples from five wells and three springs to monitor the water quality in the Valley and Ridge unconfined aquifers (Figure 3-26). Three of these wells and all three springs produced water from Knox Group carbonates. The other wells are representative of water from the Ordovician Chickamauga Group in Walker County and the Cambrian Shady Dolomite in Bartow County.

Water from the Valley and Ridge monitoring stations ranged in pH from 7.21 to 7.86 and in hardness from moderately hard to very hard. Two stations (GWN-VR3 and GWN-VR4) yielded samples containing detectable iron, and, one station yielded a sample with detectable manganese. Concentrations of these two metals fell below applicable MCL's. Sodium, ranging in concentration from 1.4 ppm to 6.3 ppm, calcium, ranging from 28 to 110 ppm, and magnesium, ranging from 3.5 to 23 ppm, occurred in samples from all stations. Spring GWN-VR3 yielded the only sample with detectable aluminum. The trace metals



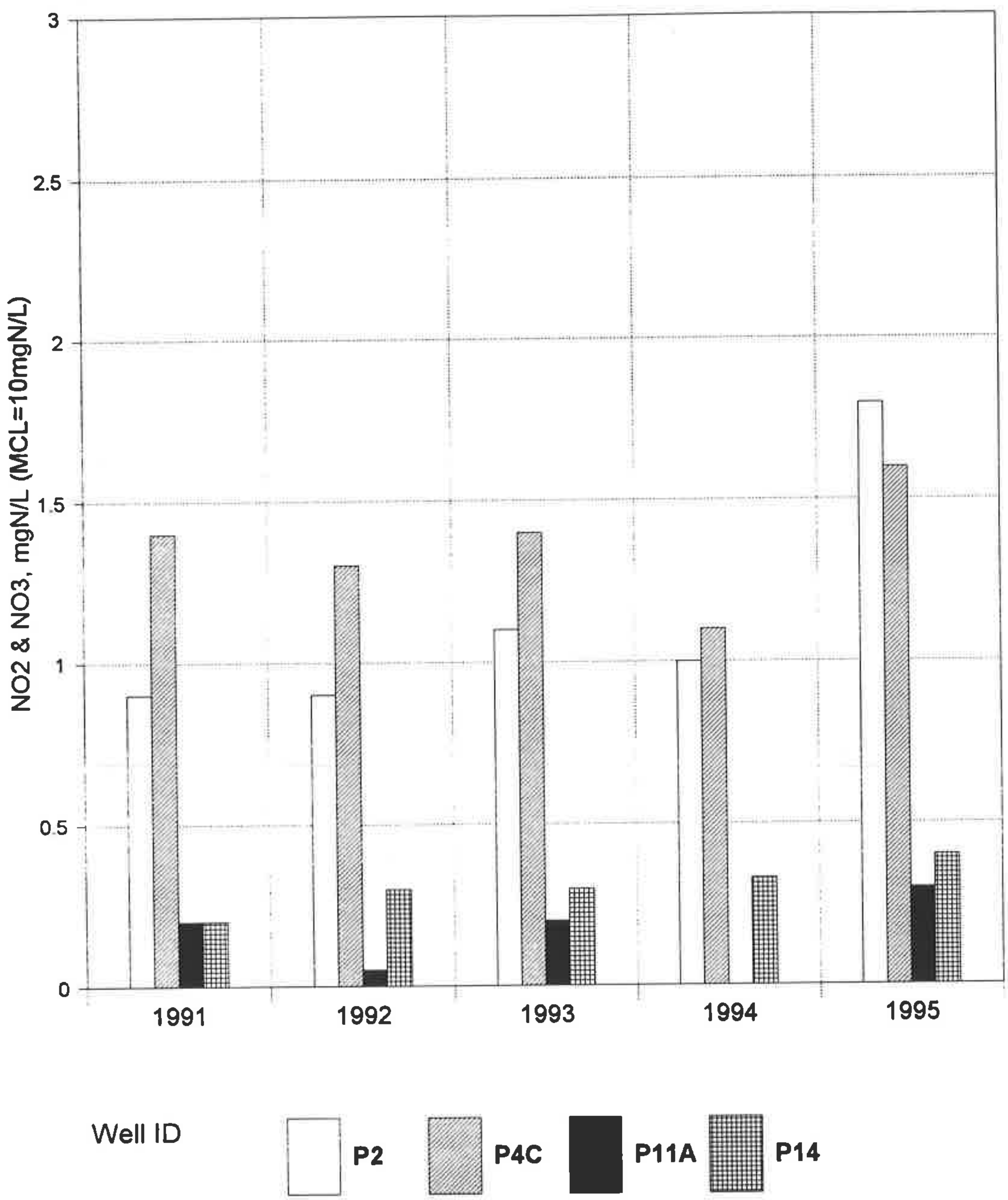
*Iron levels below the detection limit are assigned a value of 12.1 ppb. A missing bar indicates data are not available for that year.

Figure 3-22. - Iron Concentrations for Selected Wells in the Piedmont/Blue Ridge Unconfined Aquifer System: Piedmont Sector.



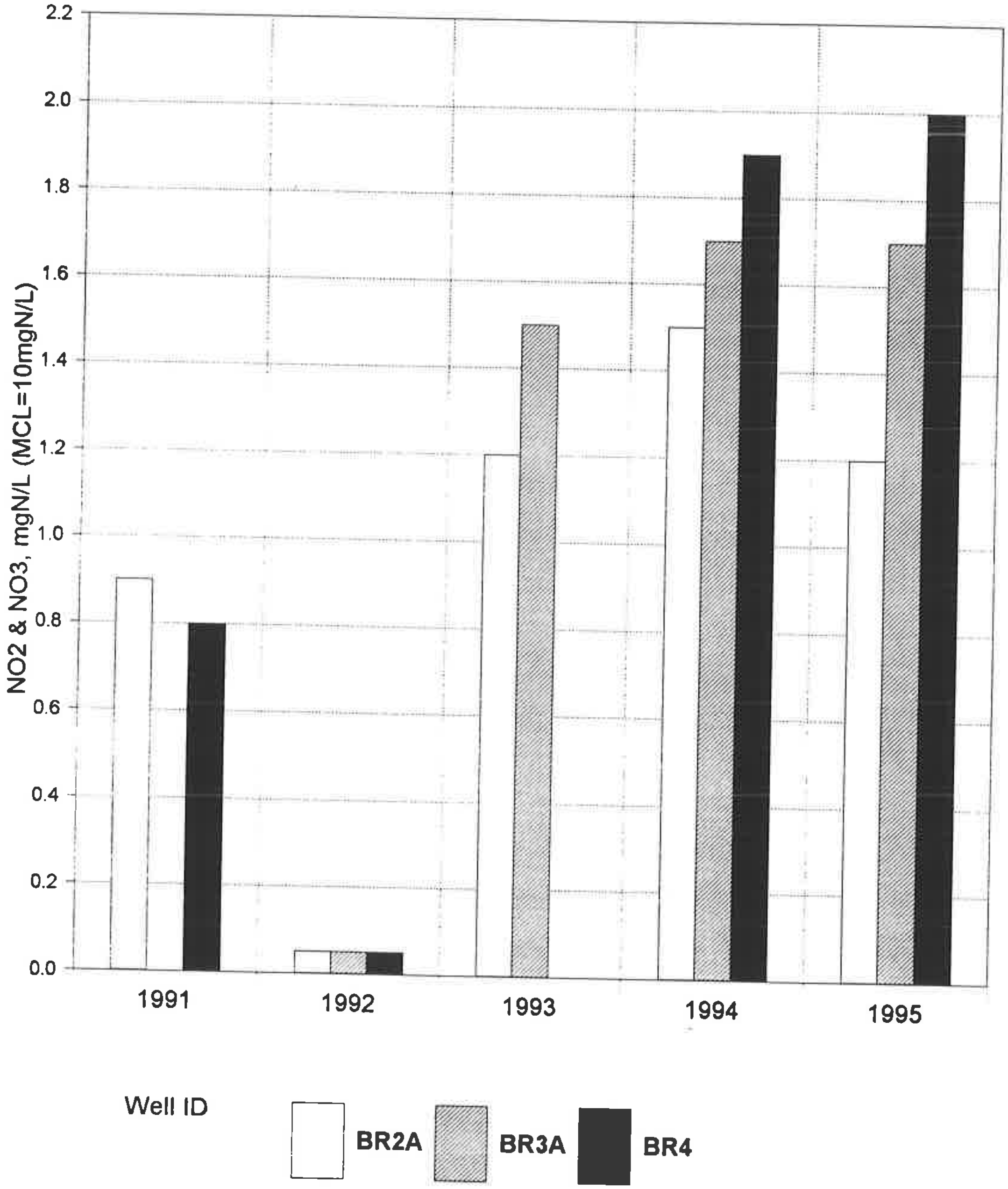
Iron levels below the detection limit are assigned a value of 5.1 ppb. A missing bar indicates data are not available for that year.

Figure 3-23. - Iron Concentrations for Selected Wells in the Piedmont/Blue Ridge Unconfined Aquifer System: Blue Ridge Sector.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-24. - Nitrate/Nitrite Concentrations for Selected Wells in the Piedmont/Blue Ridge UnconfinedAquifer System: Piedmont Sector.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-25. - Nitrate/Nitrite Concentrations for Selected Wells in the Piedmont/Blue Ridge Unconfined Aquifer System: Blue Ridge Sector.

