Field Measurements

The ground-water temperature of the Woodbine samples ranged from 18 to 42° C and averaged 27° C. The pH of all Woodbine analyses ranged from 4.4 to 9.2 (only three had a pH less than 7.0), and the average was 7.9. Secondary drinking water standards indicate that the pH should be greater than 7.0 because acidic water (less than 7.0) will act as a solvent to release metal ions to the water. The specific conductance ranged from 91 to 9,560 micromhos and averaged 1,545 micromhos. This average reflects the high concentration of total dissolved ionized salts in the southeast part of the study area. The average total alkalinity as determined in the field was 375 mg/l, with a range of 91 to 748 mg/l as $CaCO_3$; average bicarbonate ion concentration, calculated from mean total alkalinity, was 440 mg/l; and average phenol alkalinity was 11.4 mg/l. The negative Eh average of -58 mV (range: -335 to +327 mV) indicates slightly reducing conditions exist in those parts of the aquifer containing some organic matter and sluggish circulation rates.

Dissolved Inorganic Constituents

The dissolved-solids content is the main factor limiting or determining the use of ground water. These solids primarily consist of mineral constituents dissolved from the host rock, although other natural sources, such as adjacent aquifers, or man-affected sources, such as oil-field brines, can also contribute certain dissolved constituents. Table 2 describes four classes of ground water classified according to dissolved-solids content, as defined by the Texas Groundwater Protection Committee.

Class	Quality *	Examples of Use
Fresh	0 - 1,000	Drinking and all other uses
Slightly Saline	>1,000 - 3,000	Drinking if fresh unavailable; for livestock, irrigation, and industrial use
Moderately Saline	>3,000 - 10,000	Industrial, mineral extraction, oil and gas production; potential/future drinking and limited livestock watering and irrigation if fresh or slightly saline water is unavailable
Very Saline to Brine	>10,000	Mineral extraction, oil and gas production

* Concentration range of dissolved-solids in milligrams/liter
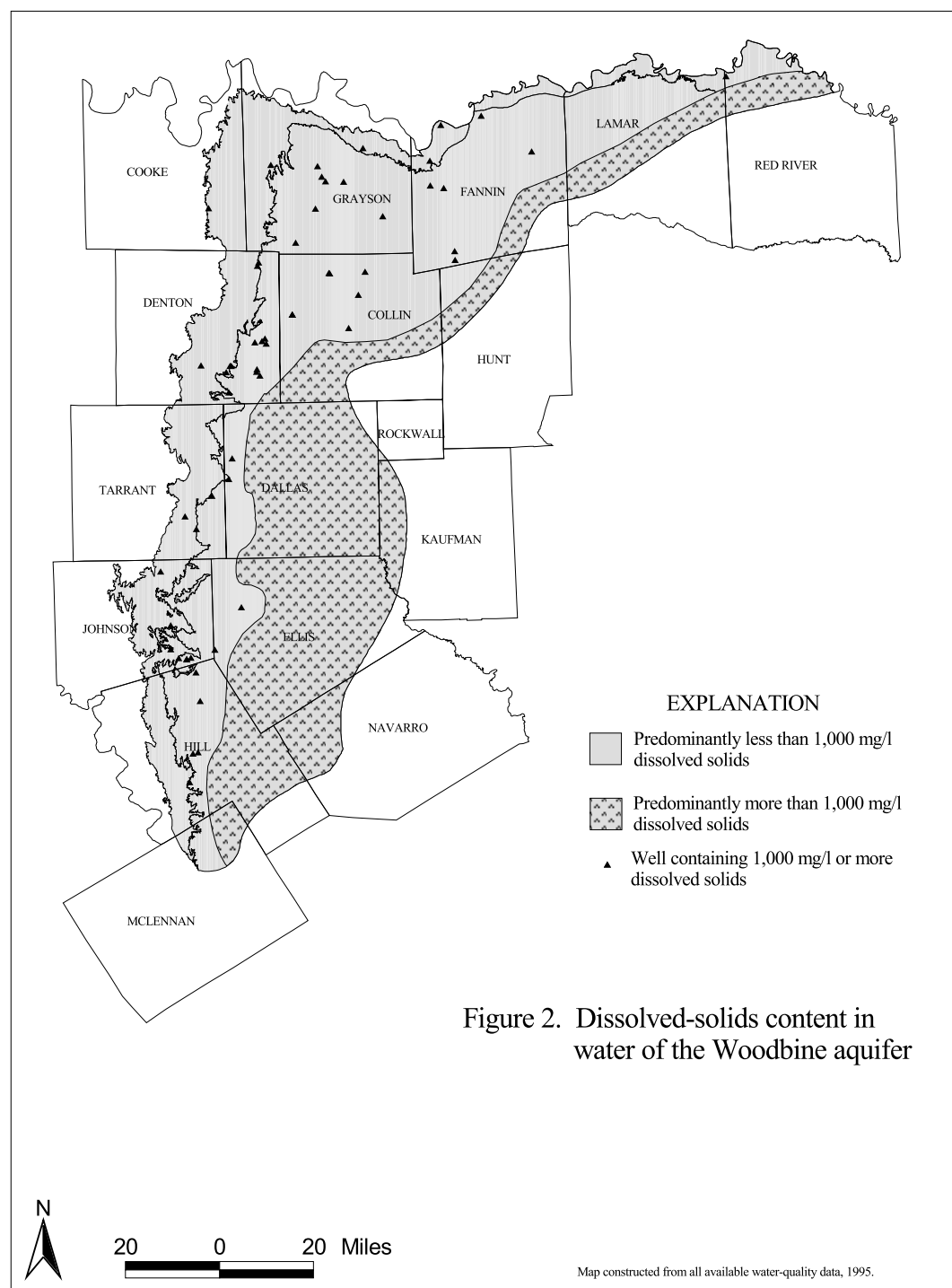Table 2. Ground-water classification system.

