State Summary for Florida

Information on population density, use of domestic wells for water supply, land use, and distribution of the 11 selected contaminants (arsenic, atrazine, benzene, deethylatrazine (CIAT), manganese, nitrate (data for nitrate consists of analyses for nitrite plus nitrate, as N, by the laboratory), perchloroethene (PCE), radon, strontium, trichloroethene (TCE), and uranium) for domestic well data for Florida is shown in figures FL1–FL16. The percentage of samples with concentrations greater than U.S. Environmental Protection Agency (USEPA) human-health benchmarks for National Water-Quality Assessment (NAWQA) Program major-aquifer studies that included Florida and had at least 10 samples is given in table FL1. The areal extent of some NAWQA major-aquifer studies goes beyond the State boundary (fig. FL4). All data associated with a major-aquifer study are provided and are used in contaminant summaries even if the sampled well was located outside the State boundary. The "Selected References" section at the end of this summary lists previous Florida studies that are relevant to the 11 contaminants.

In Florida, the largest areas with the highest population density are located mostly along the coast (fig. FL1). About 90 percent of the domestic (private) and public drinking-water supply is obtained from ground water. The population (by census-block group for 1990) using a domestic-water supply from ground water was widespread throughout the State, with the exception of most of the major population centers where less than 250 people per census block group were using ground water as a domestic water supply (fig. FL2). Although Florida is a heavily populated State, it also contains numerous wetlands and forested lands (fig. FL3).

Five major-aquifer studies in two principal aquifers (Floridan aquifer system and surficial aquifer system) were conducted in Florida (fig. FL4). All of the samples from domestic wells for the gaflsus1 major-aquifer study in the surficial aquifer system were collected in Georgia (fig. FL4) and are given for comparison because the surficial aquifer system is present in many places in Florida. The Floridan aquifer system underlies all of Florida (fig. FL4) and is one of the most productive aquifer systems in the world. It consists of a thick sequence of permeable carbonate rocks (limestone and dolomite) of Tertiary age and is divided into upper and lower units by a less-permeable confining unit (Miller, 1990). In several areas in Florida where the upper confining unit is less than 100 feet thick or absent, the transmissivity values in the aquifer system are greater than 250,000 feet squared per day. In southern Florida, the upper confining unit is thick, and the aquifer system is thinner and less permeable and has transmissivity values less than 50,000 feet squared per day (Miller, 1990).

The surficial aquifer system includes undefined aquifers that are present at land surface, and in Florida includes systems that are 150 to as much as 400 feet thick (Miller, 1990). The surficial aquifer system consists mostly of beds of unconsolidated sand, shelly sand, and shell, and in southwestern Florida, some limestone beds. Ground water in the surficial aquifer system is under unconfined conditions practically everywhere. The transmissivity of the system is extremely variable with most values ranging from 1,000 to 10,000 feet squared per day (Miller, 1990).

Water-quality data for 11 selected contaminants (table 2) in samples from domestic-water supplies were compiled and summarized. The concentrations relative to USEPA human-health benchmarks (table 2, fig. FL5) and the number of major-aquifer studies with concentrations greater than human-health benchmarks were both considered in evaluating the potential concern to human health. This analysis assumes that current USEPA benchmarks (U.S. Environmental Protection Agency, 2006) are the most relevant and accurate measure of human-health risk.

Table FL1. Percentage of samples with concentrations greater than U.S. Environmental Protection Agency human-health benchmarks for National Water-Quality Assessment (NAWQA) Program major-aquifer studies that included Florida and had at least 10 samples.

Study-Unit code for NAWQA major-aquifer study	Principal aquifer	Contaminant	Number of samples	Percentage of samples with concentrations greater than human-health benchmark
gaflsus2	Floridan aquifer system	Radon	30	[1]83/3.3
gaflsus3	Floridan aquifer system	Radon	23	[1]65/8.7
gaflsus1	Surficial aquifer system	Radon	13	[1]62/7.7
gaflsus4	Floridan aquifer system	Radon	15	[1]33/0.0
gaflsus1	Surficial aquifer system	Nitrite plus nitrate	13	7.7
gaflsus2	Floridan aquifer system	Strontium	30	3.3

[1]First number is the percentage greater than 300 picocuries per liter (proposed Maximum Contaminant Level), and second number is the percentage greater than 4,000 picocuries per liter (alternate proposed Maximum Contaminant Level).

Radon had the greatest potential human-health concern because it had the largest percentage of samples with concentrations greater than the human-health benchmark of 300 picocuries per liter (pCi/L) (table FL1). Radon concentrations were large in the gaflsus2 major-aquifer study in the Floridan aquifer system, where about 83 percent of samples had radon concentrations greater than the proposed Maximum Contaminant Level (MCL) of 300 pCi/L (table FL1); one of the samples (about 3 percent) had a concentration greater than the alternative proposed MCL of 4,000 pCi/L. About 65 percent of samples from the gaflsus3 major-aquifer study had radon concentrations greater than 300 pCi/L, and two of the samples (about 9 percent) had concentrations greater than the alternative proposed MCL of 4,000 pCi/L (table FL1). Median radon concentrations for these two major-aquifer studies (gaflsus3 and gaflsus2) were about 400 and 800 pCi/L, respectively (fig. FL5). The U.S. Geological Survey (USGS) State data also showed radon concentrations to be greater than 300 pCi/L in most of the samples collected (fig. FL13). Radon-222 is a decay product of radium-226, and radon concentrations greater than the human-health benchmark are widespread and can be attributed to natural sources in the soil and rock material in Florida.

One of the 30 samples (about 3 percent) collected for the gaflsus2 major-aquifer study had a strontium concentration that was greater than the human-health benchmark, which is the Lifetime Health Advisory (HA) of 4,000 micrograms per liter (µg/L) (table FL1). USGS State data indicated two distinct areas (northeastern and southern Florida) where strontium was greater than the human-health benchmark (fig. FL14). Although the concentrations do not appear to be coincident with a particular land-use category, many people could be using domestic-water supplies in these areas on the basis of water-use data (fig. FL3).

USGS State data showed a few samples with concentrations greater than human-health benchmarks for arsenic (fig. FL6; MCL of 10 µg/L), benzene (fig. FL8; MCL of 5 µg/L), manganese (fig. FL10; HA of 300 µg/L), and nitrate (fig. FL11; MCL of 10 mg/L as N), but these concentrations appear to be distributed randomly and are interspersed with samples that have concentrations less than the human-health benchmarks. None of the concentrations for these four contaminants were greater than human-health benchmarks in the NAWQA data set for samples collected in Florida.

For the entire Florida data set, atrazine (fig. FL7), CIAT (fig. FL9), PCE (fig. FL12), TCE (fig. FL15), and uranium (fig. FL16) did not have concentrations greater than USEPA human-health benchmarks for either NAWQA or USGS State data. CIAT is a degradation product of atrazine and does not have a human-health benchmark; however, for this report, the MCL for atrazine is used as a benchmark for CIAT because their toxicities are considered equivalent.