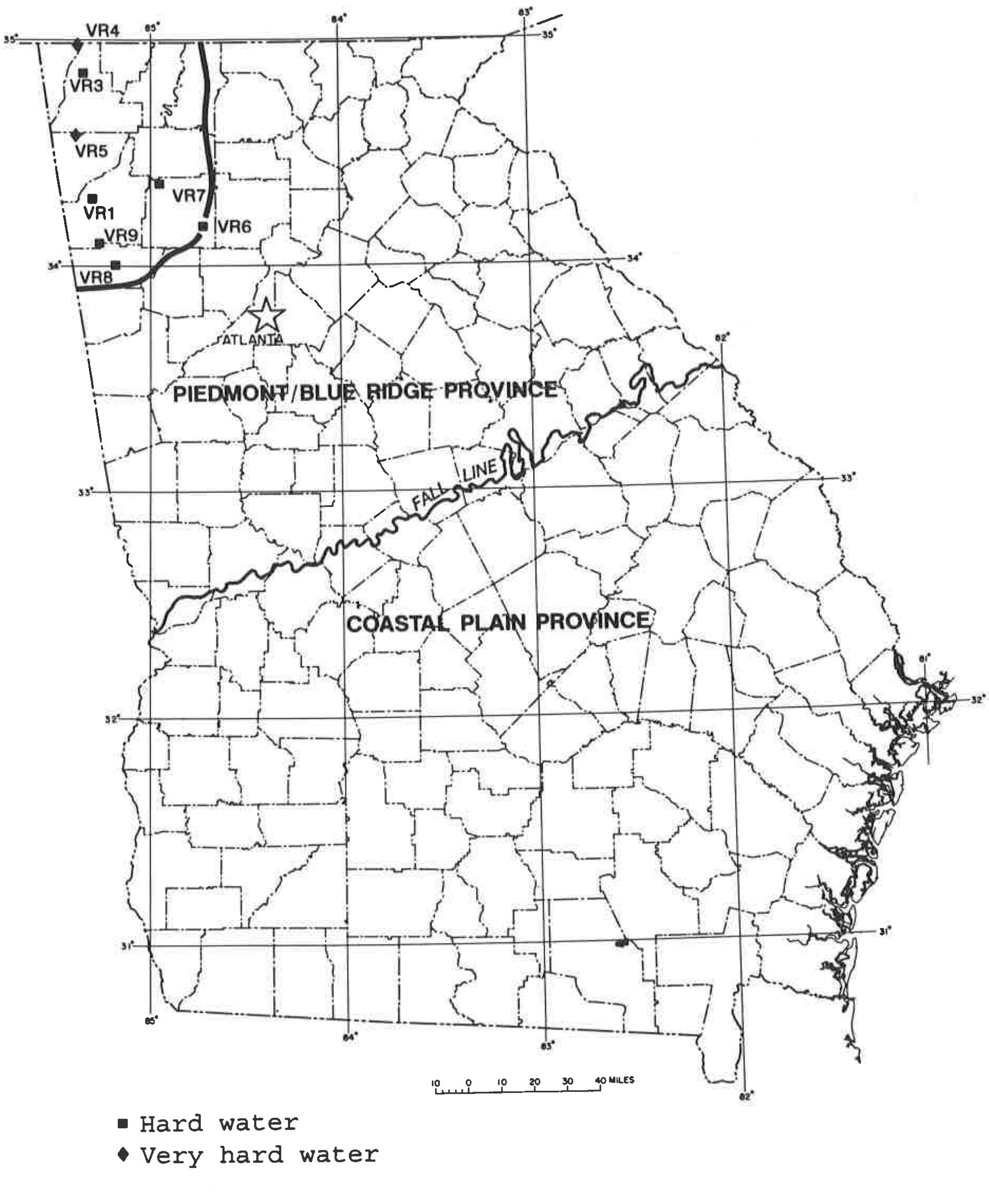
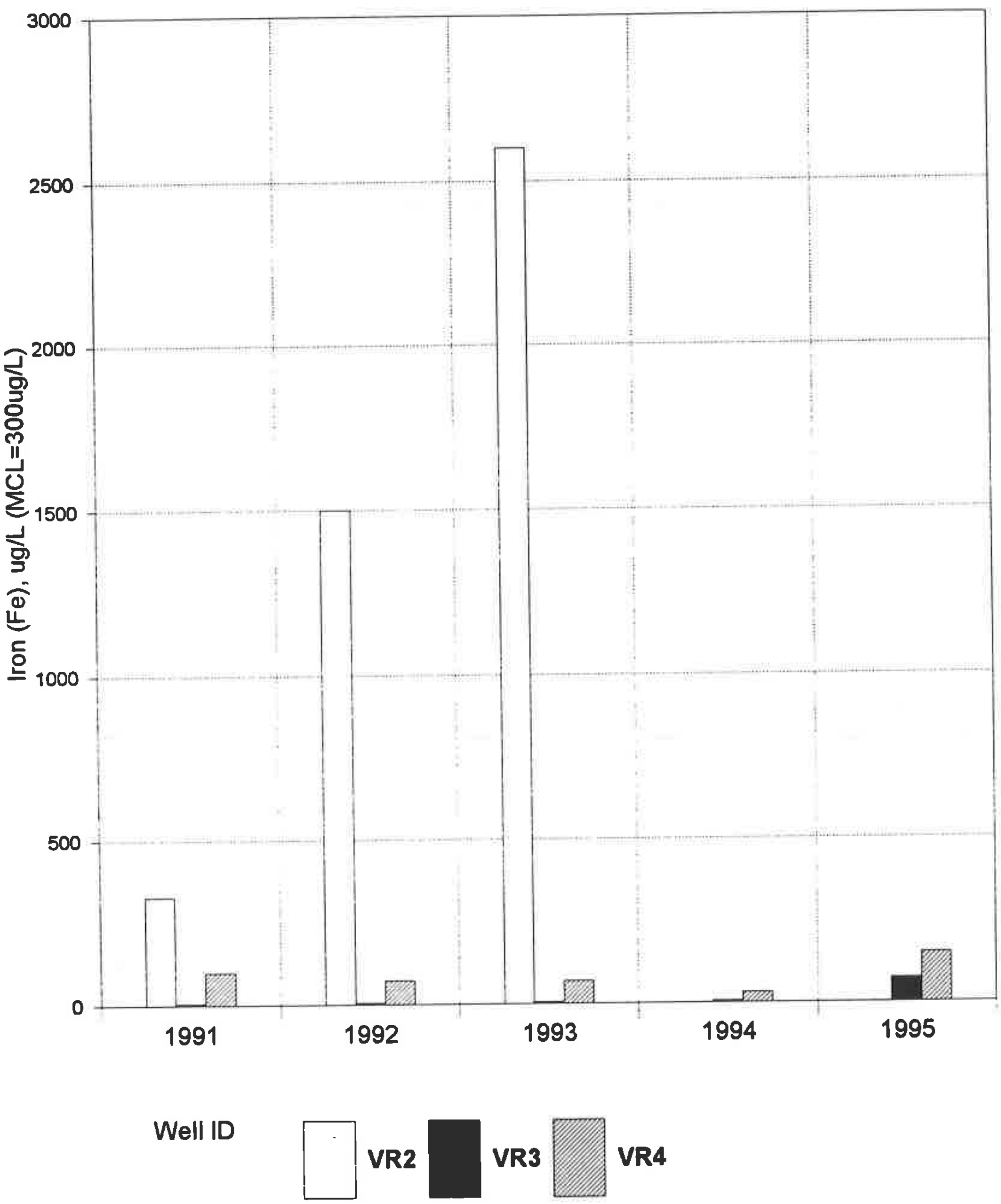


Figure 3-26. - Water Quality of Selected Wells in the Valley and Ridge Unconfined Aquifers.

present consisted of barium and strontium. The highest barium concentration, 580 ppb, occurred in a sample from well GWN-VR6. This particular well draws water from the Shady Dolomite Group, which contains numerous barite ($BaSO_4$) deposits.

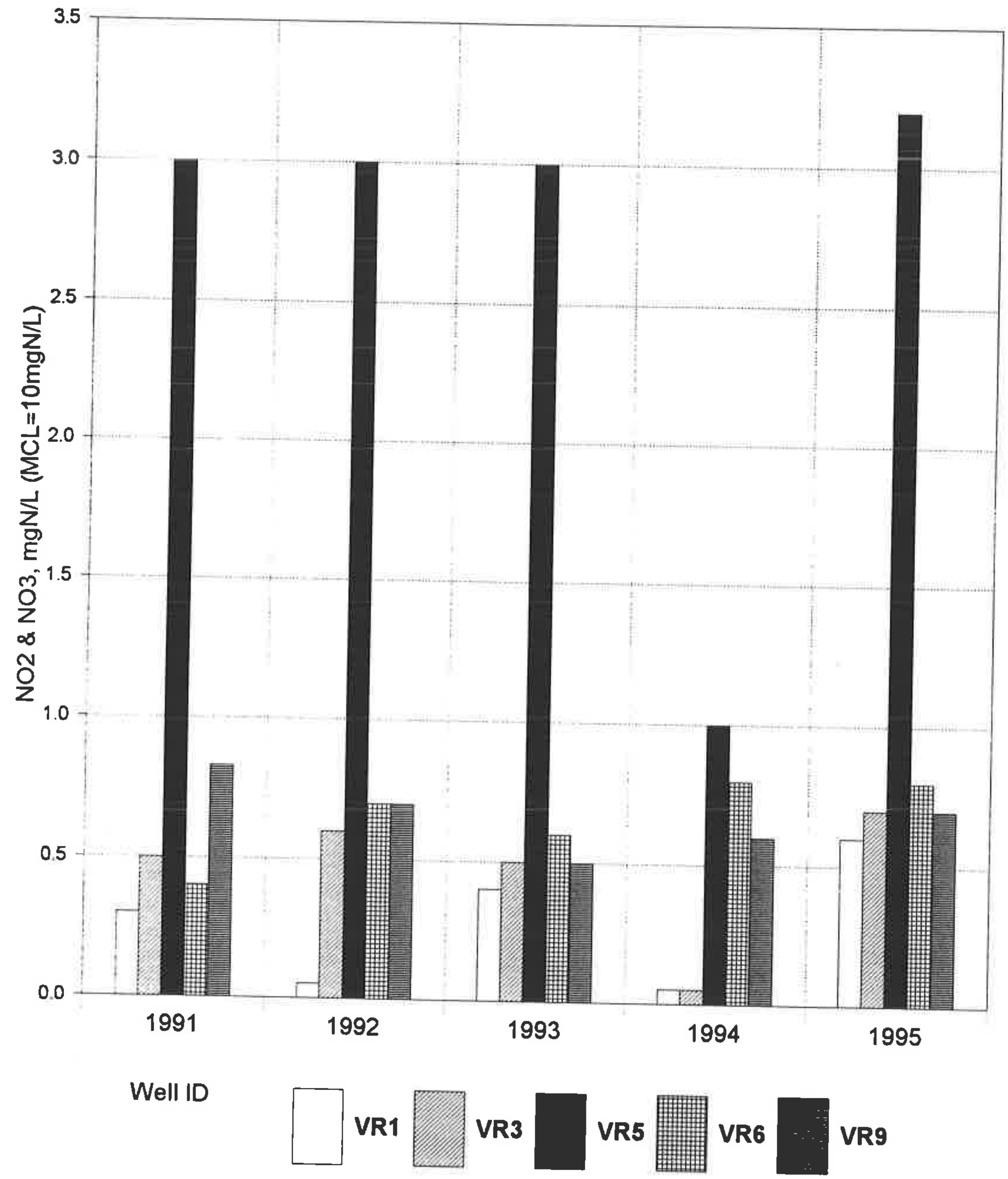
Chloride concentrations ranged from 1.23 ppm to 7.77 ppm, and, sulfate ranged from undetectable to 34.3 ppm. Except for station GWN-VR4, samples from all wells and springs contained nitrate/nitrite. The highest nitrate/nitrite concentration (3.2 ppm as N) occurred in a sample from well GWN-VR5. Figures 3-27 and 3-28 show iron and nitrite/nitrate levels, respectively, for selected sampling stations in the Valley and Ridge aquifers.

The sample from well GWN-VR6, which is located in an industrial setting, contained a non-quantifiable concentration of tetrachloroethylene. Methyl-tert-butyl ether and methyl-tert-amyl ether occurred in samples from well GWN-VR5, which is located in a rural setting. There are no MCL's for the ether compounds. Appendix Table A-11 presents the analytical summary for the wells and springs located in the Valley and Ridge unconfined aquifers.



Iron levels below the detection limit are assigned a value of 5.1 ppb. A missing bar indicates data are not available for that year.

Figure 3-27. - Iron Concentrations for Selected Wells in the Valley and Ridge UnconfinedAquifers.



Nitrate/nitrite levels below the detection limit are assigned a value of 0.05 ppm. A missing bar indicates data are not available for that year.

Figure 3-28. - Nitrate/Nitrite Concentrations for Selected Wells in the Valley and Ridge UnconfinedAquifers.

4.0 SUMMARY AND CONCLUSIONS

EPD personnel collected 141 raw water samples from 111 wells and 6 springs on the Ground-Water Monitoring Network in 1995 for inorganic and organic analysis. These wells and springs monitor the water quality of nine 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

Comparisons of analyses of water samples collected in 1995 were made 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 detected at the stations of the Ground-Water Monitoring Network during 1995. Although isolated water quality problems existed during 1995 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 (MI7, MI8A and MI15), all shallow domestic wells tapping the Miocene aquifer system and located adjacent to or within row crop areas, yielded water samples in 1995 with nitrite/nitrate concentrations exceeding the primary MCL of 10 ppm as nitrogen (Table 4-1). (The owners of these wells received notification about the excess nitrate/nitrite.) 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, deriving from both natural and man-made sources. The most common sources of man-made dissolved nitrogen in Georgia usually consist of septic systems, agricultural wastes, and storage or application of fertilizers (Robertson, et. al, 1993). Dissolved nitrogen also is present in rainwater and can be derived form terrestrial vegetation and volatilization of fertilizers (Drever, 1988). The conversion of other nitrogen species to nitrate occurs in aerobic environments such as recharge areas. Anaerobic conditions in ground water, which commonly develop along the flow path of ground water, foster the denitrification process. However, the lack of denitrifying bacteria in ground water may inhibit this process (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 (Table 4-1). Although minor increases or decreases in iron, manganese, and aluminum occurred at some stations, no long-term trends in concentrations of these metals were documented for the majority of the wells and springs sampled.

Table 4-1. Pollution and Contamination Incidents, 1995.

Station	Contaminant/ Pollutant	Primary MCL	Secondary MCL
GWN-K1	Mn=50ppb Al=1800ppb		Mn=50ppb Al=200ppb
GWN-K3	Fe=420ppb		Fe=300ppb
GWN-K5	dimethylphthalate=22.7ppb	(no MCL)	(no MCL)
GWN-K8	Fe=3900ppb =2600ppb		Fe=300ppb
GWN-K9	Fe=460ppb Al=470ppb		Fe=300ppb Al=200ppb
GWN-K12	Al=350ppb =400ppb		Al=200ppb
GWN-CT2A	Fe=320ppb Fe=320ppb		Fe=300ppb
GWN-CT7A	Fe=330ppb Al=290ppb		Fe=300ppb Al=200ppb
GWN-CL4	benzene=7.2ppb benzene=tr methyl-tert-butyl ether=16ppb methyl-tert-butyl ether=17.6ppb Mn=59ppb	benzene=5.0ppb benzene=5.0ppb (no MCL) (no MCL)	(no MCL) (no MCL) Mn=50ppb
GWN-CL8	Fe=670ppb Mn=51ppb		Fe=300ppb Mn=50ppb
GWN-CL9	$CHCl_3$=tr	trihalomethanes=100ppb	
GWN-J3	Mn=130ppb		Mn=50ppb
GWN-J8	Be=4.1ppb Mn=78ppb	Be=4.0ppb	Mn=50ppb
GWN-PA9C	Fe=1400ppb Mn=61ppb SO_4=398ppm Cl=1770ppm tetrahydrofuran=30ppb	(No MCL)	Fe=300ppb Mn=50ppb SO_4=250ppm Cl=250ppm (No MCL)
GWN-PA15	Fe=420ppb		Fe=300ppb

Table 4-1 (continued). Pollution and Contamination Incidents, 1995.