Table 3 lists ranges and average concentrations (of analyses above detection limts) of dissolved solids and other inorganic constituents from the Woodbine sampled from 1993 through 1995. The average dissolved-solids content of 1,076 mg/l reflects the influence of slightly saline waters in the southeastern part of the study area, as seen in the map in Figure 2; the median dissolved solids value is 885 mg/l. Contours on the map indicate areas in which the predominant range of dissolved solids is greater than 1,000 mg/l; any individual well with a high concentration in an area where the dissolved-solids range is below 1,000 is indicated with an asterisk. The majority of the 38 percent of samples recently collected that contain dissolved solids in amounts higher than the MCL are concentrated in the southeast.

Constituent	Range	Average	Percent > MCL
Silica	10 - 55	15	
Calcium	<1- 700	54	
Magnesium	<1 - 420	16	
Potassium	<1 - 23	3.4	
Sodium	29 - 1,200	319	
Strontium	<.02 - 14.1	0.6	
Bicarbonate	105 - 874	440	
Sulfate	5.0 - 3,400	313	33*
Chloride	6.0 - 1,500	129	9*
Fluoride	<0.1 - 4.7	0.9	5**
Dissolved solids	287 - 7,259	1,076	38*
Hardness	1 - 3,374	199	

* Secondary MCL
** 2% > secondary MCL of 2.0 mg/l and 3% > primary MCL of 4.0 mg/l
Table 3. Major anions and cations in Woodbine aquifer ground water in milligrams/liter.

EXPLANATION

Predominantly less than 1,000 mg/l dissolved solids

Predominantly more than 1,000 mg/l dissolved solids

▲ Well containing 1,000 mg/l or more dissolved solids

Figure 2. Dissolved-solids content in water of the Woodbine aquifer

N

20   0   20 Miles

Map constructed from all available water-quality data, 1995.

Although historical data were considered in the construction of this map, data from the recent sampling event (1993 - 1995) were the main determinants of contour positions, particularly from wells with multiple sampling events in which recent data could more accurately delineate an increase or decrease in the amount of dissolved solids (or other constituents) over time. All of the maps were constructed in a similar manner, using results from other sampling events dating back several decades in areas where recent data were not available. The numerous points that appear outside of contoured areas indicate locations of wells with anomalously high concentrations of dissolved constituents; these wells are typically surrounded by wells with lower concentrations. By contrast, discussions of averages and ranges listed in Tables 3, 4, and 5 only refer to data collected during the recent sampling event.