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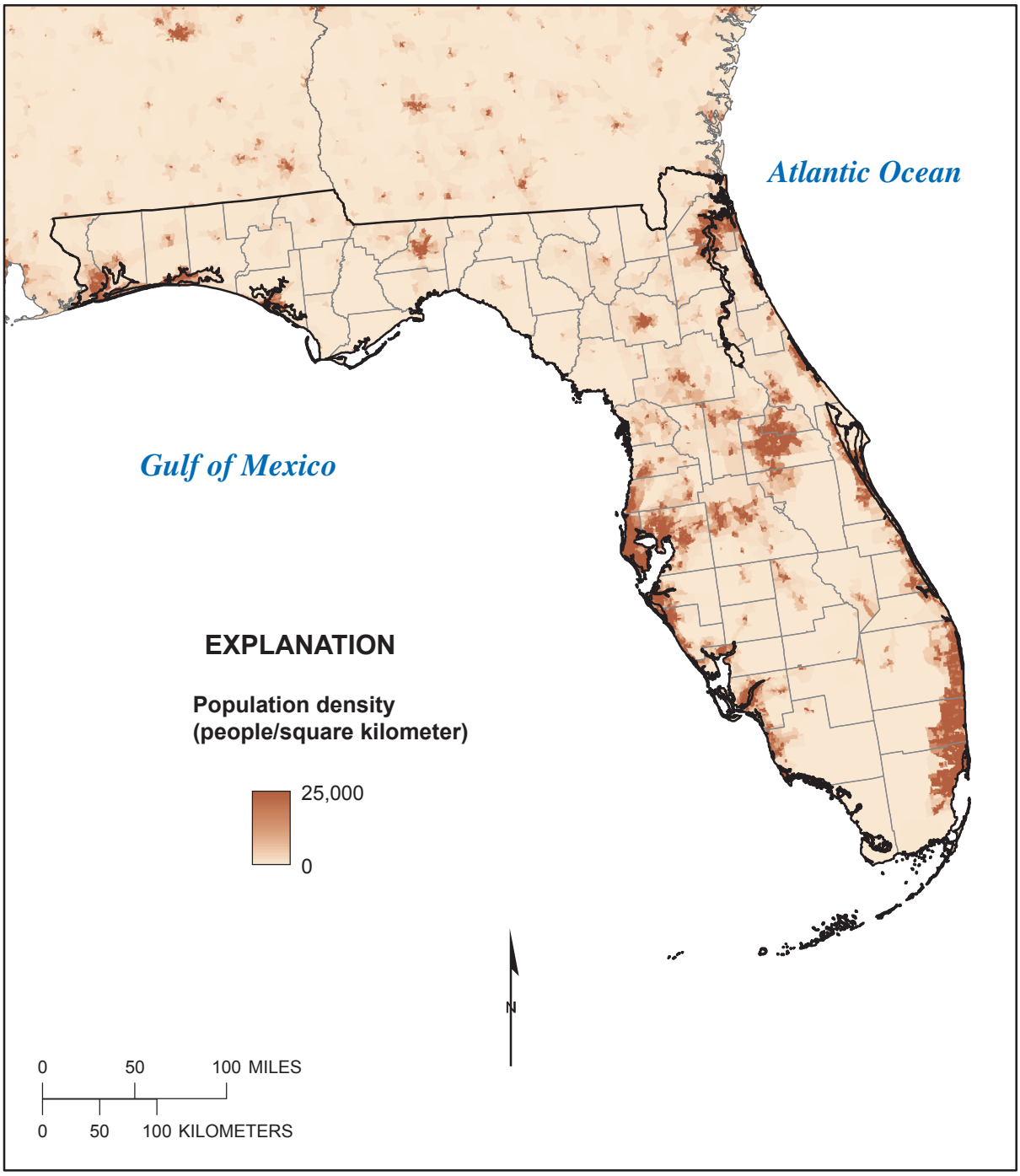
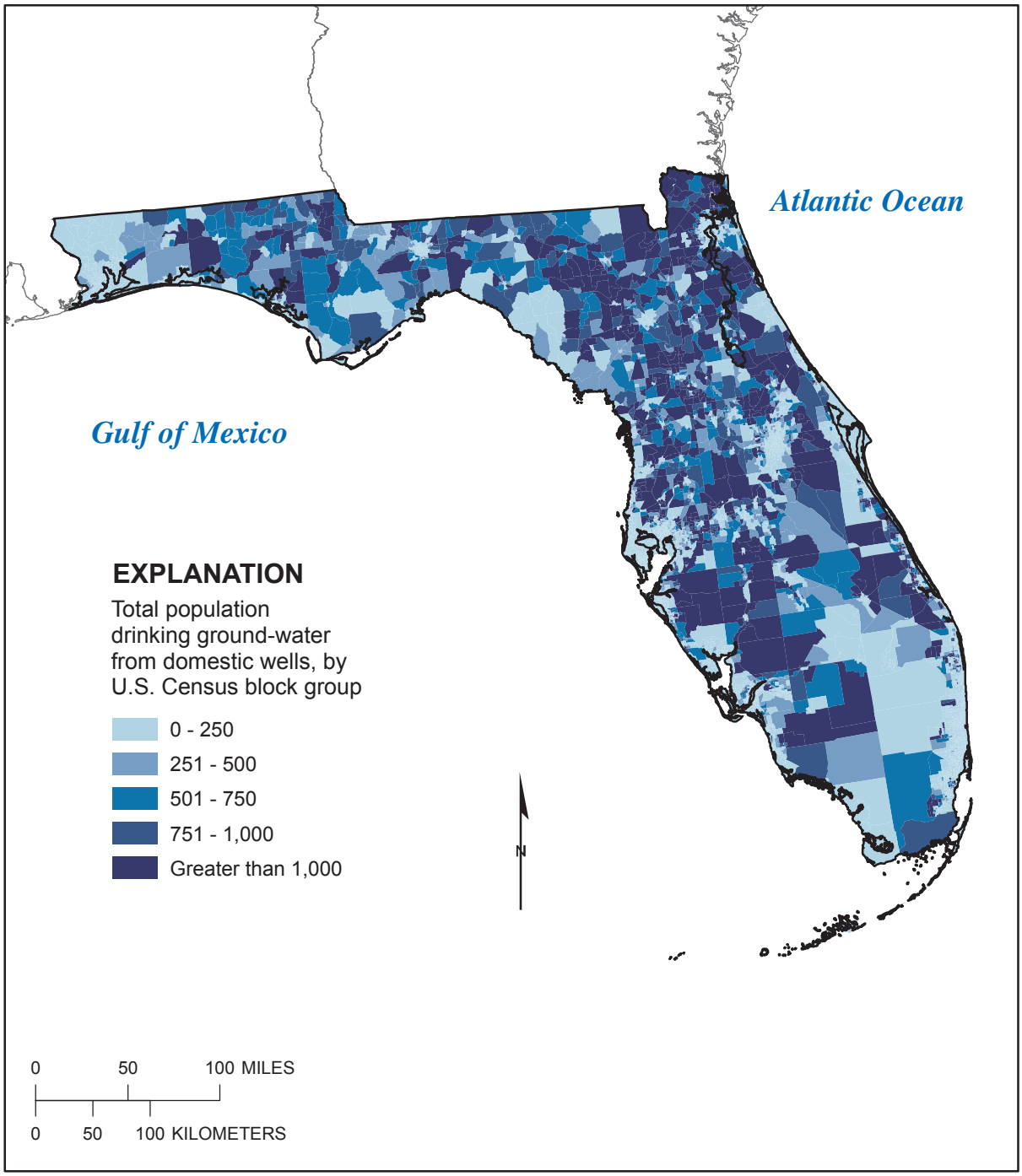


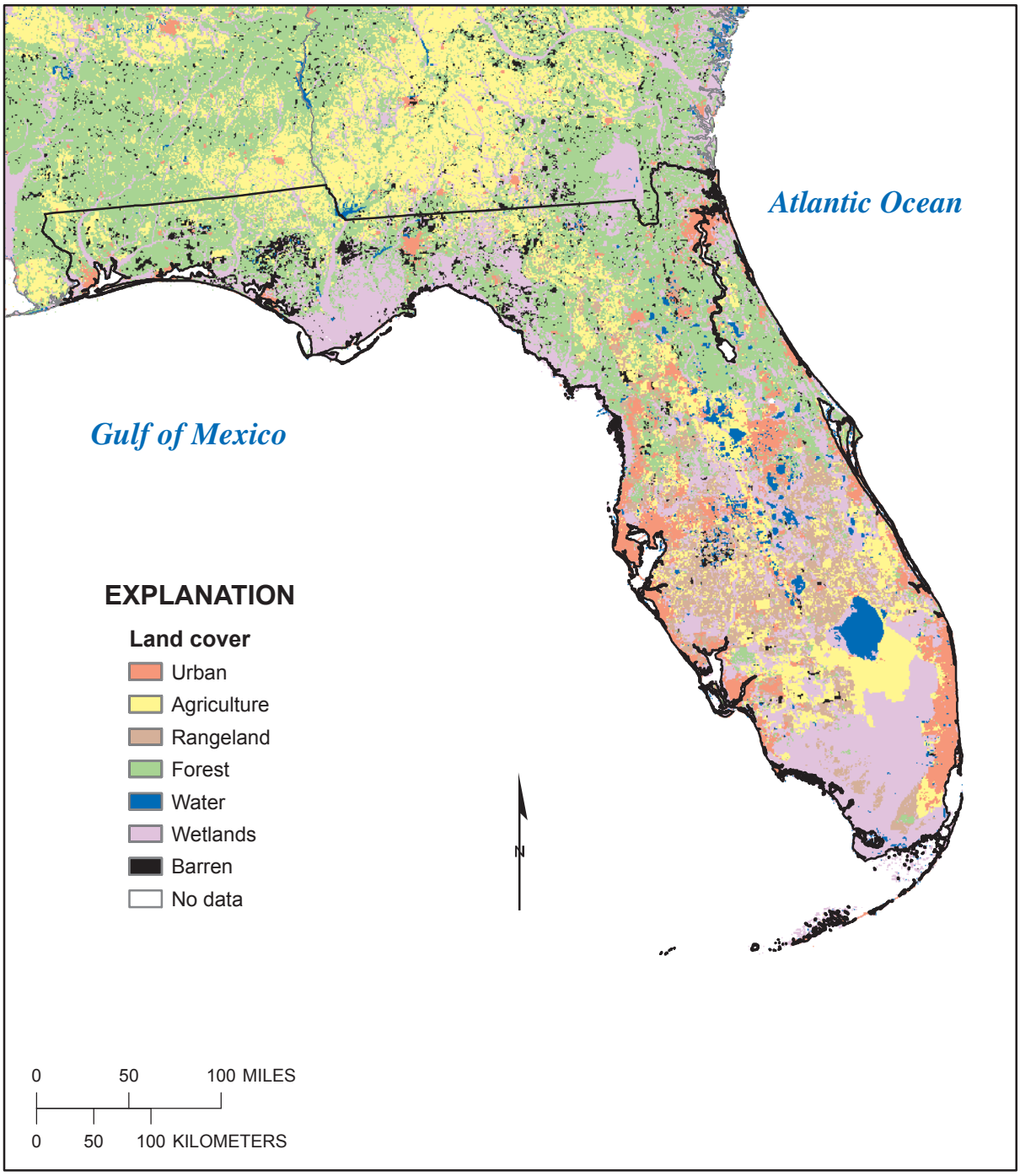
Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Figure FL1. Population density for Florida and nearby States. (Data from Hitt, 2003.)