Station	Contaminant/Pollutant	Primary MCL	Secondary MCL
GWN-PA18	Mn=59ppb		Mn=50ppb
GWN-PA27	dimethyl phthalate=tr	(no MCL)	(no MCL)
GWN-PA33A	$CHCl_3$=8.04ppb $CHBrCl_2$=tr	trihalomethanes=100ppb	
GWN-PA34	Mn=100ppb		Mn=50ppb
GWN-PA39	$CHCl_3$=tr	trihalomethanes=100ppb	
GWN-MI2	dimethyl phthalate-tr	(no MCL)	(no MCL)
GWN-MI5	Mn=71ppb		Mn=50ppb
GWN-MI7	NO_X=10.8ppm as N Al=760ppb	NO_X=10ppm as N	Al=200ppb
GWN-MI8A	NO_X=12.3ppm as N $CHCl_3$=tr Mn=62ppb Al=1400ppb	NO_X=10ppm as N trihalomethanes=100ppb	Mn=50ppb Al=200ppb
GWN-MI10B	Fe=320ppb Mn=160ppb		Fe=300ppb Mn=50ppb
GWN-MI15	NO_X=13.8ppm as N Al=220ppm	NO_X=10ppm as N	Al=200ppb
GWN-BR3A	Mn=64ppb		Mn=50ppb
GWN-P1B	Fe=2200ppb Fe=2100ppb Mn=62ppb Mn=60ppb		Fe=300ppb Fe=300ppb Mn=50ppb Mn=50ppb
GWN-P2	Fe=300ppb		Fe=300ppb
GWN-P6B	Mn=99ppb		Mn=50ppb
GWN-P9	Fe=990ppb Mn=150ppb		Fe=300ppb Mn=50ppb

Table 4-1 (continued). Pollution and Contamination Incidents, 1995.

Station	Contaminant/Pollutant	Primary MCL	Secondary MCL
GWN-P10A	Be=3.4ppb Be =4.3ppb Al=1000ppb Al=2900ppb Fe=19000ppb Fe=81000ppb Mn=120ppb Mn =160ppb	Be=4.0ppb Be=4.0ppb	 Al=300ppb Al=300pp Fe=300ppb Fe=300ppb Mn=50ppb Mn=50ppb
GWN-P15A	Fe=420ppb Mn=81ppb		Fe=300ppb Mn=50ppb
GWN-P16C	vinyl chloride=20..2ppb vinyl chloride =n.d. 1,1,2-trichloroethane=8.58ppb 1,1,2-trichloroethane =n.d. Fe=830ppb Fe=1600ppb Mn=67ppb Mn=68ppb	vinyl chloride=2.0ppb vinyl chloride=2.0ppb 1,1,2-trichloroethane=5.0ppb 1,1,2-trichloroethane=5.0ppb	 Fe=300ppb Fe=300ppb Mn=50ppb Mn=50ppb
GWN-P17	Fe=420ppb Mn=120ppb		Fe=300ppb Mn=50ppb
GWN-VR5	methyl-tert-butyl ether=40ppb methyl-tert-butyl ether=40ppb	(No MCL) (No MCL)	(No MCL) (No MCL)
GWN-VR6	tetrachloroethylene=tr.	tetrachloroethylene=5ppb	

Note: Listing of a substance twice for one station means that the station was sampled twice.
tr. = trace.

Samples from twelve stations contained some amount of synthetic organic compounds. In five instances, the concentration of the substance was too small to quantify. Only two wells yielded samples with organic chemical pollutants in excess of primary MCL's, GWN-CL4 with excessive benzene and GWN-P16C with excessive vinyl chloride and trichloroethane. The sporadic nature of the occurrence of such compounds in most of these wells makes defining spatial and temporal trends in levels of organic pollutants indeterminate for the purposes of this study.

5.0 LIST OF REFERENCES

Brooks, R., Clarke, J.S., and Faye, R.E., 1985, Hydrology of the Gordon Aquifer System of East-Central Georgia: Georgia Geologic Survey Information Circular 75, 41 p., 2 pl.

Clarke, J.S., Brooks, R., and Faye, R.E., 1985, Hydrogeology of the Dublin and Midville Aquifer Systems of East Central Georgia: Georgia Geologic Survey Information Circular 74, 62 p., 2 pl.

Clarke, J.S., Faye, R.E., and Brooks, R., 1983, Hydrogeology of the Providence Aquifer of Southwest Georgia: Georgia Geologic Survey Hydrologic Atlas 11, 5 pl.

Clarke, J.S., Faye, R.E., and Brooks, R., 1984, Hydrogeology of the Clayton Aquifer of Southwest Georgia: Georgia Geologic Survey Hydrologic Atlas 13, 6 pl.

Clarke, J.S., Hacke, C.M., and Peck, M.F., 1990, Geology and Ground-Water Resources of the Coastal Area of Georgia: Georgia Geologic Survey Bulletin 113, 116 p., 12 pl.

Crews, P.A., and Huddlestun, P.F., 1984, Geologic Sections of the Principal Artesian Aquifer System, in Hydrogeologic Evaluation for Underground Injection Control in the Coastal Plain of Georgia: in R. Arora, ed., Georgia Geologic Survey Hydrologic Atlas 10, 41pl.

Davis, K.R., Donahue, J.C., Hutcheson, R.H., and Waldrop, D.L., 1988, Most Significant Ground-Water Recharge Areas of Georgia: Georgia Geologic Survey Hydrologic Atlas 18, 1 pl.

Drever, J. I., 1988, The Geochemistry of Natural Waters: Prentice-Hall, Englewood Cliffs, New Jersey, 437 p.

EPD, 1991, A Ground-Water Management Plan for Georgia: Georgia Geologic Survey Circular 11, 100 p.

EPD, 1994, Rules for Safe Drinking Water, Section 391-3-5, Rules of the Georgia Department of Natural Resources Environmental Protection Division, p. 601-728.

Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Prentice-Hall, Englewood Cliffs, New Jersey, 604 p.

Gorday, L.L., Lineback, J,A., Long, A.F., McLemore, W.H., 1997, A Digital Model Approach to Water-Supply Management of the Claiborne, Clayton, and Providence Aquifers of Southwestern Georgia: Georgia Geologic Survey Bulletin 118, 31 p., Appendix, Supplements I and II.

Hayes, L.R., Maslia, M.L., and Meeks, W.C., 1983, Hydrology and Model Evaluation of the Principal Artesian Aquifer, Dougherty Plain, Southwest Georgia: Georgia Geologic Survey Bulletin 97, 93p.

Hicks, D.W., Krause, R.E., and Clarke, J.S., 1981, Geohydrology of the Albany Area, Georgia: Georgia Geologic Survey Information Circular 57, 31 p.

Joiner, C.N., Reynolds, M.S., Stayton, W.L., and Boucher, F.G., 1988, Ground-Water Data for Georgia, 1987: United States Geological Survey Open-File Report 88-323, 172 p.

Kellam, M.F., and Gorday, L.L., 1990, Hydrogeology of the Gulf Trough-Apalachicola Embayment Area, Georgia: Georgia Geologic Survey Bulletin 94, 74 p., 15 pl.

Krause, R.E., 1979, Geohydrology of Brooks, Lowndes, and Western Echols Counties, Georgia: United States Geological Survey Water-Resources Investigations 78-117, 48 p., 8 pl.

Long, A.F., 1989, Hydrogeology of the Clayton and Claiborne Aquifer Systems: Georgia Geologic Survey Hydrologic Atlas 19, 6 pl.

McFadden, S.S., and Perriello, P.D., 1983, Hydrogeology of the Clayton and Claiborne Aquifers in Southwestern Georgia: Georgia Geologic Survey Information Circular 55, 59p., 2 pl.

Pollard, L.D., and Vorhis, R.C., 1980, The Geohydrology of the Cretaceous Aquifer System in Georgia: Georgia Geologic Survey Hydrologic Atlas 3, 5 pl.

Robertson, S.J., Shellenberger, D.L., York, G.M., Clark, M.G., Eppihimer, R.M., Lineback, J.A., 1993, Sampling for Nitrate Concentrations in North Georgia's Ground Water: 1993 Georgia Water Resources Conference 364-365, 1 p.

Shellenberger, D.L., Barget, R.G., Lineback, J.A., and Shapiro, E.A., 1996, Nitrate in Georgia's Ground Water: Georgia Geologic Survey Project Report 25, 12 p., 1 pl.

Standard Methods for the Evaluation of Water and Waste Water, 1995, Franson, M.A.H., ed.: American Public Health Assn., Washington, D.C., p. 1-1 to 10-157, 35 pl.

Stuart, M.A., Rich, F.J., and Bishop, G.A., 1995, Survey of Nitrate Contamination in Shallow Domestic Drinking Water Wells in the Inner Coastal Plain of Georgia: Ground Water, Vol. 33, No. 2, p. 284-290.

Vincent, R.H., 1982, Geohydrology of the Jacksonian Aquifer in Central and East Central Georgia: Georgia: Geologic Survey Hydrologic Atlas 8, 3 pl.

Wait, R.L., 1960, Source and Quality of Ground Water in Southwestern Georgia: Georgia Geologic Survey Information Circular 18, 74 p.

Watson, T., 1982, Aquifer Potential of the Shallow Sediments of the Coastal Area of Georgia: Proceedings, Second Symposium on the Geology of the Southeastern Coastal Plain, Arden, D.D., Beck, B.F., Morrow, E., eds., Georgia Geologic Survey Information Circular 53, p. 183-194.

Webb, G.L., 1995, Pesticide Monitoring Network 1993-1994: Georgia Geologic Survey Project Report 22, 52 p.

ANALYSES OF SAMPLES COLLECTED DURING 1995 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 that includes tests for pH, specific conductance, certain common inorganic anions, and thirty metals (Table A-1). 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 consist of those for mercury, agricultural chemicals, semivolatile organic compounds, and volatile organic compounds (Table A-2). In previous editions of Circular 12, the metals analyses and the various organic chemical analyses were referred to as screens.

EPA has set forth a series of (serially numbered) analytical methods officially recognized as suitable for environmental purposes. As the EPD laboratory and the Georgia Department of Agriculture laboratory use these methods and now cite EPA method numbers along with analysis results, Tables A-1 and A-2 list the EPA method number appropriate for the substance being tested. For the majority of the organic analyses, the screens coincide with the EPA methods. Screen #5, done by the Cooperative Extension Service laboratory at the University of Georgia, is effective for most carbamates and urea-derivative pesticides. EPA method 531.1 is effective for carbamates but not urea-derivatives. EPA has not designated an official method for analyzing the urea derivative pesticides. Table A-2 makes note of this situation.

Other than the two physical parameters, four of the major anions, and nine of the metals, other parameters are listed in the following analytical results tables A-3 through A-11only if they were detected.

For this appendix, the following abbreviations are used:

AAS	= atomic absorbtion spectrophotometry
SU	= standard units
mg/L	= milligrams per liter (parts per million)
mg/L as N	= milligrams per liter (parts per million), as nitrogen
ug/L	= micrograms per liter (parts per billion)
ICPOES	= ion coupled plasma optical emission spectroscopy
umho/cm	= micromhos per centimeter
U	= less than (below detection limit)
a	= EPA method 507.0 (organophosphate pesticides)
b	= EPA method 508.1 (organochlorine pesticides and PCB's)
c	= EPA method 515.2 (chlorinated phenoxy herbicides)
d	= EPA method 531.1 (carbamate pesticides)
s	= EPA method 8270B (semivolatile organic compounds)
v	= EPA method 8260A (volatile organic compounds)

(Note: detection limits may change due to temporary differences in the performance of instruments and apparatus.)

Table A-1. Standard Water Quality Analyses: ICPOES Metals, AAS Metals, Major Anions, and Other Parameters.

ICPOES METALS TEST			
Parameter	**Test Method**	**Typical Detection Limit**	**Max.Contaminant Level**
Silver (Ag)	EPA 200.7	30 ug/L	100 ug/L$_2$
Aluminum (Al)	EPA 200.7	50 ug/L	200 ug/L$_2$
Gold (Au)	EPA 200.7	10 ug/L	None
Barium (Ba)	EPA 200.7	10 ug/L	2000 ug/L$_1$
Bismuth (Bi)	EPA 200.7	30 ug/L	None
Calcium (Ca)	EPA 200.7	1.0 mg/L	None
Cobalt (Co)	EPA 200.7	10 ug/L	None
Chromium (Cr)	EPA 200.7	20 ug/L	100 ug/L$_1$
Copper (Cu)	EPA 200.7	20 ug/L	1000 ug/L$_2$
Iron (Fe)	EPA 200.7	20 ug/L	300 ug/L$_2$
Potassium (K)	EPA 200.7	5.0 mg/L	None
Magnesium (Mg)	EPA 200.7	1.0 mg/L	None
Manganese (Mn)	EPA 200.7	10 ug/L	50 ug/L$_2$
Molybdenum (Mo)	EPA 200.7	10 ug/L	None
Sodium (Na)	EPA 200.7	1.0 mg/L	None
Nickel (Ni)	EPA 200.7	20 ug/L	100 ug/L$_1$
Lead (Pb)	EPA 200.7	50 ug/L	None
Tin (Sn)	EPA 200.7	90 ug/L	None
Strontium (Sr)	EPA 200.7	10 ug/L	None
Titanium (Ti)	EPA 200.7	10 ug/L	None
Vanadium (V)	EPA 200.7	10 ug/L	None
Yttrium (Y)	EPA 200.7	10 ug/L	None
Zinc (Zn)	EPA 200.7	20 ug/L	5000 ug/L$_2$

ICPOES METALS TEST (continued)			
Parameter	**Test Method**	**Typical Detection Limit**	**Max.Contaminant Level**
Zirconium (Zr)	EPA 200.7	10 ug/L	None

AAS METALS TESTS			
Parameter	**Test Method**	**Typical Detection Limit**	**Max.Contaminant Level**
Arsenic (As)	EPA 206.2	25 ug/L	50 ug/L_1
Beryllium (Be)	EPA 210.2	2 ug/L	4 ug/L_1
Cadmium (Cd)	EPA 213.2	2.5 ug/L	5 ug/L_1
Antimony (Sb)	EPA 204.2	3 ug/L	6 ug/L_1
Selenium (Se)	EPA 270.2	25 ug/L	50 ug/L_1
Thallium (Tl)	EPA 279.2	1 ug/L	2 ug/L_1

MAJOR ANIONS TESTS			
Parameter	**Test Method**	**Typical Detection Limit**	**Max.Contaminant Level**
Chloride (Cl^-)	EPA 300.0	0.1 mg/L	250 mg/L_2
Sulfate ($SO_4^=$)	EPA 300.0	2.0 mg/L	250 mg/L_2
Nitrate/Nitrite (NO_x^-)	EPA 353.1	0.1 mg/L as N	10 mg/L as N_1
Fluoride (F^-)	EPA 300.0	0.1 mg/L	4.0 mg/L_1, 2.0 mg/L_2

OTHER PARAMETERS		
Parameter	**Units**	**Maximum Contaminant Level**
pH	0.01 SU	None
Conductivity	1.0 mho/cm	None

*pH is measured in the field (see Chapter 2); conductivity is measured according to Standard Methods of Water Quality Analysis method 2510B. (Franson, ed., 1995).

$_1$=Primary Maximum Contaminant Level (MCL).
$_2$=Secondary MCL.

MCL's from Georgia Rules for Safe Drinking Water, March 1994 edition (EPD, 1994).

Table A-2. Additional Water Quality Analyses: Organophosphate Pesticides, Organochlorine Pesticides/PCB's, Phenoxy Herbicides, Carbamate/Urea-Derived Pesticides, Semivolatile Organic Compounds, Volatile Organic Compounds, and Mercury.

ORGANOPHOSPHATE PESTICIDES *(Screen #1)*			
Parameter	**Test Method**	**Typical Detection Limit**	**Primary Maximum Contaminant Level**
Alachlor	EPA 507.0	1.0 ug/L	2.0 ug/L
Atrazine	EPA 507.0	0.3 ug/L	3.0 ug/L
Azodrin	EPA 507.0	1.0 ug/L	None
Chloropyrifos	EPA 507.0	0.8 ug/L	None
Cyanazine	EPA 507.0	1.0 ug/L	None
DCPA	EPA 507.0	0.01 ug/L	None
Dasanit	EPA 507.0	0.6 ug/L	None
Demeton	EPA 507.0	1.0 ug/L	None
Diazinon	EPA 507.0	1.0 ug/L	None
Dimethoate	EPA 507.0	0.5 ug/L	None
Disyston	EPA 507.0	1.0 ug/L	None
Eptam	EPA 507.0	0.5 ug/L	None
Ethoprop	EPA 507.0	0.5 ug/L	None
Fonophos	EPA 507.0	0.5 ug/L	None
Guthion	EPA 507.0	2.0 ug/L	None
Isopropalin	EPA 507.0	1.0 ug/L	None
Malathion	EPA 507.0	1.4 ug/L	None
Metolachlor	EPA 507.0	1.0 ug/L	None
Metribuzin	EPA 507.0	1.25 ug/L	None
Mevinphos	EPA 507.0	1.4 ug/L	None
Parathion (E)	EPA 507.0	0.08 ug/L	None

ORGANOPHOSPHATE PESTICIDES (continued) *(Screen #1)*			
Parameter	**Test Method**	**Typical Detection Limit**	**Primary Maximum Contaminant Level**
Parathion (M)	EPA 507.0	0.1 ug/L	None
Pebulate	EPA 507.0	0.6 ug/L	None
Pendimethalin	EPA 507.0	0.8 ug/L	None
Phorate	EPA 507.0	1.0 ug/L	None
Profluralin	EPA 507.0	0.9 ug/L	None
Simazine	EPA 507.0	0.9 ug/L	4.0 ug/L
Sutan	EPA 507.0	0.7 ug/L	None
Terbufos	EPA 507.0	3.0 ug/L	None
Trifluralin	EPA 507.0	1.0 ug/L	None
Vernam	EPA 507.0	0.5 ug/L	None

ORGANOCHLORINE PESTICIDES/PCB'S *(Screen #2)*			
Parameter	**Test Method**	**Typical Detection Limit**	**Primary Maximum Contaminant Level**
Chlordane	EPA 508.1	2.0 ug/L	2.0 ug/L
Dicofol	EPA 508.1	0.1 ug/L	None
Endrin	EPA 508.1	0.03 ug/L	2.0 ug/L
Methoxychlor	EPA 508.1	0.3 ug/L	40.0 ug/L
gamma-HCH (lindane)	EPA 508.1	0.008 ug/L	0.2 ug/L
PCB's	EPA 508.1	0.6 ug/L	0.5 ug/L
Permethrin	EPA 508.1	0.3 ug/L	None
Toxaphene	EPA 508.1	1.2 ug/L	3.0 ug/L

PHENOXY HERBICIDES *(Screens #3 and #4)*			
Parameter	**Test Method**	**Typical Detection Limit**	**Primary Maximum Contaminant Level**
2,4-D	EPA 515.1	5.2 ug/L	70.0 ug/L
Acifluorfen	EPA 515.1	1.0 ug/L	None
Chloramben	EPA 515.1	0.2 ug/L	None
Dalapon	EPA 515.1	0.2 ug/L	200 ug/L
Dinoseb	EPA 515.1	0.1 ug/L	7ug/L
Pichloram	EPA 515.1	500 ug/L	500 ug/L
Silvex	EPA 515.1	0.1 ug/L	50.0 ug/L
Trichlorofon	EPA 515.1	2.0 ug/L	None

CARBAMATE/UREA-DERIVATIVE PESTICIDES			
Parameter	**Test Method**	**Typical Detection Limit**	**Primary Maximum Contaminant Level**
Aldicarb	EPA 531.1	1.0 ug/L	None
Aldicarb Sulfone	EPA 531.1	2.0 ug/L	None
Aldicarb Sulfoxide	EPA 531.1	2.0 ug/L	None
Baygon	EPA 531.1 Screen #5	1.0 ug/L	None
Carbaryl	EPA 531.1 Screen #5	2.0 ug/L	None
Carbofuran	EPA 531.1 Screen #5	1.0 ug/L	40.0 ug/L
Diuron	Screen #5	1.0 ug/L	None
Fluometron	Screen #5	1.0 ug/L	None
Linuron	Screen #5	1.0 ug/L	None

CARBAMATE/UREA-DERIVATIVE PESTICIDES (continued)			
Parameter	**Test Method**	**Typical Detection Limit**	**Primary Maximum Contaminant Level**
Methomyl	EPA 531.1 Screen #5	1.0 ug/L	None
Methiocarb	EPA 531.1 Screen #5	4.0 ug/L	None
Monuron	Screen #5	1.0 ug/L	None
Oxamyl	EPA 531.1 Screen #5	2.0 ug/L	200 ug/L

SEMIVOLATILE ORGANIC COMPOUNDS *(Screens #8 and #9)*			
Parameter	**Test Method**	**Method Detection Limit**	**Primary Maximum Contaminant Level**
N-Nitrosodimethyl-amine	EPA 8270B	10.0 ug/L	None
2-Picoline	EPA 8270B	10.0 ug/L	None
Methylmethanesul-fonate	EPA 8270B	10.0 ug/L	None
Ethylmethanesul-fonate	EPA 8270B	20.0 ug/L	None
Aniline	EPA 8270B	10.0 ug/L	None
Phenol	EPA 8270B	10.0 ug/L	None
Bis(2-Chloroethyl) ether	EPA 8270B	10.0 ug/L	None
2-Chlorophenol	EPA 8270B	10.0 ug/L	None
1.3-Dichlorobenzene (m)	EPA 8270B	10.0 ug/L	None
1,4-Dichlorobenzene (p)	EPA 8270B	10.0 ug/L	75.0 ug/L
Benzyl Alcohol	EPA 8270B	20.0 ug/L	None

SEMIVOLATILE ORGANIC COMPOUNDS (continued) *(Screens #8 and #9)*			
Parameter	**Test Method**	**Method Detection Limit**	**Primary Maximum Contaminant Level**
1,2-Dichlorobenzene (o)	EPA 8270B	10.0 ug/L	600.0 ug/L
2-Methylphenol	EPA 8270B	10.0 ug/L	None
Bis(2-Chloroiso-propyl) Ether	EPA 8270B	10.0 ug/L	None
Acetophenone	EPA 8270B	10.0 ug/L	None
4-Methylphenol	EPA 8270B	10.0 ug/L	None
N-Nitrosodi-N-Propylamine	EPA 8270B	10.0 ug/L	None
Hexachloroethane	EPA 8270B	10.0 ug/L	None
Nitrobenzene	EPA 8270B	10.0 ug/L	None
N-Nitrosopiperidine	EPA 8270B	20.0 ug/L	None
Isophorone	EPA 8270B	10.0 ug/L	None
2-Nitrophenol	EPA 8270B	10.0 ug/L	None
2,4-Dimethylphenol	EPA 8270B	10.0 ug/L	None
Bis(2-Chloroethoxy) Methane	EPA 8270B	10.0 ug/L	None
Benzoic Acid	EPA 8270B	50.0 ug/L	None
2,4-Dichlorophenol	EPA 8270B	10.0 ug/L	None
1,2,4-Trichlorobenzene	EPA 8270B	10.0 ug/L	None
A,a-Dimethyl-phenylethylamine	EPA 8270B	10.0 ug/L	None
Naphthalene	EPA 8270B	10.0 ug/L	None
4-Chloroaniline	EPA 8270B	20.0 ug/L	None
2,6-Dichlorophenol	EPA 8270B	10.0 ug/L	None

SEMIVOLATILE ORGANIC COMPOUNDS (continued) *(Screens #8 and #9)*			
Parameter	**Test Method**	**Minimum Detection Limit**	**Primary Maximum Contaminant Level**
Hexachlorobutadi-ene	EPA 8270B	10.0 ug/L	None
N-Nitroso-Di-N-Butylamine	EPA 8270B	10.0 ug/L	None
4-Chloro-3-methylphenol	EPA 8270B	20.0 ug/L	None
2-Methyl Naphthalene	EPA 8270B	10.0 ug/L	None
1,2,4,5-Tetrachlorobenzene	EPA 8270B	10.0 ug/L	None
Hexachlorocyclo-pentadiene	EPA 8270B	10.0 ug/L	50 ug/L
2,4,6-Trichlorophenol	EPA 8270B	10.0 ug/L	None
2-Chloronaphthalene	EPA 8270B	10.0 ug/L	None
2,4,5-Trichlorophenol	EPA 8270B	10.0 ug/L	None
1-Chloronaphthalene	EPA 8270B	10.0 ug/L	None
2-Nitroanaline	EPA 8270B	50.0 ug/L	None
Dimethylphthalate	EPA 8270B	10.0 ug/L	None
Acenaphthylene	EPA 8270B	10.0 ug/L	None
2,6-Dinitrotoluene	EPA 8270B	10.0 ug/L	None
3-Nitroaniline	EPA 8270B	50.0 ug/L	None
Acenaphthene	EPA 8270B	10.0 ug/L	None
2,4-Dinitrophenol	EPA 8270B	50.0 ug/L	None
4-Nitrophenol	EPA 8270B	50.0 ug/L	None
Dibenzofuran	EPA 8270B	10.0 ug/L	None
Pentachlorobenzene	EPA 8270B	10.0 ug/L	None