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Figure FL2. Population using domestic-water supply (from ground water) for Florida. (Data from 1990 U.S. Census block group, Kerie Hitt, U.S. Geological Survey, written commun., 1997.)



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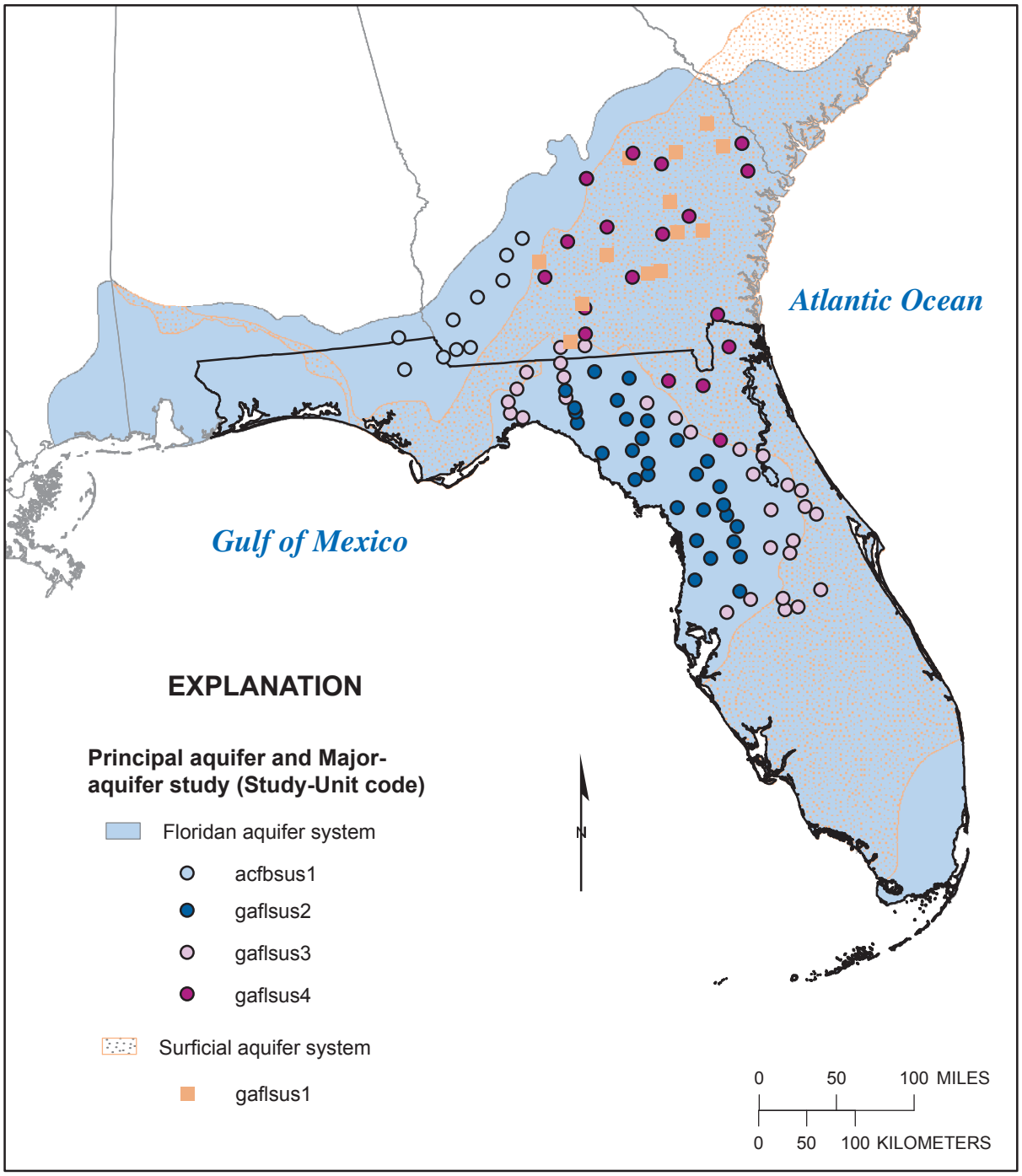
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Figure FL3. Land use/land cover for Florida and nearby States. (Data from Naomi Nakagaki, U.S. Geological Survey, written commun., 2005.)



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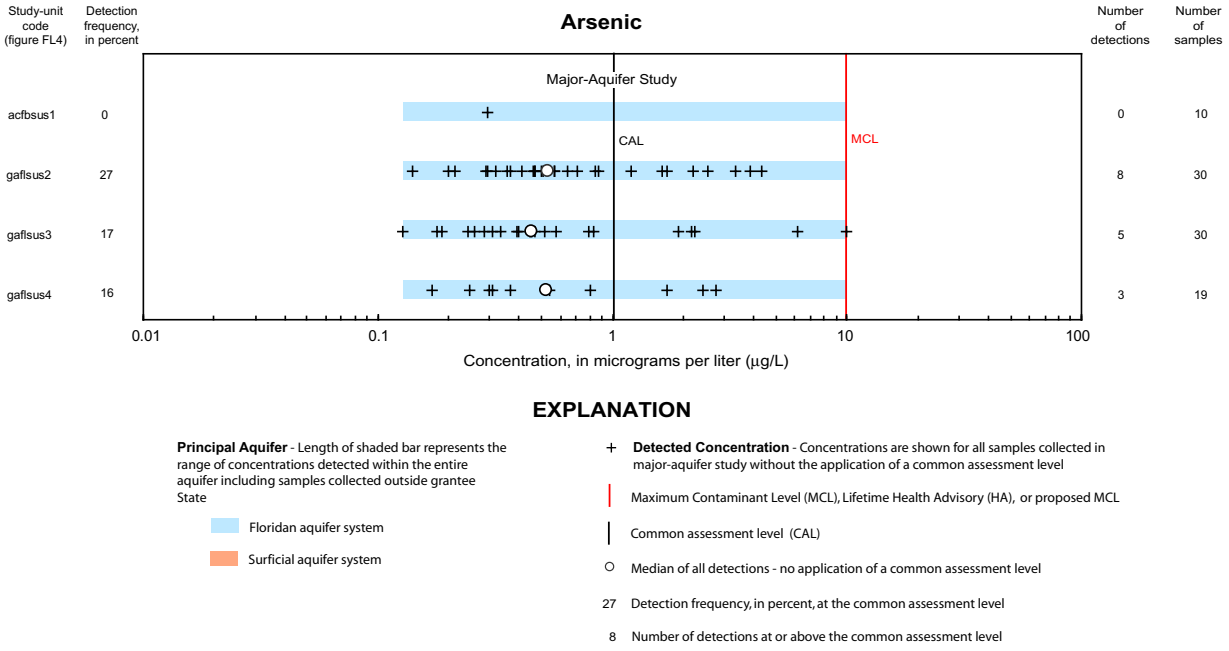
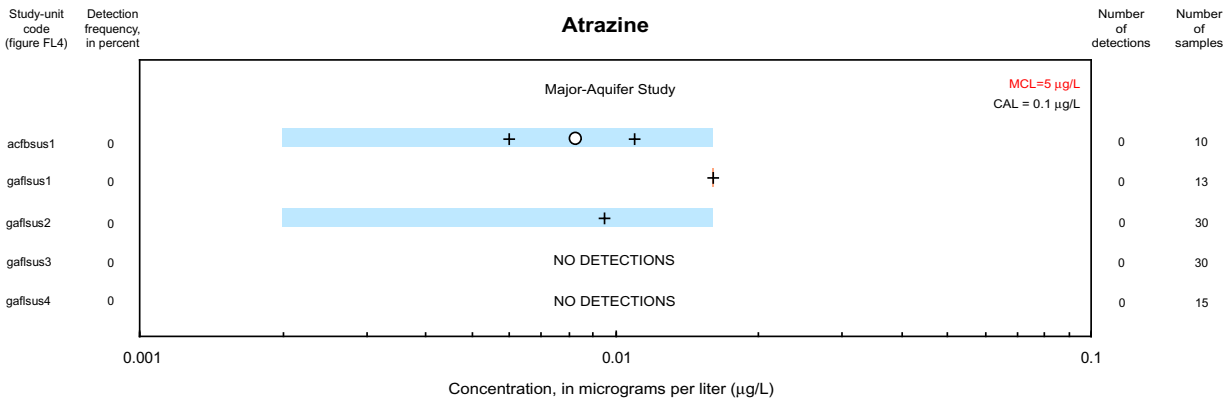
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure FL4. Location of domestic wells sampled for National Water-Quality Assessment (NAWQA) major-aquifer studies that included Florida.