SEMIVOLATILE ORGANIC COMPOUNDS (continued) *(Screens #8 and #9)*			
Parameter	**Test Method**	**Minimum Detection Limit**	**Primary Maximum Contaminant Level**
2,4-Dinitrotoluene	EPA 8270B	10.0 ug/L	None
1-Naphthylamine	EPA 8270B	10.0 ug/L	None
2-Naphthylamine	EPA 8270B	10.0 ug/L	None
2,3,4,6-tetrachlorobenzene	EPA 8270B	10.0 ug/L	None
Diethylphthalate	EPA 8270B	10.0 ug/L	None
Fluorene	EPA 8270B	10.0 ug/L	None
4-Chlorophenyl Phenyl Ether	EPA 8270B	10.0 ug/L	None
4-Nitroaniline	EPA 8270B	20.0 ug/L	None
Diphenylamine	EPA 8270B	10.0 ug/L	None
4,6-Dinitro-2-methylphenol	EPA 8270B	50.0 ug/L	None
N-Nitroso-diphenylamine	EPA 8270B	10.0 ug/L	None
1,2-diphenyl-hydrazine	EPA 8270B	10.0 ug/L	None
4-Bromophenyl-Phenyl Ether	EPA 8270B	10.0 ug/L	None
Phenacetin	EPA 8270B	20.0 ug/L	None
Hexachlorobenzene	EPA 8270B	10.0 ug/L	1 ug/L
4-Aminobiphenyl	EPA 8270B	20.0 ug/L	None
Pentachlorophenol	EPA 8270B	50.0 ug/L	1.0 ug/L
Pronamide	EPA 8270B	10.0 ug/L	None
Pentachloronitro-benzene	EPA 8270B	20.0 ug/L	None
Phenanthrene	EPA 8270B	10.0 ug/L	None

SEMIVOLATILE ORGANIC COMPOUNDS (continued) *(Screens #8 and #9)*			
Parameter	**Test Method**	**Minimum Detection Limit**	**Primary Maximum Contaminant Level**
Anthracene	EPA 8270B	10.0 ug/L	None
Di-N-Butyl Phthalate	EPA 8270B	10.0 ug/L	None
Fluoranthene	EPA 8270B	10.0 ug/L	None
Benzidine	EPA 8270B	80.0 ug/L	None
Pyrene	EPA 8270B	10.0 ug/L	None
P-Dimethyl-aminoazobenzene	EPA 8270B	10.0 ug/L	None
N-butylbenzylphthalate	EPA 8270B	10.0 ug/L	None
Benzo (a) Anthracene	EPA 8270B	10.0 ug/L	None
3,3-Dichlorobenzidine	EPA 8270B	20.0 ug/L	None
Chrysene	EPA 8270B	10.0 ug/L	None
Bis(2-Ethyl-hexyl) Phthalate	EPA 8270B	10.0 ug/L	6 ug/L
Di-N-Octyl Phthalate	EPA 8270B	10.0 ug/L	None
Benzo (B)Fluoranthene	EPA 8270B	10.0 ug/L	None
Benzo (K)Fluoranthene	EPA 8270B	10.0 ug/L	None
7,12-Dimethylbenz (A)Anthracene	EPA 8270B	10.0 ug/L	None
Benzo (A)Pyrene	EPA 8270B	10.0 ug/L	0.2ug/L
3-Methyl-cholanthrene	EPA 8270B	10.0 ug/L	None
Dibenz(A,J)Acridine	EPA 8270B	10.0 ug/L	None

SEMIVOLATILE ORGANIC COMPOUNDS (continued) *(Screens #8 and #9)*			
Parameter	**Test Method**	**Minimum Detection Limit**	**Primary Maximum Contaminant Level**
Indeno(1,2,3-C-D)Pyrene	EPA 8270B	10.0 ug/L	None
Dibenz(A.H)Anthra-cene	EPA 8270B	10.0 ug/L	None
Benzo(GHI)-Perylene	EPA 8270B	10.0 ug/L	None
ά-BHC	EPA 8270B	10.0 ug/L	None
'Y-BHC (Lindane)	EPA 8270B	10.0 ug/L	0.2 ug/L
δ-BHC	EPA 8270B	10.0 ug/L	None
β-BHC	EPA 8270B	10.0 ug/L	None
Heptachlor	EPA 8270B	10.0 ug/L	0.4 ug/L
Aldrin	EPA 8270B	10.0 ug/L	None
Heptachlor Epoxide	EPA 8270B	25.0 ug/L	0.2 ug/L
Endosulfan 1	EPA 8270B	50.0 ug/L	None
Dieldrin	EPA 8270B	10.0 ug/L	None
P,P'-DDE	EPA 8270B	10.0 ug/L	None
Endrin	EPA 8270B	20.0 ug/L	2.0 ug/L
Endosulfan 2	EPA 8270B	50.0 ug/L	None
P,P'-DDD	EPA 8270B	10.0 ug/L	None
Endrin Aldehyde	EPA 8270B	10.0 ug/L	None
Endosulfan Sulfate	EPA 8270B	25.0 ug/L	None
P,P'-DDT	EPA 8270B	10.0 ug/L	None

VOLATILE ORGANIC COMPOUNDS *(Screens #7 and #10)*			
Parameter	**Test Method**	**Method Detection Limit**	**Primary Maximum Contaminant Level**
Dichlorodifluoro-methane	EPA 8260A	5.0 ug/L	None
Chloromethane	EPA 8260A	10.0 ug/L	None
Bromomethane	EPA 8260A	10.0 ug/L	None
Chloroethane	EPA 8260A	10.0 ug/L	None
Vinyl Chloride	EPA 8260A	10.0 ug/L	2.0 ug/L
Dichloromethane	EPA 8260A	5.0 ug/L	5.0 ug/L
Trichlorofluoro-methane	EPA 8260A	5.0 ug/L	None
Acetone	EPA 8260A	100 ug/L	None
Dibromomethane	EPA 8260A	5.0 ug/L	None
Trans-1,2-Dichloroethylene	EPA 8260A	5.0 ug/L	100 ug/L
Iodomethane	EPA 8260A	5.0 ug/L	None
Carbon Disulfide	EPA 8260A	5.0 ug/L	None
1,1-Dichloro-ethylene	EPA 8260A	5.0 ug/L	7.0 ug/L
1,1-Dichloroethane	EPA 8260A	5.0 ug/L	None
Cis-1,2-Dichloro-ethylene	EPA 8260A	5.0 ug/L	70.0 ug/L
2,2-Dichloropropane	EPA 8260A	5.0 ug/L	None
Bromochloro-methane	EPA 8260A	5.0 ug/L	None
Chloroform	EPA 8260A	5.0 ug/L	100 ug/L*
1,1-Dichloro-propylene	EPA 8260A	5.0 ug/L	None
1,2-Dichloroethane	EPA 8260A	5.0 ug/L	5.0 ug/L

VOLATILE ORGANIC COMPOUNDS (continued)
(Screens #7 and #10)

Parameter	Test Method	Method Detection Limit	Primary Maximum Contaminant Level
Methyl Ethyl Ketone	EPA 8260A	100 ug/L	None
1,1,1-Trichloro-ethane	EPA 8260A	5.0 ug/L	200 ug/L
Carbon Tetrachloride	EPA 8260A	5.0 ug/L	5.0 ug/L
Vinyl Acetate	EPA 8260A	50 ug/L	None
Bromodichloro-methane	EPA 8260A	5.0 ug/L	100 ug/L*
1,2-Dichloropropane	EPA 8260A	5.0 ug/L	5.0 ug/L
Trichloroethylene	EPA 8260A	5.0 ug/L	5.0 ug/L
Benzene	EPA 8260A	5.0 ug/L	5.0 ug/L
2-Chloroethyl Vinyl Ether	EPA 8260A	5.0 ug/L	None
Cis-1,3-Dichloropropylene	EPA 8260A	5.0 ug/L	None
Trans-1,3-Dichloropropylene	EPA 8260A	5.0 ug/L	None
Chlorodibromo-methane	EPA 8260A	5.0 ug/L	100 ug/L*
1,1,2-Trichloroethane	EPA 8260A	5.0 ug/L	5.0 ug/L
Bromoform	EPA 8260A	5.0 ug/L	100 ug/L*
1,2,3-Trichloro-propane	EPA 8260A	5.0 ug/L	None
Methyl Isobutyl Ketone	EPA 8260A	50 ug/L	None
Methyl N-butyl Ketone	EPA 8260A	50 ug/L	None
Tetrachloroethylene	EPA 8260A	5.0 ug/L	5.0 ug/L

VOLATILE ORGANIC COMPOUNDS (continued) *(Screens #7 and #10)*			
Parameter	**Test Method**	**Method Detection Limit**	**Primary Maximum Contaminant Level**
1,2-Dichloropropane	EPA 8260A	5.0 ug/L	5.0 ug/L
1,1,2,2,-Tetra-chloroethane	EPA 8260A	5.0 ug/L	None
Toluene	EPA 8260A	5.0 ug/L	1000 ug/L
1,2-Dibromoethane	EPA 8260A	5.0 ug/L	None
Ethylene dibromide	EPA 8260A	5.0 ug/L	0.05 ug/L
Chlorobenzene	EPA 8260A	5.0 ug/L	100 ug/L
Ethylbenzene	EPA 8260A	5.0 ug/L	700 ug/L
1,1,1,2-Tetra-chloroethane	EPA 8260A	5.0 ug/L	None
Styrene	EPA 8260A	5.0 ug/L	100 ug/L
Xylenes (total)	EPA 8260A	5.0 ug/L	10,000 ug/L
Isopropylbenzene	EPA 8260A	5.0 ug/L	None
Bromobenzene	EPA 8260A	5.0 ug/L	None
N-Propylbenzene	EPA 8260A	5.0 ug/L	None
2-Chlorotoluene	EPA 8260A	5.0 ug/L	None
1,3,5-Trimethyl-benzene	EPA 8260A	5.0 ug/L	None
4-Chlorotoluene	EPA 8260A	5.0 ug/L	None
Tert-Butylbenzene	EPA 8260A	5.0 ug/L	None
1,2,4-Trimethyl-benzene	EPA 8260A	5.0 ug/L	None
Sec-Butylbenzene	EPA 8260A	5.0 ug/L	None
1,3-Dichlorobenzene (m)	EPA 8260A	5.0 ug/L	None
1,4-Isopropyltoluene	EPA 8260A	5.0 ug/L	None

VOLATILE ORGANIC COMPOUNDS (continued) *(Screens #7 and #10)*			
Parameter	**Test Method**	**Method Detection Limit**	**Primary Maximum Contaminant Level**
1,4-Dichlorobenzene (p)	EPA 8260A	5.0 ug/L	75.0 ug/L
N-Butylbenzene	EPA 8260A	5.0 ug/L	None
1,2-Dichlorobenzene (o)	EPA 8260A	5.0 ug/L	600 ug/L
1,2-Dibromo-3-Chloropropane	EPA 8260A	5.0 ug/L	0.2ug/L
1,2,4-Trichlorobenzene	EPA 8260A	5.0 ug/L	70.0 ug/L
Hexachlorobutadi-ene	EPA 8260A	5.0 ug/L	None
Naphthalene	EPA 8260A	5.0 ug/L	None
1,2,3-Trichlorobenzene	EPA 8260A	5.0 ug/L	None

* *Indicates a trihalomethane compound. The primary MCL for total trihalomethanes is 100 ug/L.*

MERCURY			
Parameter	**Test Method**	**Method Detection Limit**	**Primary Maximum Contaminant Level**
Mercury (Hg)	EPA 245.2	0.2 ug/L	2.0 ug/L

Table A-3. 1995 Ground-Water Quality Analyses of the Cretaceous Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-K1		4.30	2.6	5U	2.9	1.1	19	13	77	50	1800	2.4	0.1U	19.65	0.3	69	Be=0.8 Y=26 Zn=39	b,c
	Well Name:		Englehard Kaolin Company #2															
	County:		Wilkinson															
	Date Sampled:		1995/05/10															
GWN-K2		4.53	1.9	5U	1.3	1U	10U	10U	43	10U	67	2.04	0.1U	3.71	0.3	29		b,c,v
	Well Name:		Irwinton #2															
	County:		Wilkinson															
	Date Sampled:		1995/05/11															
GWN-K3		5.99	2.3	5U	17	1.4	55	24	420	33	50U	2.29	0.1U	7.51	0.2U	105		a,b,c,d,v
	Well Name:		Sandersville #7B															
	County:		Washington															
	Date Sampled:		1995/05/10															
GWN-K5		3.80	2.0	5U	1U	1U	10U	10U	20U	10U	50U	1.73	0.1U	2U	0.9	20	dimethyl phthalate=22.7	b,c,s,v
	Well Name:		Richmond County #101															
	County:		Richmond															
	Date Sampled:		1995/05/20															
GWN-K6		5.44	3.3	5U	4.1	1U	50	15	20U	10U	50U	2.51	0.1U	4.26	0.2U	45	Zn=26	v
	Well Name:		J.M. Huber #6															
	County:		Twiggs															
	Date Sampled:		1995/05/11															
GWN-K7		4.93	1.9	5U	1.8	1U	11	13	20U	10U	50U	2.38	0.1U	2U	0.2U	23		b,c
	Well Name:		Jones County #4															
	County:		Jones															
	Date Sampled:		1995/05/10															
GWN-K8		6.41	2.5	5U	30	1.3	120	79	3900	48	50U	1.93	0.103	11.5	0.2U	179		v
	Well Name:		Mohawk Carpet #3															
	County:		Laurens															
	Date Sampled:		1995/02/23															
GWN-K8		6.87	2.9	5U	39	1.7	170	78	2600	32	130	2.00	0.12	13.14	0.2U	269		v
	Well Name:		Mohawk Carpet #3															
	County:		Laurens															
	Date Sampled:		1995/12/19															

Table A-3 (Continued). 1995 Ground-Water Quality Analyses of the Cretaceous Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-K9		4.40	1.2	5U	1U	1U	10U	10U	460	10U	470	1.53	0.1U	7.99	0.2U	46		
	Well Name:		Marshallville #1															
	County:		Macon															
	Date Sampled:		1995/05/11															
GWN-K10		4.33	3.2	5U	1.3	1U	10U	10U	20U	10U	50U	3.18	0.1U	2U	1.4	33		b,c,v
	Well Name:		Fort. Valley #1															
	County:		Peach															
	Date Sampled:		1995/02/22															
GWN-K10		4.85	3.8	5U	1.3	1U	10U	10U	20U	10U	50U	3.35	0.1U	1.27	1.4	30		b,c,v
	Well Name:		Fort. Valley #1															
	County:		Peach															
	Date Sampled:		1995/11/02															
GWN-K11A		4.15	1.7	5U	1U	1U	10U	10U	20U	10U	50U	1.58	0.1U	2U	0.7	20		b,c,v
	Well Name:		Warner Robins #2															
	County:		Houston															
	Date Sampled:		1995/02/22															
GWN-K11A		4.91	2.0	5U	1U	1U	10U	10U	71	10U	50U	1.54	0.1U	1.14	0.8	17		b,c
	Well Name:		Warner Robins #2															
	County:		Houston															
	Date Sampled:		1995/11/02															
GWN-K12		4.77	1.7	5U	1U	1U	10U	10U	240	12	350	1.69	0.1U	7.87	0.2U	44	Zn=110	a,b,c,d,v
	Well Name:		Perry/Holiday Inn Well															
	County:		Houston															
	Date Sampled:		1995/02/22															
GWN-K12		4.05	1.5	5U	1U	1U	10U	10U	160	11	400	1.58	0.1U	8.65	0.2U	45	Cu=29 Zn=27	a,b,c,d,v
	Well Name:		Perry/Holiday Inn Well															
	County:		Houston															
	Date Sampled:		1995/11/02															
GWN-K13		9.13	44	5U	2.2	1U	39	10U	20U	10U	50U	8.9	0.1U	10U	0.2U	202		
	Well Name:		Omaha #1															
	County:		Stewart															
	Date Sampled:		1995/01/06															

Table A-3 (Continued). 1995 Ground-Water Quality Analyses of the Cretaceous Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Screens Tested
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-K13		9.03	46	5U	2.3	1U	42	10U	20U	10U	50U	8.25	0.1U	6.68	0.2U	202		
	Well Name:		Omaha #1															
	County:		Stewart															
	Date Sampled:		1995/05/11															
GWN-K16		5.62	4.4	5U	1U	1U	10U	10U	20U	10U	50U	2.15	0.1U	2.49	0.4	27	Zn=24	b,c,v
	Well Name:		Packaging Corp. Amer. North Well															
	County:		Bibb															
	Date Sampled:		1995/02/22															
GWN-K16		5.27	4.7	5U	1U	1U	10U	10U	140	10U	50U	2.05	0.1U	2.12	0.4	22	Cu=36	b,c,v
	Well Name:		Packaging Corp. Amer. North Well															
	County:		Bibb															
	Date Sampled:		1995/11/02															
GWN-K18A		4.98	1.4	5U	1.3	1U	10U	10U	35	10U	50U	1.48	0.1U	3.57	0.2U	24		b,c,v
	Well Name:		Buena Vista #6															
	County:		Marion															
	Date Sampled:		1995/05/11															
GWN-K19		4.88	1.4	5U	1U	1U	10U	10U	20U	10U	50U	1.64	0.1U	2U	0.2U	17		b,c,v
	Well Name:		Hephzibah Murphy St. Well															
	County:		Richmond															
	Date Sampled:		1995/06/21															

Table A-4. 1995 Ground-Water Quality Analyses of the Providence Aquifer System

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Screens Tested
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-PD3		8.37	79	5U	6.1	1.0	97	10U	20U	10U	50U	9.7	0.5U	10U	0.2U	368		
	Well Name:		Ft. Gaines #2															
	County:		Clay															
	Date Sampled:		1995/01/06															
GWN-PD3		8.52	81	5U	6.2	1U	96	10U	20U	10U	50U	9.86	0.61	9.96	0.2U	334		
	Well Name:		Ft. Gaines #2															
	County:		Clay															
	Date Sampled:		1995/09/28															

Table A-5. 1995 Ground-Water Quality Analyses of the Clayton Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-CT2A		7.93	6.7	5U	40	3.0	280	10U	320	10U	50U	3.4	0.5U	10U	0.2U	243	Zn=31	a,b,c screen 5
	Well Name:		Burton Thomas Residence Well															
	County:		Sumter															
	Date Sampled:		1995/01/06															
GWN-CT2A		7.90	6.1	5U	39	2.9	260	10U	320	10U	50U	1.34	0.1U	17.26	0.2U	229	Zn=30	a,b,c,d,v
	Well Name:		Burton Thomas Residence Well															
	County:		Sumter															
	Date Sampled:		1995/10/18															
GWN-CT3		7.80	7.7	5U	39	4.2	410	10U	37	10U	50U	4.0	0.5U	14.7	0.2U	250		v
	Well Name:		Dawson Crawford St. Well															
	County:		Terrell															
	Date Sampled:		1995/01/04															
GWN-CT3		7.77	7.3	5U	38	4.1	400	10U	32	10U	50U	1.78	0.1U	12.58	0.2U	232		v
	Well Name:		Dawson Crawford St. Well															
	County:		Terrell															
	Date Sampled:		1995/10/18															
GWN-CT5A		7.68	2.6	5U	45	3.9	150	16	110	35	50U	1.87	0.1U	11.2	0.2U	247		a,b,c screen 5
	Well Name:		Cuthbert #3															
	County:		Randolph															
	Date Sampled:		1995/01/04															
GWN-CT5A		7.68	2.0	5U	42	3.8	150	15	170	33	50U	1.72	0.1U	11.61	0.2U	231		b,c,d,v
	Well Name:		Cuthbert #3															
	County:		Randolph															
	Date Sampled:		1995/10/18															
GWN-CT7A		4.60	2.2	5U	4.6	5.8	71	30	330	15	290	10.40	0.2U	2U	7.4	108		b,c,d,v
	Well Name:		St. John Farm Well															
	County:		Sumter															
	Date Sampled:		1995/10/18															
GWN-CT8		4.78	2.6	5U	1U	1U	10U	10U	20U	13	50U	3.23	0.1U	2U	0.8	25		b,c,d,v
	Well Name:		Weathersby house well															
	County:		Schley															
	Date Sampled:		1995/09/26															

Table A-6. 1995 Ground-Water Quality Analyses of the Claiborne Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-CL2		7.47	1.5	5U	41	1U	96	12	20U	10U	50U	1.70	0.1U	7.33	0.2	213		
	Well Name:		Unadilla #3															
	County:		Dooly															
	Date Sampled:		1995/04/18 (special followup for excessive F)															
GWN-CL2		7.42	1.6	5U	42	1U	100	12	20U	10U	50U	1.73	0.21	8.34	0.2U	194		c
	Well Name:		Unadilla #3															
	County:		Dooly															
	Date Sampled:		1995/09/27															
GWN-CL4		5.28	--	--	--	--	--	--	--	--	--	--	--	--	--	52	C6H6=7.20 methyl tert-butyl ether=16	v only
	Well Name:		Plains #3															
	County:		Sumter															
	Date Sampled:		1995/03/06 (special followup for excessive C6H6)															
GWN-CL4		4.81	4.2	5U	1.9	1.2	14	17	20U	59	50U	5.83	0.1U	2U	3.0	52	Cu=53 Zn=62 C6H6=tr methyl tert-butyl ether=17.6	a,b,c,d,v
	Well Name:		Plains #3															
	County:		Sumter															
	Date Sampled:		1995/09/27															
GWN-CL6		7.86	21	5U	34	7.6	430	10U	75	10U	50U	5U	0.5U	5.2	0.2U	308		
	Well Name:		Georgia Tubing Company Well															
	County:		Early															
	Date Sampled:		1995/01/05															
GWN-CL6		7.72	21	5U	34	7.7	430	10U	68	10U	50U	3.71	0.11	3.76	0.2U	283		
	Well Name:		Georgia Tubing Company Well															
	County:		Early															
	Date Sampled:		1995/09/28															
GWN-CL8		6.25	2.2	5U	11	1.1	41	37	670	51	50U	1.52	0.1U	7.74	0.2U	78	Zn=43	b,c,v
	Well Name:		Flint River Nursery Office Well															
	County:		Dooly															
	Date Sampled:		1995/09/27															
GWN-CL9		7.95	23	5U	24	6.5	350	10U	23	10U	50U	2.43	0.14	6.75	0.2U	227	CHCl3=tr	b,c,d,v
	Well Name:		Newton #3															
	County:		Baker															
	Date Sampled:		1995/10/19															

Table A-7. 1995 Ground-Water Quality Analyses of the Jacksonian Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-J1B		7.60	5.1	5U	55	1U	25	22	37	10U	50U	8.03	0.1U	2U	2.3	266	Zn=21	a,b,c,d,v
	Well Name:		Quick house well															
	County:		Burke															
	Date Sampled:		1995/08/03															
GWN-J2A		6.75	1.5	5U	31	1U	37	35	240	29	50U	--	--	--	0.4	146	Zn=220	a,b,c,d,v
	Well Name:		Oakwood Village Mobile Home Park #2															
	County:		Burke															
	Date Sampled:		1995/06/21															
GWN-J3		7.82	9.3	5U	36	5.7	270	650	98	130	50U	6.89	0.1U	2U	0.2U	245		a,b,c,d,v
	Well Name:		Black house well															
	County:		Emanuel															
	Date Sampled:		1995/06/21															
GWN-J4		7.31	3.4	5U	47	2.3	170	10U	56	10U	50U	2.50	0.14	7.11	0.2U	245		a,b,c,d
	Well Name:		Wrightsville #4															
	County:		Johnson															
	Date Sampled:		1995/06/22															
GWN-J5		7.11	3.2	5U	68	2.3	200	10U	110	28	50U	2.45	0.2	8.23	0.2U	329		a,b,c,d,v
	Well Name:		Cochran #3															
	County:		Bleckley															
	Date Sampled:		1995/06/21															
GWN-J6		6.07	1.7	5U	27	1U	90	12	160	11	50U	1.81	0.1U	8.23	0.2U	143		a,b,c,d,v
	Well Name:		Wrens #3															
	County:		Jefferson															
	Date Sampled:		1995/06/22															
GWN-J7		4.80	3.9	5U	2.8	1.7	18	27	20U	15	50U	6.92	0.1U	2U	3.2	60		a,b,c,d
	Well Name:		Templeton livestock well															
	County:		Burke															
	Date Sampled:		1995/06/21															
GWN-J8		---	5.9	5U	9.9	1.7	22	45	20U	78	58	--	--	--	8.7	--	Be=4.1 Cd=1.8 Zn=55	a,b,c,d
	Well Name:		Kahn house well															
	County:		Jefferson															
	Date Sampled:		1995/08/03															