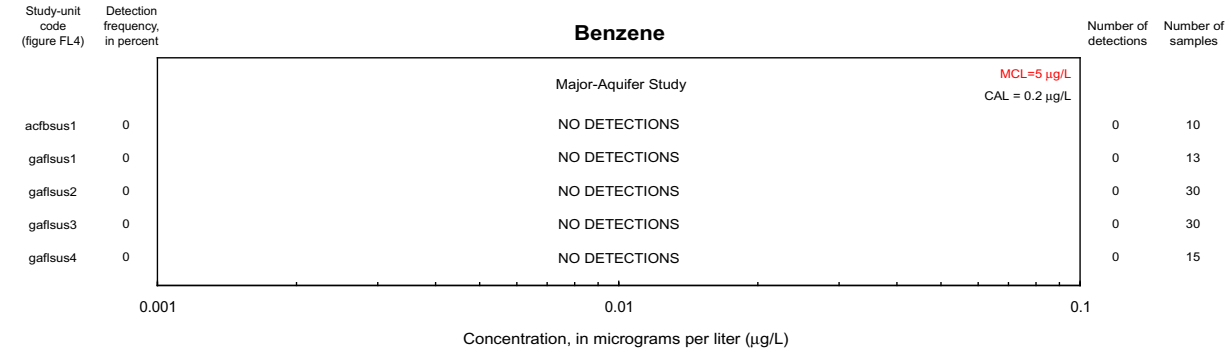


Figure FL5. Statistical summary for 11 selected contaminants by major-aquifer study using domestic-well data from National Water-Quality Assessment (NAWQA) studies for Florida (includes studies for which at least 10 analyses were available).

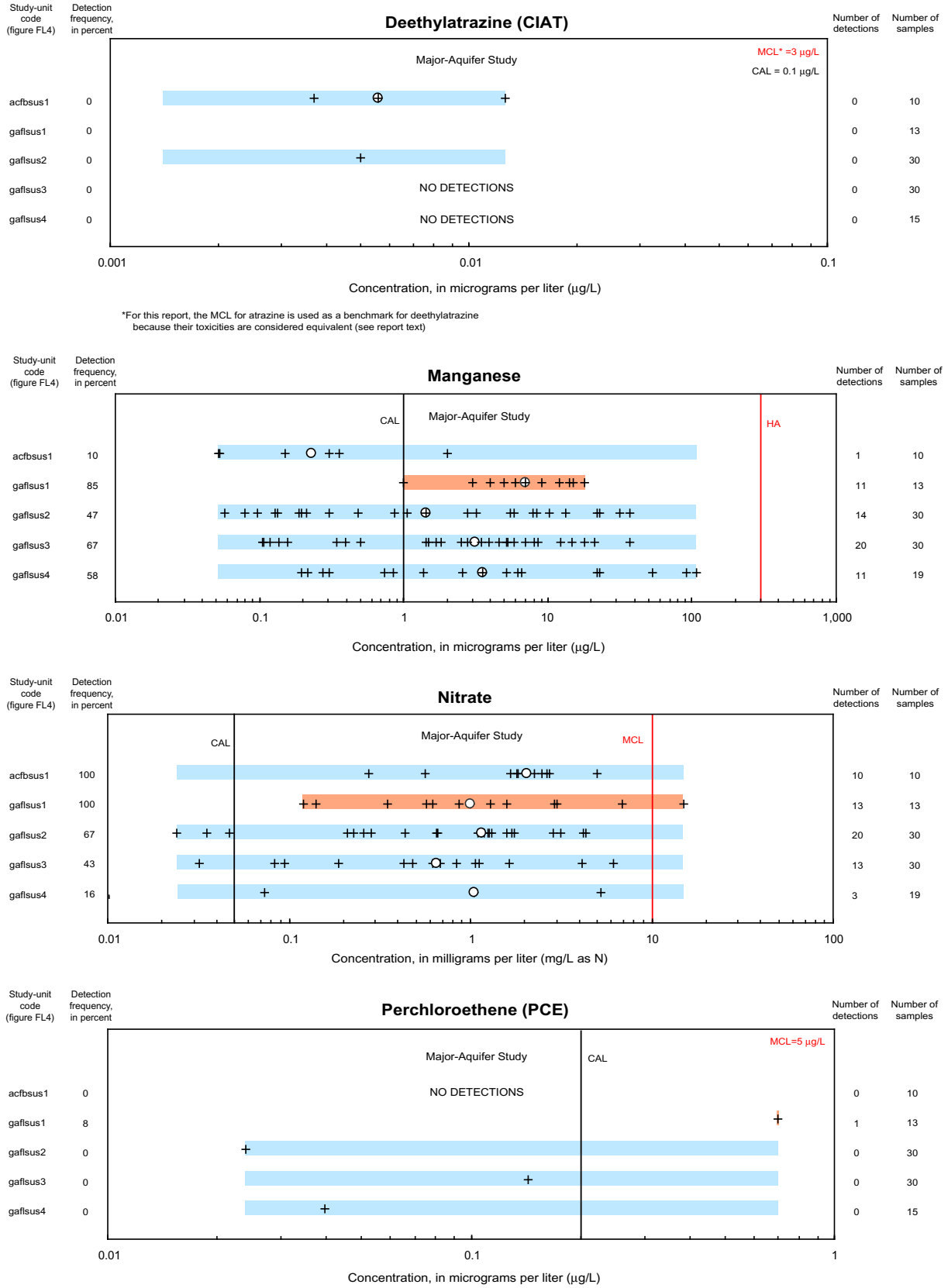
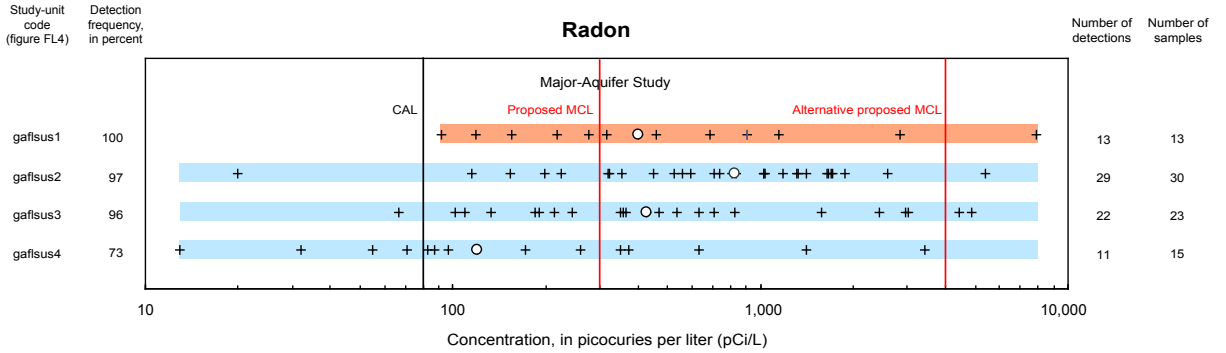
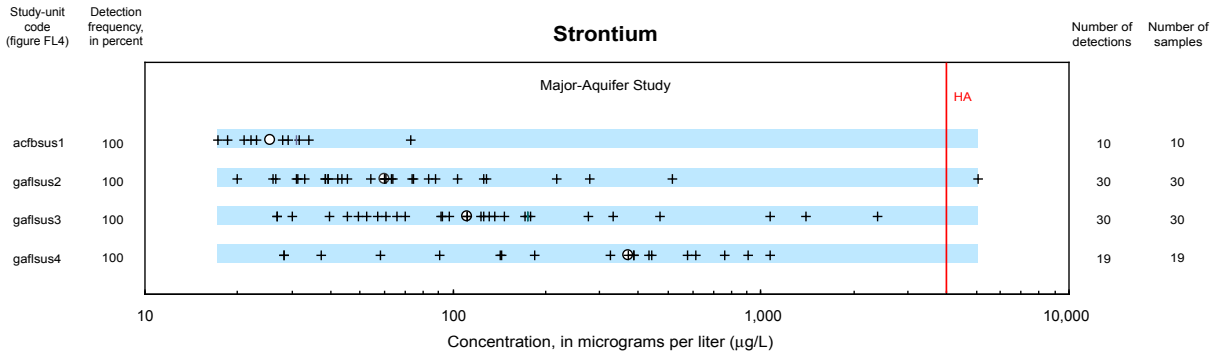
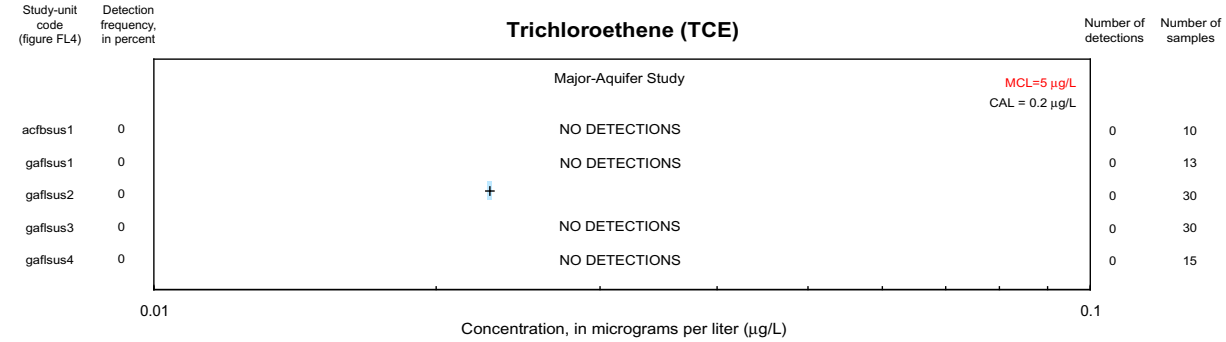