Table A-8. 1995 Ground-Water Quality Analyses of the Floridan Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-PA1		7.96	110	5.1	34	19	410	13	20U	10U	50U	182.56	0.39	24.33	0.2U	857		
	Well Name:		Thunderbolt #1															
	County:		Chatham															
	Date Sampled:		1995/09/14															
GWN-PA2A		8.11	11	5U	24	7.8	280	12	20U	10U	50U	3.99	0.36	5.54	0.2U	225		
	Well Name:		Savannah #6															
	County:		Chatham															
	Date Sampled:		1995/09/14															
GWN-PA4		7.96	56	5U	36	27	1300	10U	20U	10U	50U	48.57	0.66	148.22	0.2U	662		
	Well Name:		Tybee Island #1															
	County:		Chatham															
	Date Sampled:		1995/09/14															
GWN-PA5A		7.99	17	5U	25	14	400	30	20U	10U	50U	5.34	0.47	35.3	0.2U	311		v
	Well Name:		Interstate Paper #2															
	County:		Liberty															
	Date Sampled:		1995/03/21															
GWN-PA6		7.89	15	5U	24	12	360	24	20U	10U	50U	4.36	0.45	22.6	0.2U	267		v
	Well Name:		Hinesville #5															
	County:		Liberty															
	Date Sampled:		1995/03/22															
GWN-PA7		7.98	25	5U	44	27	700	53	190	10U	50U	22.2	0.56	127	0.2U	548		v
	Well Name:		Darien #2 South															
	County:		McIntosh															
	Date Sampled:		1995/03/21															
GWN-PA8		7.97	18	5U	31	17	530	75	20U	10U	50U	6.8	0.4	51.7	0.2U	359		v
	Well Name:		ITT Rayonier #4D															
	County:		Wayne															
	Date Sampled:		1995/03/21															
GWN-PA9C		8.67	725	15	94	84	2100	53	1400	61	50U	1385	5U	284	0.2U	4800	Zn=50 tetrahydrofuran=30	v
	Well Name:		Miller Ball Park TW25															
	County:		Glynn															
	Date Sampled:		1995/03/21															

Table A-8 (Continued). 1995 Ground-Water Quality Analyses of the Floridan Aquifer System

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-PA10B		7.54	67	5U	78	44	780	42	20U	10U	50U	116	0.50	177	0.2U	1016		
	Well Name:		Gilman Paper #11															
	County:		Camden															
	Date Sampled:		1995/03/22															
GWN-PA11		7.67	24	5U	72	38	650	37	33	10U	50U	29.9	0.50	166	0.2U	704		v
	Well Name:		St. Marys #2															
	County:		Camden															
	Date Sampled:		1995/03/22															
GWN-PA12		7.51	23	5U	68	30	510	36	71	10U	50U	26.8	0.72	116	0.2U	621		v
	Well Name:		Folkston #3															
	County:		Charlton															
	Date Sampled:		1995/03/22															
GWN-PA13		7.75	17	5U	42	17	340	75	20	10U	50U	13.2	0.32	51.3	0.2U	393		v
	Well Name:		Waycross #3															
	County:		Ware															
	Date Sampled:		1995/03/22															
GWN-PA14		7.92	6.2	5U	34	4.9	180	28	20U	11	50U	2.72	0.23	5.87	0.2U	219		v
	Well Name:		Statesboro #7															
	County:		Bulloch															
	Date Sampled:		1995/06/22															
GWN-PA15		7.88	8.4	5U	26	8.5	390	10U	420	10U	50U	2.54	0.27	7.34	0.2U	236	Zn=120	v
	Well Name:		King Finishing Co. fire well															
	County:		Screven															
	Date Sampled:		1995/03/21															
GWN-PA16		7.74	5.5	5U	45	3.0	190	10U	20U	35	50U	4.79	0.12	8.05	0.2U	264		
	Well Name:		Millen #1															
	County:		Jenkins															
	Date Sampled:		1995/03/21															
GWN-PA17		7.57	4.5	5U	60	1.9	170	190	240	26	170	2.74	0.78	2U	0.2U	251	Cu=23	
	Well Name:		Swainsboro #7															
	County:		Emanuel															
	Date Sampled:		1995/03/21															

Table A-8 (Continued). 1995 Ground-Water Quality Analyses of the Floridan Aquifer System

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-PA18		7.88	11	5U	30	3.3	240	25	20U	59	50U	3.50	0.19	3.98	0.2U	217		v
	Well Name:		Metter #2															
	County:		Candler															
	Date Sampled:		1995/03/22															
GWN-PA19		7.86	11	5U	45	19	450	56	63	27	50U	7.40	0.30	78.0	0.2U	357		v
	Well Name:		Douglas #4															
	County:		Coffee															
	Date Sampled:		1995/04/05															
GWN-PA20		7.96	4.8	5U	44	16	190	28	20U	10U	50U	3.32	0.27	61.0	0.2U	406		v
	Well Name:		Lakeland #2															
	County:		Lanier															
	Date Sampled: ; 1		1995/04/04															
GWN-PA21A		7.95	2.9	5U	36	8.6	120	15	20U	20	50U	2.87	0.20	30.9	0.2U	256		
	Well Name:		Valdosta New #4															
	County:		Lowndes															
	Date Sampled: ;		1995/04/04															
GWN-PA22		7.86	7.6	5U	44	20	330	24	20U	10U	50U	6.56	0.40	71.0	0.2U	396		
	Well Name:		Thomasville #6															
	County:		Thomas															
	Date Sampled:		1995/04/04															
GWN-PA23		7.72	14	5U	35	1.6	370	130	60	10U	50U	6.99	0.31	45.3	0.2U	354	Mo=29	
	Well Name:		Cairo #8															
	County:		Grady															
	Date Sampled:		1995/04/04															
GWN-PA24		8.26	2.1	5U	38	3.5	37	10U	20U	10U	50U	3.03	0.1U	2U	1.3	182		a,b,c,d,v
	Well Name:		Bainbridge #1															
	County:		Decatur															
	Date Sampled:		1995/04/18															
GWN-PA25		7.94	3.9	5U	55	1U	23	10U	20U	10U	50U	4.43	0.1U	2U	1.4	235		a,b,c,d,v
	Well Name:		Donalsonville 7th Street Well															
	County:		Seminole															
	Date Sampled:		1995/04/18															

Table A-8 (Continued). 1995 Ground-Water Quality Analyses of the Floridan Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-PA26		8.09	2.3	5U	44	1U	17	10U	20U	10U	50U	3.17	0.1U	2U	1.7	188		a,b,c,d,v
	Well Name:		Colquitt #3															
	County:		Miller															
	Date Sampled:		1995/04/18															
GWN-PA27		8.02	1.9	5U	42	1.1	32	10U	20U	10U	50U	2.36	0.1U	2U	0.2	180	dimethyl phthalate=tr	a,b,c,d,s,v
	Well Name:		Camilla New Well															
	County:		Mitchell															
	Date Sampled:		1995/04/19															
GWN-PA28		8.06	27	5U	38	21	2100	93	20U	10U	50U	9.11	0.52	118	0.2U	484		v
	Well Name:		Moultrie #1															
	County:		Colquitt															
	Date Sampled:		1995/04/04															
GWN-PA29		7.81	3.4	5U	42	14	280	13	66	33	50U	3.17	0.24	45.3	0.2U	325		v
	Well Name:		Adel #6															
	County:		Cook															
	Date Sampled:		1995/04/04															
GWN-PA30		7.88	4.9	5U	40	16	220	54	35	10U	50U	4.10	0.29	62.1	0.2U	338		
	Well Name:		Amoco/Nashville Mills #2															
	County:		Berrien															
	Date Sampled:		1995/04/04															
GWN-PA31		7.35	2.6	5U	42	8.0	260	66	20U	10U	50U	2.24	0.15	2U	0.2U	267		
	Well Name:		Tifton #6															
	County:		Tift															
	Date Sampled:		1995/04/05															
GWN-PA32		7.87	2.5	5U	33	4.8	150	77	130	28	50U	2.31	0.10	2U	0.2U	196		v
	Well Name:		Ocilla #3															
	County:		Irwin															
	Date Sampled:		1995/04/05															
GWN-PA33A		7.90	2.6	5U	32	5.9	180	330	20U	10U	50U	3.10	0.45	2U	0.2U	208	CHCl3=8.04 CHBrCl2=tr	v
	Well Name:		Fitzgerald Well G															
	County:		Ben Hill															
	Date Sampled:		1995/04/05															

Table A-8 (Continued). 1995 Ground-Water Quality Analyses of the Floridan Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-PA34		7.33	5.2	5U	49	9.7	660	260	180	100	50U	4.91	0.2	3.94	0.2U	324		v
	Well Name:		McRae Telfair Ave. Well															
	County:		Telfair															
	Date Sampled:		1995/02/23															
GWN-PA35		7.64	6.0	5U	29	12	440	90	63	30	50U	3.37	0.36	7.64	0.2U	191		
	Well Name:		Mt. Vernon New Well															
	County:		Montgomery															
	Date Sampled:		1995/02/23															
GWN-PA35		7.94	6.1	5U	27	12	460	89	60	29	50U	3.37	0.34	7.73	0.2U	277		
	Well Name:		Mt. Vernon New Well															
	County:		Montgomery															
	Date Sampled:		1995/12/20															
GWN-PA36		7.90	13	5U	27	5.1	340	150	24	32	50U	4.78	0.88	3.91	0.2U	231		
	Well Name:		Vidalia #1															
	County:		Toombs															
	Date Sampled:		1995/02/23															
GWN-PA36		8.06	11	5U	27	5.1	350	140	21	36	50U	3.66	0.27	3.70	0.2U	261	Cu=29	
	Well Name:		Vidalia #1															
	County:		Toombs															
	Date Sampled:		1995/12/20															
GWN-PA38		7.49	2.2	5U	43	1.3	85	110	20U	10U	50U	2.23	0.1U	2U	0.3	227		v
	Well Name:		Eastman #4															
	County:		Dodge															
	Date Sampled:		1995/02/23															
GWN-PA38		7.76	2.1	5U	42	1.3	89	110	20U	10U	50U	2.21	0.1U	1.33	0.3	202	Cu=30	
	Well Name:		Eastman #4															
	County:		Dodge															
	Date Sampled:		1995/12/20															
GWN-PA39		7.68	3.5	5U	46	7.1	350	190	20U	10U	50U	2.44	0.19	2.06	0.2U	306		a,b,c,d,v
	Well Name:		Sylvester #1															
	County:		Worth															
	Date Sampled:		1995/04/17															

Table A-8 (Continued). 1995 Ground-Water Quality Analyses of the Floridan Aquifer System.

PARAMETER / Well ID#	UNITS	pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
		SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-PA40		7.79	2.6	5U	57	1.1	48	16	20U	10U	50U	3.37	0.1U	2U	1.6	313		v
	Well Name:		Merck and Co. #8															
	County:		Worth															
	Date Sampled:		1995/04/19															
GWN-PA43A		7.70	2.4	5U	48	1U	31	10U	20U	10U	50U	5.04	0.1U	1.20	2.3	246		a,b,c,d,v
	Well Name:		Pineland Fish Farm office well															
	County:		Baker															
	Date Sampled:		1995/10/19															
GWN-PA44		7.73	2.4	5U	30	4.1	270	140	20U	10U	50U	1.98	0.18	2U	0.2U	188		v
	Well Name:		Sycamore #2															
	County:		Turner															
	Date Sampled:		1995/04/05															
GWN-PA45A		7.61	1.9	5U	52	1U	63	68	20U	10U	50U	2.41	0.1U	2U	0.4	267		v
	Well Name:		Abbeville #1															
	County:		Wilcox															
	Date Sampled:		1995/04/05															
GWN-PA49		7.58	1.9	5U	40	1U	24	19	20U	10U	50U	2.58	0.1U	2U	1.7	209	Zn=56	a,b,c,d
	Well Name:		Harmony Church well															
	County:		Dooly															
	Date Sampled:		1995/04/05															
GWN-PA50		7.43	3.2	5U	59	1.3	160	39	36	10U	50U	4.11	0.1U	5.10	1.3	248		a,b,c,d,v
	Well Name:		Reynolds house well															
	County:		Laurens															
	Date Sampled:		1995/08/02															
GWN-PA51		7.68	2.6	5U	45	1U	19	10U	20U	10U	50U	3.09	0.1U	2U	1.0	210		a,b,c
	Well Name:		J.L. Adams house well															
	County:		Mitchell															
	Date Sampled:		1995/09/28															
GWN-PA52		8.14	2.4	5U	38	1U	22	10U	20U	10U	50U	3.94	0.1U	2U	3.3	205	Zn=45	a,b,c,d
	Well Name:		James Simmons house well															
	County:		Mitchell															
	Date Sampled:		1995/04/20															

Table A-8 (Continued). 1995 Ground-Water Quality Analyses of the Floridan Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-PA53		7.82	2.8	5U	39	1U	24	11	20U	10U	50U	3.09	0.1U	2U	4.6	195	Zn=34	a,b,c
	Well Name:		Lorene Cato house well															
	County:		Decatur															
	Date Sampled:		1995/09/28															
GWN-PA55		7.93	4.0	5U	48	2.3	220	160	20U	10U	50U	2.26	0.1U	4.71	0.2U	242		a,b,c,v
	Well Name:		W.A. Holland house well															
	County:		Burke															
	Date Sampled:		1995/08/03															

Table A-9. 1995 Ground-Water Quality Analyses of the Miocene Aquifer System.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-MI1	Well Name: McMillan house well County: Cook Date Sampled: 1995/05/10	8.03	6.9	5U	24	14	120	20	20U	25	50U	2.66	0.35	3.64	0.2U	235	Bi=35	a,b,c,d,v
GWN-MI2	Well Name: Boutwell house well County: Lowndes Date Sampled: 1995/05/10	5.79	2.6	5U	3.1	1U	10U	10U	20U	10U	50U	2.85	0.1U	2U	0.2U	36	dimethyl phthalate=tr	a,b,c,d,s,v
GWN-MI5	Well Name: Carter house well County: Appling Date Sampled: 1995/06/22	5.31	5.4	5U	4.5	1.2	21	57	22	71	50	11.30	0.1U	2.73	1.7	74	Zn=40	a,b,c
GWN-MI7	Well Name: Chaudoin house well County: Irwin Date Sampled: 1995/11/21	4.26	6.3	5U	5.8	5.1	57	93	20U	16	760	12.8	0.12	1U	10.8	142		a,b,c,v
GWN-MI8A	Well Name: Barry house well County: Colquitt Date Sampled: 1995/11/21	4.33	5.3	5U	6.8	6.4	69	160	66	62	1400	17.2	0.1U	1U	12.3	168	Ti=12 Zn=49 CHCl3=tr	a,b,c,d,v
GWN-MI9A	Well Name: Murphy garden well County: Thomas Date Sampled: 1995/11/21	5.64	6.2	5U	7.3	4.2	52	42	87	16	140	7.72	0.1U	3.68	7.7	110		a,b,c
GWN-MI10B	Well Name: Calhoun house well County: Colquitt Date Sampled: 1995/11/21	--	8.4	5U	9.3	6.3	90	210	320	150	50U	2.81	0.34	2.12	0.2U	122		a,b,c,d,v
GWN-MI15	Well Name: Aldrich house well County: Bulloch Date Sampled: 1995/06/22	4.52	1.7	5U	10	7.7	92	53	20U	13	220	8.77	0.1U	2U	13.8	138		a,b,c,d

Table A-10. 1995 Ground-Water Quality Analyses of the Piedmont/Blue Ridge Unconfined Aquifers.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-BR1B		6.82	3.1	5U	10	3.3	46	110	20U	20	50U	1U	0.1U	14.07	0.2U	96	Zn=150	v
	Well Name:		Young Harris New Well															
	County:		Towns															
	Date Sampled:		1995/08/25															
GWN-BR2A		5.70	3.8	5U	3.4	1.4	36	46	35	19	50U	3.25	0.1U	2U	1.2	48		v
	Well Name:		Notla Water Auth. #3															
	County:		Union															
	Date Sampled:		1995/07/20															
GWN-BR3A		5.33	4.4	5U	2.6	1.2	20	24	20U	64	84	4.94	0.1U	2U	1.7	50		
	Well Name:		Dawsonville City Spring															
	County:		Dawson															
	Date Sampled:		1995/07/20															
GWN-BR4		6.12	6.7	5U	10	2.1	85	10U	20U	10U	50U	3.84	0.06	1.65	2.0	108		
	Well Name:		Morganton Old Well															
	County:		Fannin															
	Date Sampled:		1994/08/02															
GWN-P1B		6.39	9.3	5U	7.8	2.5	96	10U	2200	62	50U	5.08	0.133	16.7	0.2U	118		
	Well Name:		Luthersville New Well															
	County:		Meriwether															
	Date Sampled:		1995/01/03															
GWN-P1B		6.24	9.3	5U	7.6	2.4	93	10U	2100	60	50U	5.61	0.1U	15.64	0.2U	114		
	Well Name:		Luthersville New Well															
	County:		Meriwether															
	Date Sampled:		1995/05/24															
GWN-P2		6.51	9.6	5U	12	1.6	90	30	300	23	50U	3.2	0.1U	2U	1.8	113	Zn=28	v
	Well Name:		Riverdale Delta Drive Well															
	County:		Clayton															
	Date Sampled:		1995/05/23															
GWN-P4C		6.34	7.7	5U	7.2	1.2	70	19	20U	10U	50U	1.6	0.4	2U	1.6	86		
	Well Name:		Barton Brands #3															
	County:		Fulton															
	Date Sampled:		1995/05/23															

Table A-10 (Continued). 1995 Ground-Water Quality Analyses of the Piedmont/Blue Ridge Unconfined Aquifers.

PARAMETER	pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID# / UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-P5 Well Name: Flowery Branch #1 County: Hall Date Sampled: 1995/02/08	7.07	1.9	5U	23	4.0	85	29	20U	10U	50U	--	--	--	0.4	141		v
GWN-P5 Well Name: Flowery Branch #1 County: Hall Date Sampled: 1995/12/06	6.94	3.3	5U	24	3.9	85	28	20U	10U	50U	1.36	0.1U	1.87	0.5	150		v
GWN-P6B Well Name: Shiloh #1 County: Harris Date Sampled: 1995/05/12	7.39	8.0	5U	18	2.5	44	10U	120	99	50U	1.88	0.45	5.60	0.2U	143	Bi=38	
GWN-P7 Well Name: Hampton #6 County: Henry Date Sampled: 1995/05/24	6.22	7.6	5U	11	4.1	63	48	21	10U	50U	2.1	0.1U	4.0	0.3	116		v
GWN-P8 Well Name: Wayne Poultry #4 County: Jackson Date Sampled: 1995/02/08	6.65	9.5	5U	31	9.8	84	10U	20U	10U	50U	--	--	--	0.2U	244		v
GWN-P8 Well Name: Wayne Poultry #4 County: Jackson Date Sampled: 1995/12/06	6.81	11.0	5U	30	9.3	80	10U	20U	10U	50U	17.1	0.15	5.75	0.3	253		v
GWN-P9 Well Name: Gray #4 County: Jones Date Sampled: 1995/05/10	6.33	15	5U	19	8.6	140	46	990	150	50U	8.08	0.1U	38.54	0.2U	239	Zn=41	
GWN-P10A Well Name: Franklin Springs #4 County: Franklin Date Sampled: 1995/02/08	6.34	8.2	5U	13	6.1	140	11	19000	120	1000	--	--	--	0.2U	150.8	Be=3.4 Zn=320	10

Table A-10 (Continued). 1995 Ground-Water Quality Analyses of the Piedmont/Blue Ridge Unconfined Aquifers.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-P10A		6.37	7.8	5U	12	5.3	120	15	81000	160	2900	4.12	0.28	65.2	0.2U	162	Be=4.3 Cd=0.3 Zn=650	v
	Well Name:		Franklin Springs #4															
	County:		Franklin															
	Date Sampled:		1995/12/05															
GWN-P11A		6.43	6.8	5U	12	5.8	34	11	140	23	50U	--	--	--	0.2	126		
	Well Name:		Danielsville #3															
	County:		Madison															
	Date Sampled:		1995/02/08															
GWN-P11A		6.72	6.8	5U	11	5.4	33	10	170	22	50U	2.72	0.1U	6.89	0.3	132		
	Well Name:		Danielsville #3															
	County:		Madison															
	Date Sampled:		1995/12/05															
GWN-P12A		7.16	36	5U	15	2.4	150	10U	20U	20	50U	9.80	4.15	24.11	0.2U	238	Zn=21	
	Well Name:		Indian Spring															
	County:		Butts															
	Date Sampled:		1995/05/25															
GWN-P13A		5.60	6.7	5U	4.4	1.1	38	30	20U	10U	50U	7.99	0.1U	2U	0.7	69		
	Well Name:		Covington/Academy Spring															
	County:		Newton															
	Date Sampled:		1995/05/25															
GWN-P14		4.95	1.7	5U	1U	1U	10U	29	20U	10U	50U	1.70	0.1U	2U	0.4	20		
	Well Name:		Upson County Sunset Village well															
	County:		Upson															
	Date Sampled:		1995/05/24															
GWN-P15A		6.79	8.1	5U	19	4.4	94	56	420	81	50U	6.70	0.1	6.86	0.2U	179	Cd=0.5 Zn=320	v
	Well Name:		Bolton garden well															
	County:		DeKalb															
	Date Sampled:		1995/05/23															
GWN-P16C		6.46	2.8	5U	8.2	1.6	48	10U	830	67	50U	1U	0.1U	7.32	0.2U	64	Zn=55 vinyl chloride=20.2 1,1,2-trichloro-ethane=8.58	v
	Well Name:		Mt. Airy #4															
	County:		Habersham															
	Date Sampled:		1995/07/19															

Table A-10 (Continued). 1995 Ground-Water Quality Analyses of the Piedmont/Blue Ridge Unconfined Aquifers.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-P16C		6.36	3.6	5U	7.7	1.6	49	10U	1600	68	50U	0.98	0.1U	7.76	0.2U	68		v
	Well Name:		Mt. Airy #4															
	County:		Habersham															
	Date Sampled:		1995/12/05															
GWN-P17		7.55	8.2	5U	25	2.1	130	10U	420	120	50U	2.75	0.10	12.80	0.2U	168	Zn=34	a,b,c,d,v
	Well Name:		Oconee County Hillcrest #2															
	County:		Oconee															
	Date Sampled:		1995/12/05															

Table A-11. 1995 Ground-Water Quality Analyses of the Valley and Ridge Unconfined Aquifers.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-VR1		7.83	1.9	5U	29	14	15	10U	20U	10U	50U	1.82	0.1U	2U	0.6	190		v
	Well Name:		Floyd County Kingston Rd, Well															
	County:		Floyd															
	Date Sampled:		1995/07/27															
GWN-VR3		7.52	1.8	5U	29	12	24	74	74	10U	140	1.60	0.1U	2.65	0.7	202		v
	Well Name:		Chickamauga Crawfish Spring															
	County:		Walker															
	Date Sampled:		1995/07/28															
GWN-VR4		7.21	6.3	5U	110	23	650	180	150	29	50U	--	--	34.3	0.2U	835		v
	Well Name:		Coats-American #3															
	County:		Walker															
	Date Sampled:		1995/07/28															
GWN-VR5		7.21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	methyl-tert-butyl ether=40 methyl-tert-amyl ether=2.4	v
	Well Name:		Chattooga County #4															
	County:		Chattooga															
	Date Sampled:		1995/03/07 (special, screen #10 only)															
GWN-VR5		7.25	5.5	5U	83	3.7	170	100	20U	10U	50U	7.77	0.1U	3.84	3.2	345	methyl-tert-butyl ether=26.7	v
	Well Name:		Chattooga County #4															
	County:		Chattooga															
	Date Sampled:		1995/07/27															
GWN-VR5		7.26	5.4	5U	69	3.5	160	97	20U	10U	50U	7.34	0.1U	4.68	3.1	385		v
	Well Name:		Chattooga County #4															
	County:		Chattooga															
	Date Sampled:		1995/12/07															
GWN-VR6		7.86	5.7	5U	30	16	160	580	20U	10U	50U	3.75	0.1U	4.99	0.8	218	tetrachloro-ethylene=tr	v
	Well Name:		Chemical Products Corp. East Well															
	County:		Bartow															
	Date Sampled:		1995/07/27															
GWN-VR7		7.71	1.4	5U	28	13	23	34	20U	10U	50U	1.23	0.1U	2U	0.3	200		v
	Well Name:		Adairsville/Lewis Spring															
	County:		Bartow															
	Date Sampled:		1995/07/27															

Table A-11 (Continued). 1995 Ground-Water Quality Analyses of the Valley and Ridge Unconfined Aquifers.

PARAMETER		pH	Na	K	Ca	Mg	Sr	Ba	Fe	Mn	Al	Cl	F	SO4	Nitrate/ Nitrite	Spec. Cond.	Other Parameters Detected	Other Tests
Well ID#	UNITS	SU	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mgN/L	mho/cm	ug/L	
GWN-VR8		7.55	1.7	5U	28	13	17	12	20U	10U	50U	1.56	0.1U	2.11	0.6	215		v
	Well Name:		Cedartown Spring															
	County:		Polk															
	Date Sampled:		1995/07/26															
GWN-VR9		7.57	1.6	5U	34	12	22	11	20U	10U	50U	1.96	0.1U	2.13	0.7	218		v
	Well Name:		Polk County #2															
	County:		Polk															
	Date Sampled:		1995/07/26															

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