Figure FL5. Statistical summary for 11 selected contaminants by major-aquifer study using domestic-well data from National Water-Quality Assessment (NAWQA) studies for Florida (includes studies for which at least 10 analyses were available). —Continued







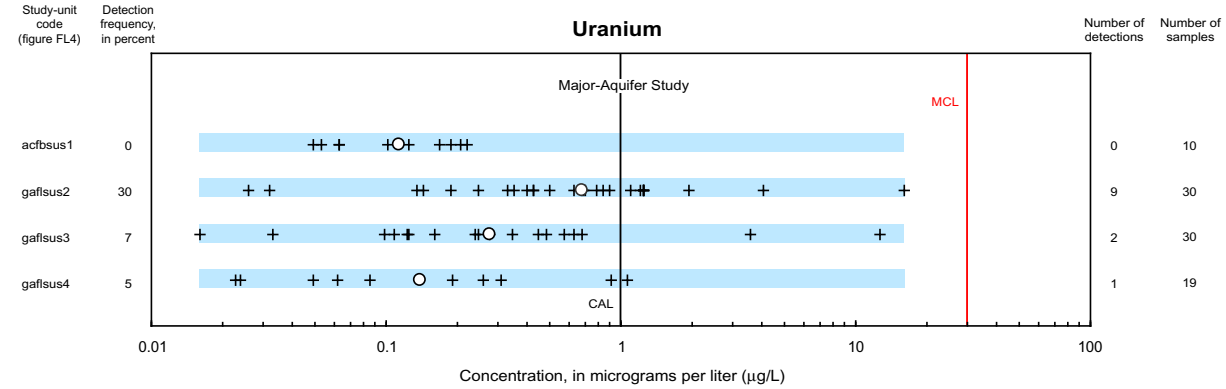
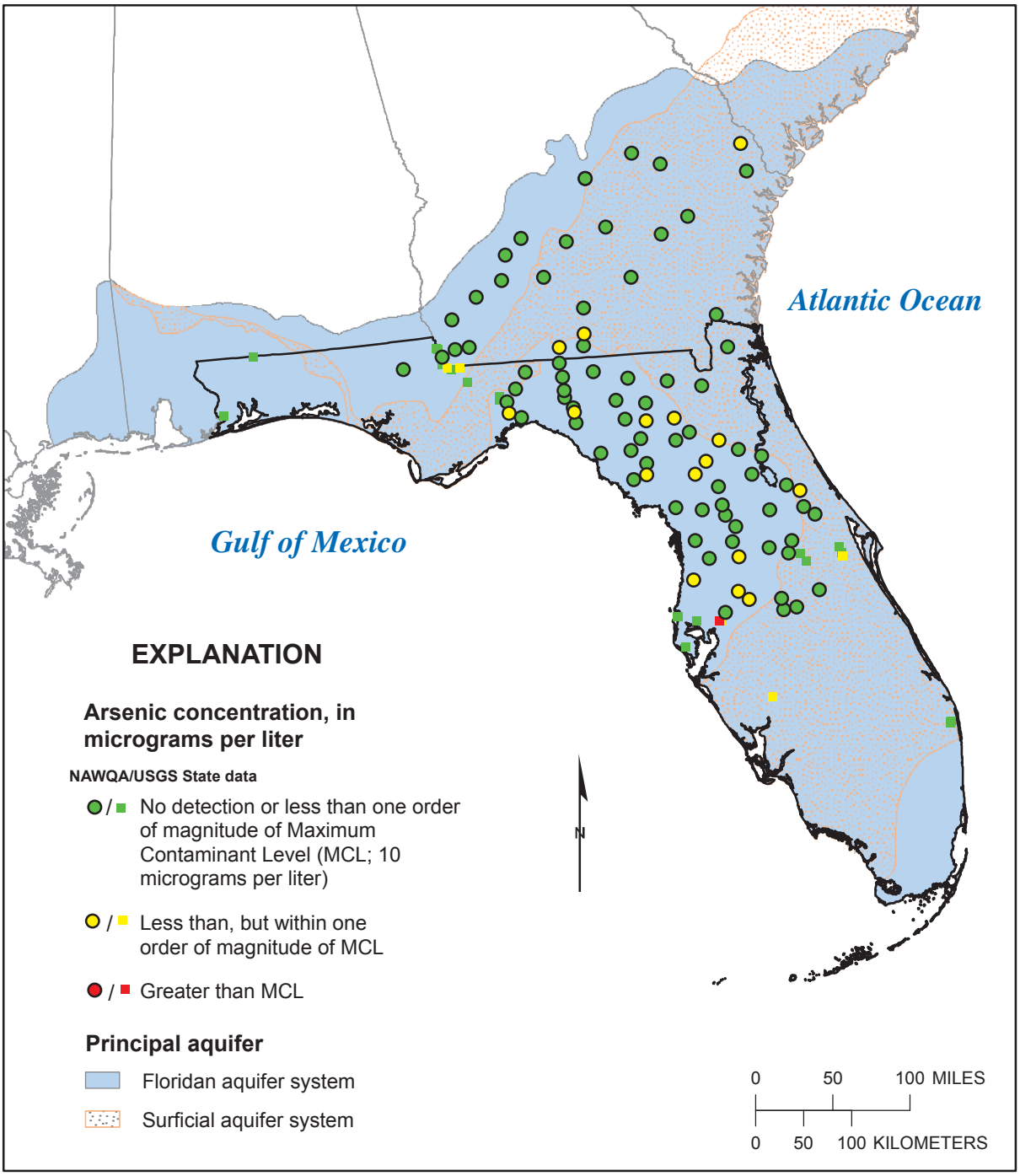


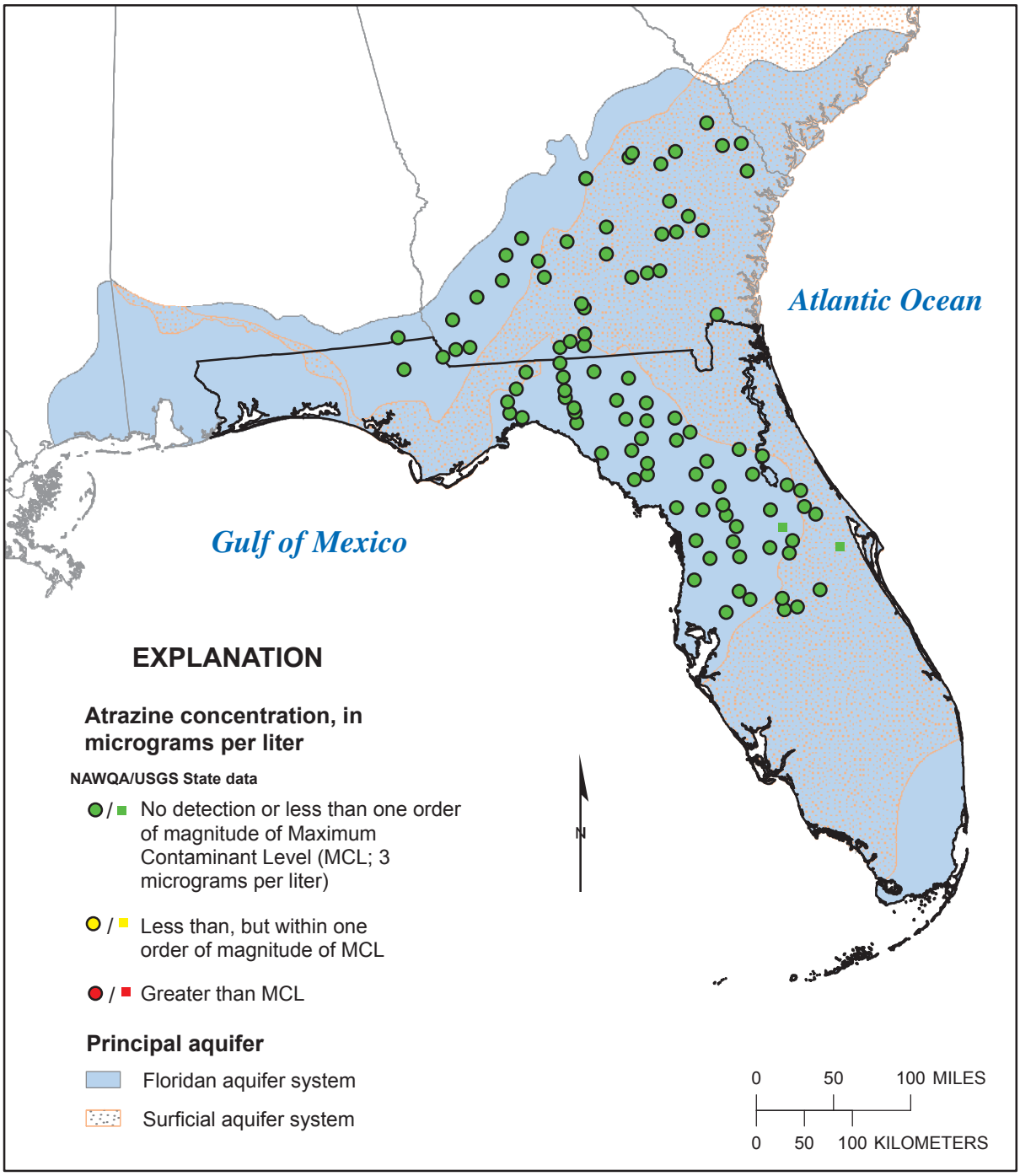
Figure FL5. Statistical summary for 11 selected contaminants by major-aquifer study using domestic-well data from National Water-Quality Assessment (NAWQA) studies for Florida (includes studies for which at least 10 analyses were available). —Continued



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

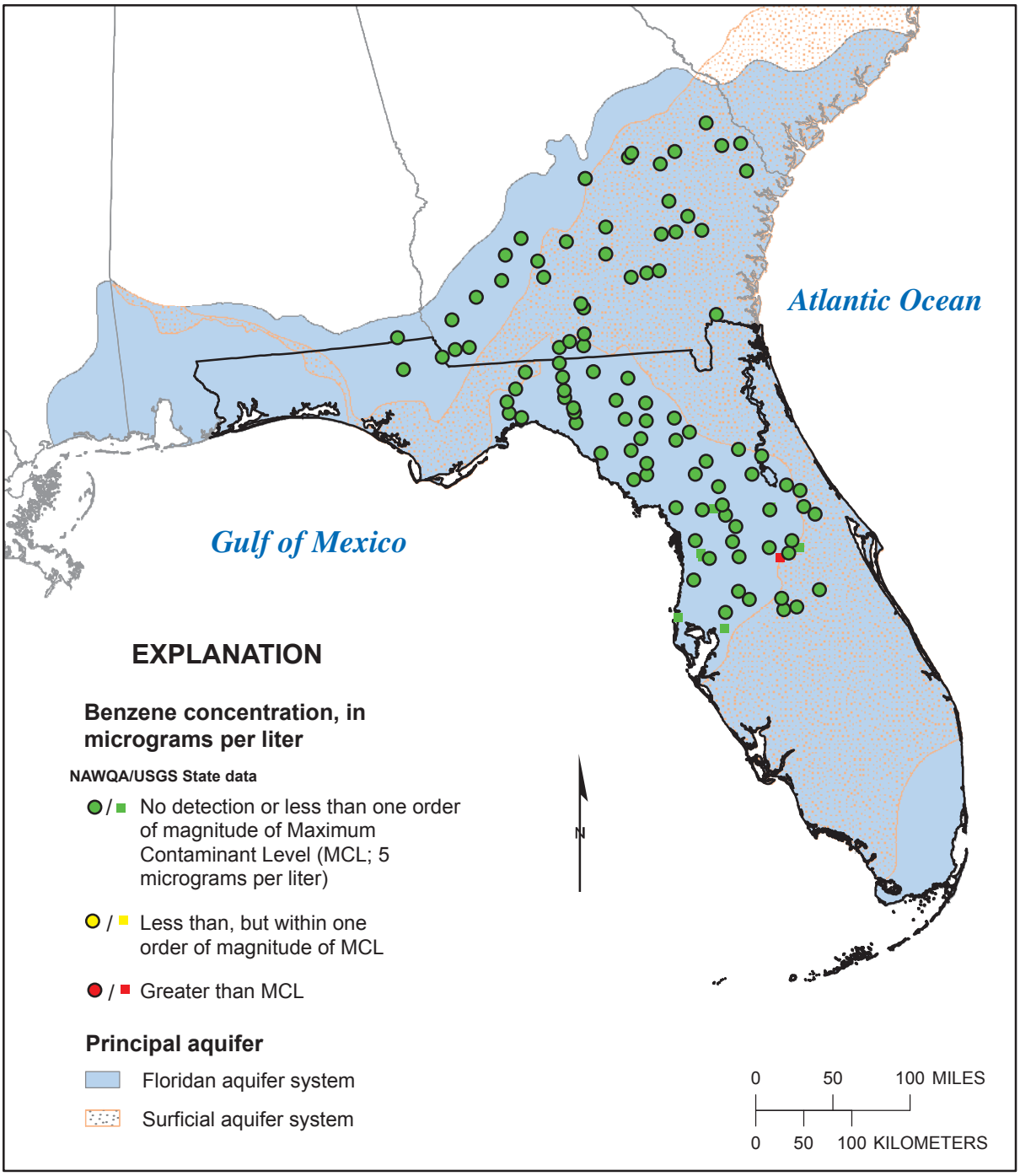
Figure FL6. Concentration of arsenic in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure FL7. Concentration of atrazine in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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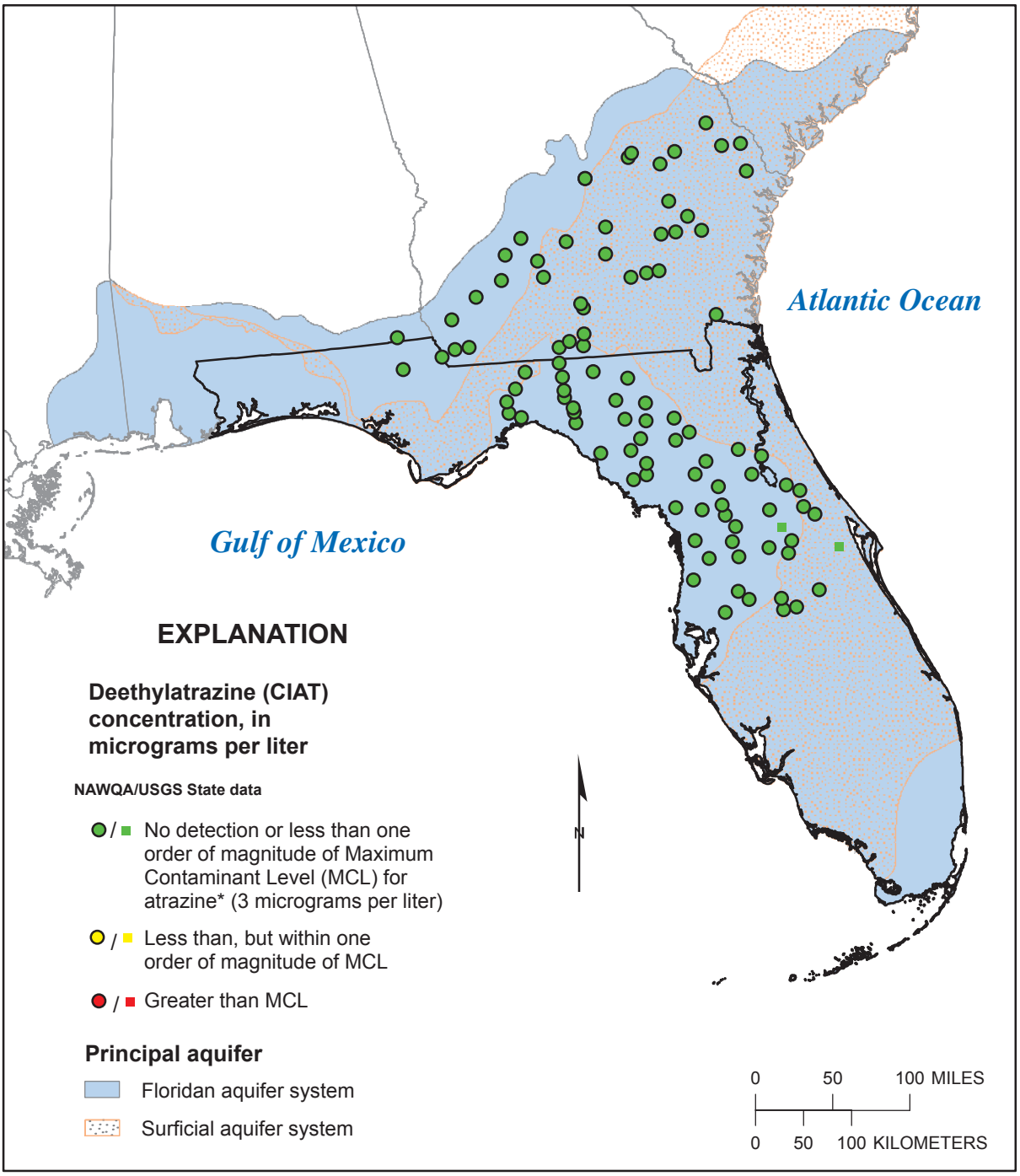
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure FL8. Concentration of benzene in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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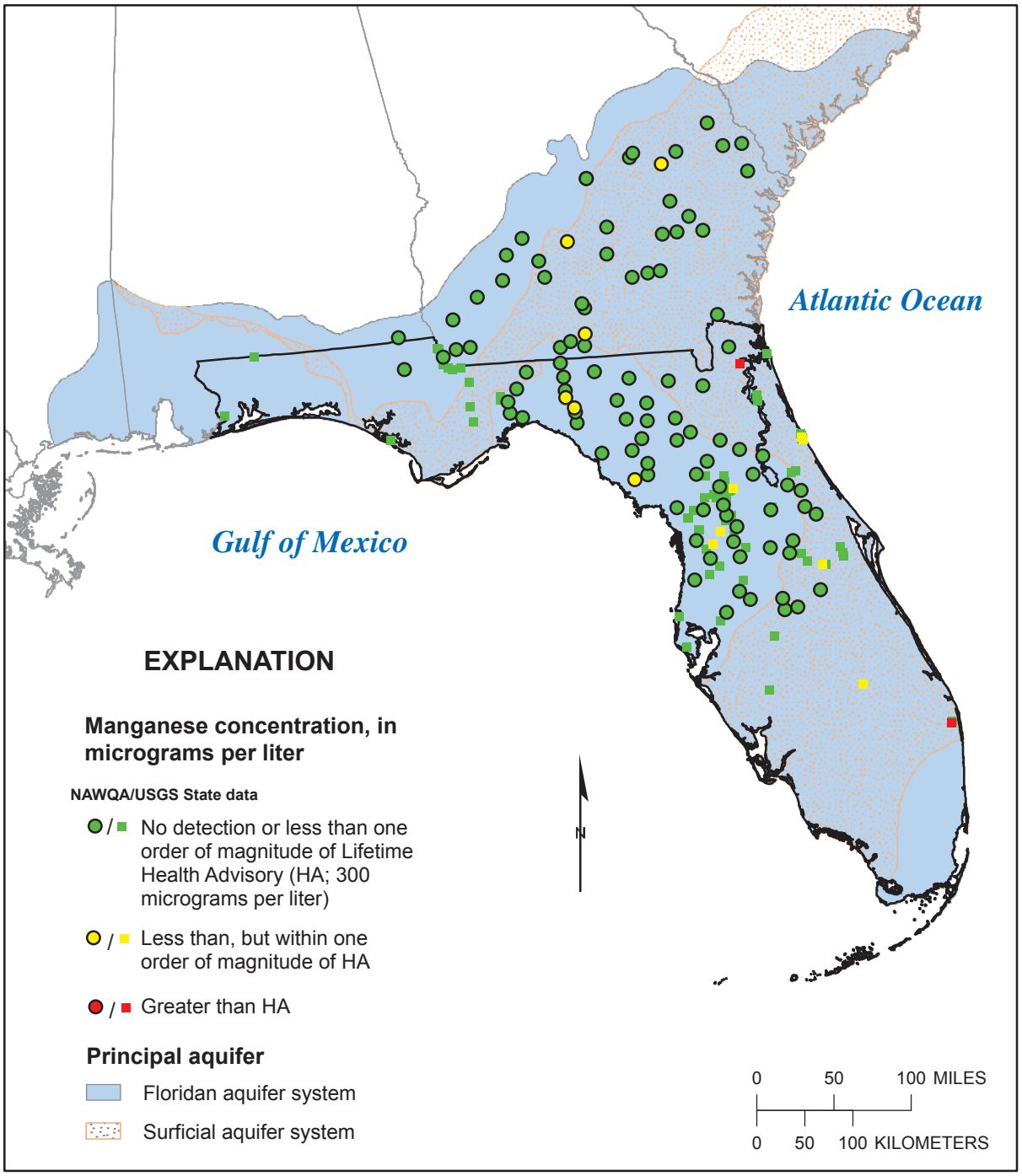
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

* For this report, the MCL for atrazine is used as benchmark for deethylatrazine because their toxicities are considered equivalent (see report text).

Figure FL9. Concentration of deethylatrazine (CIAT) in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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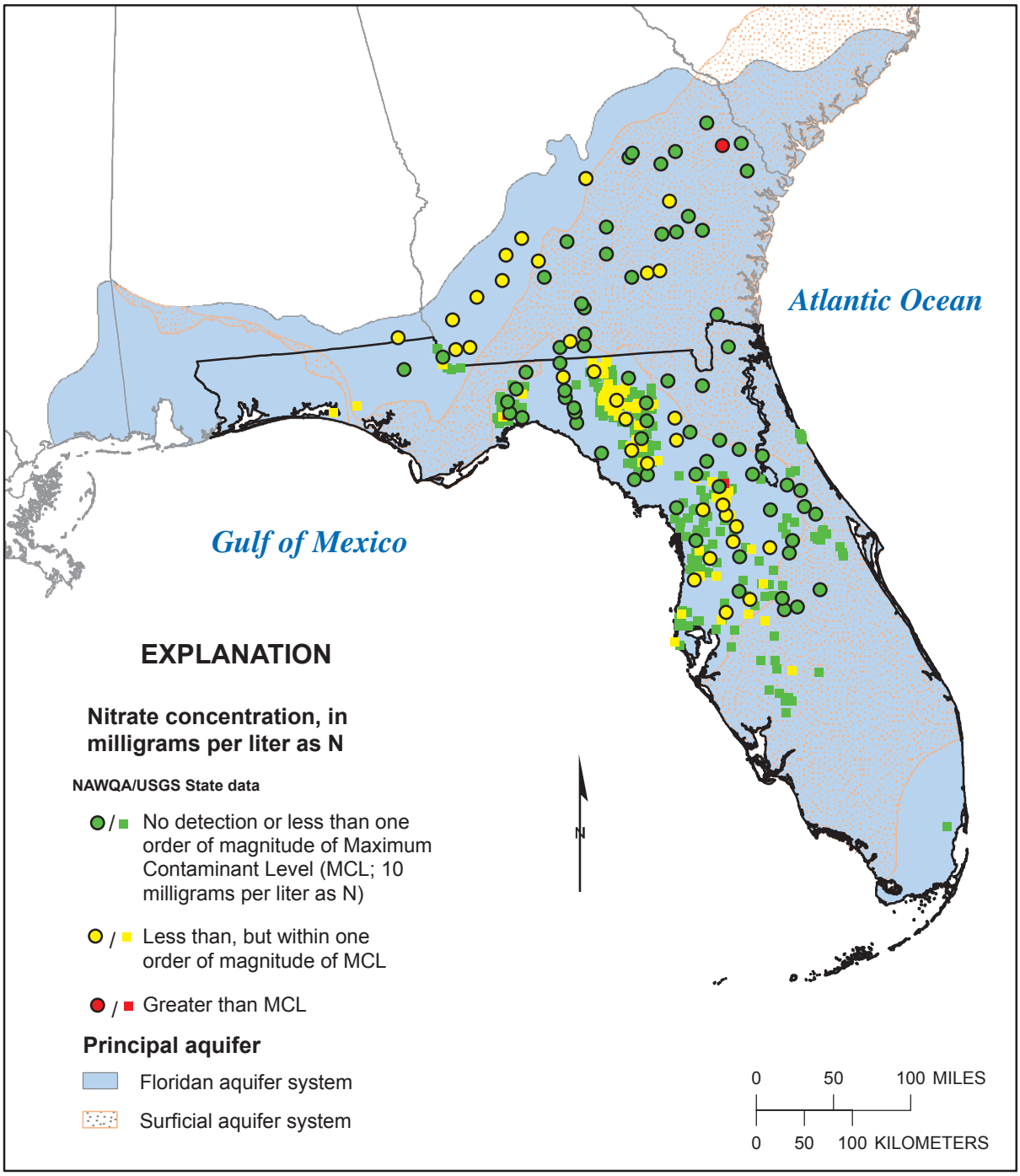
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure FL10. Concentration of manganese in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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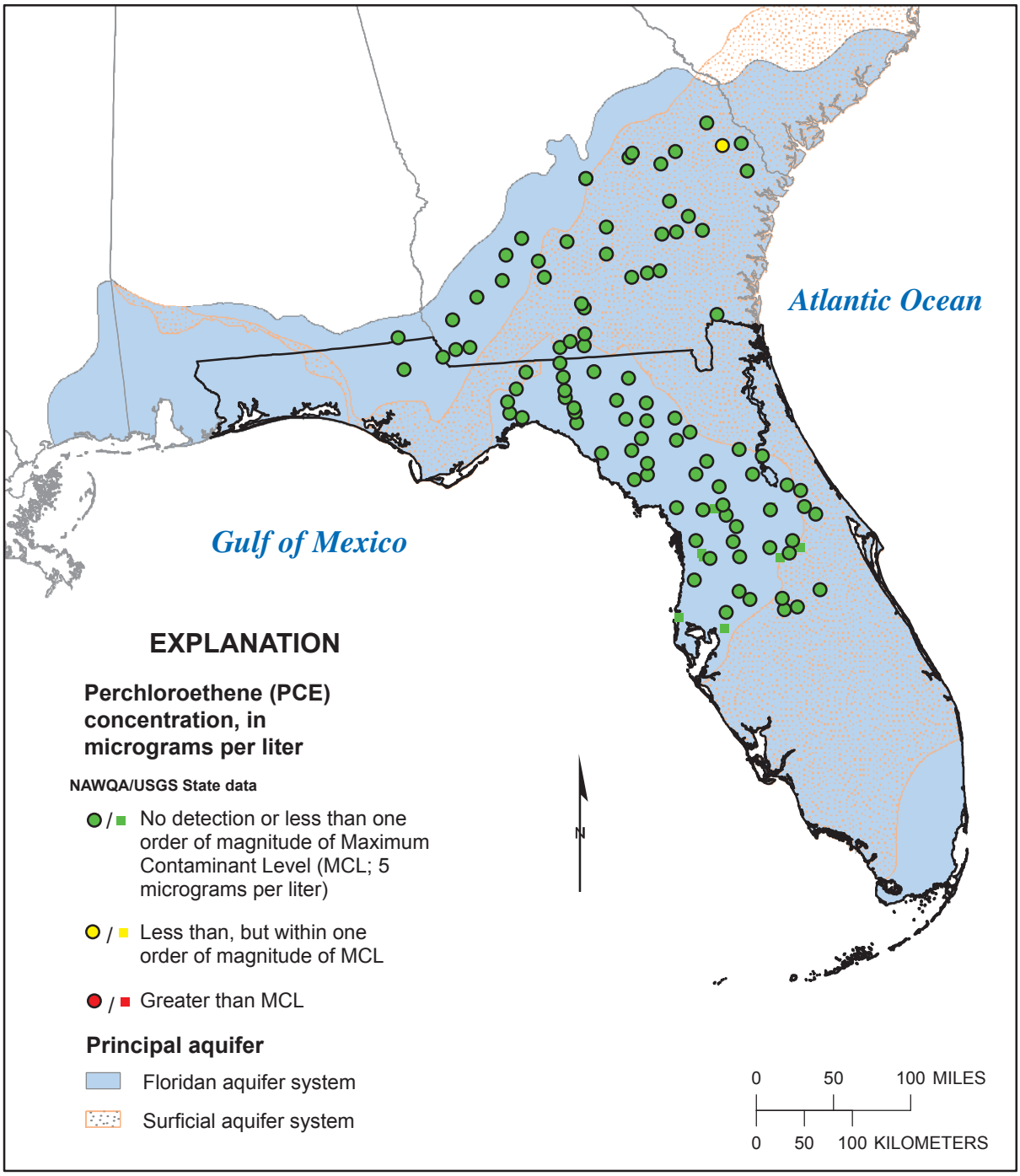
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure FL11. Concentration of nitrate in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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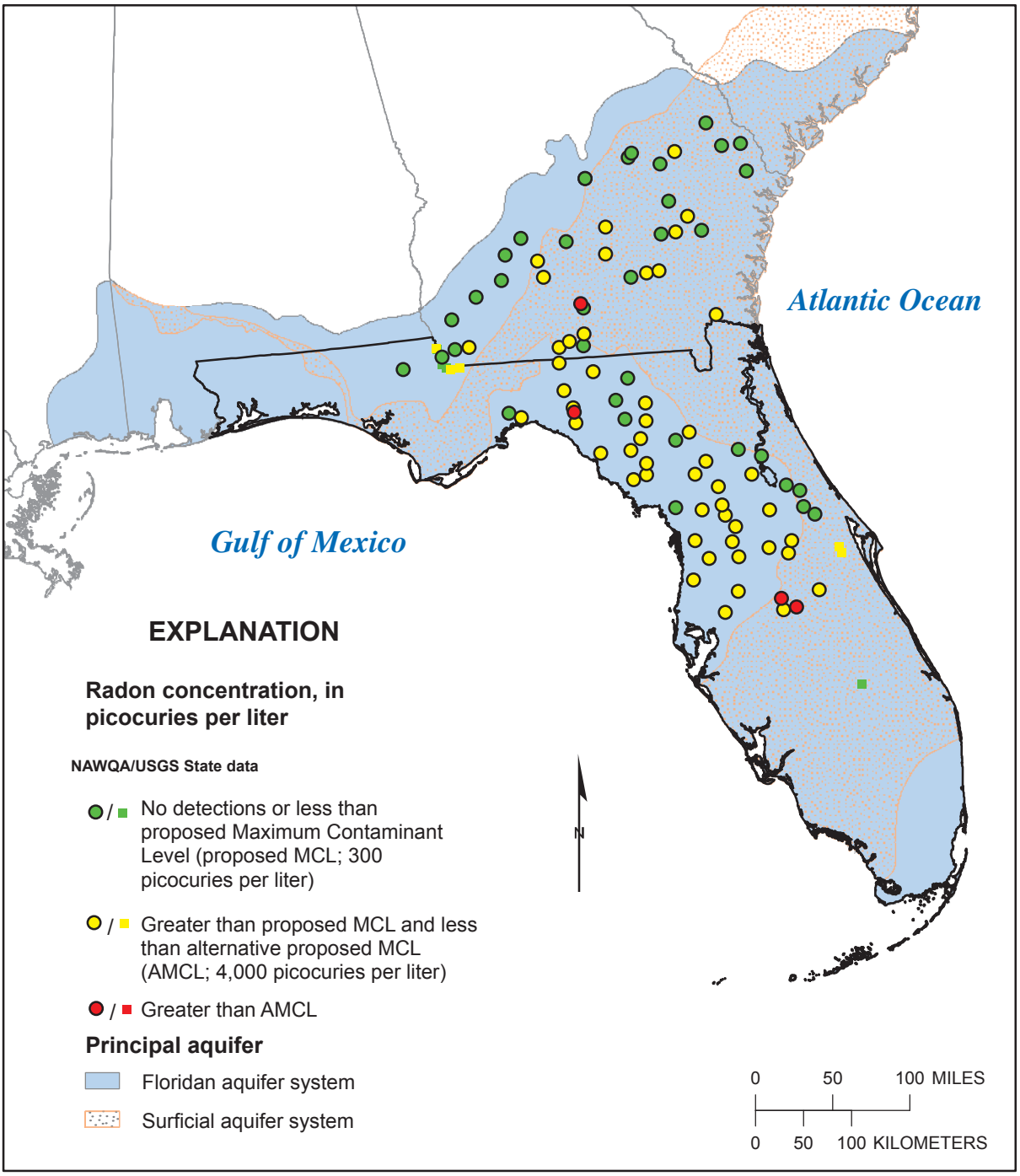
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

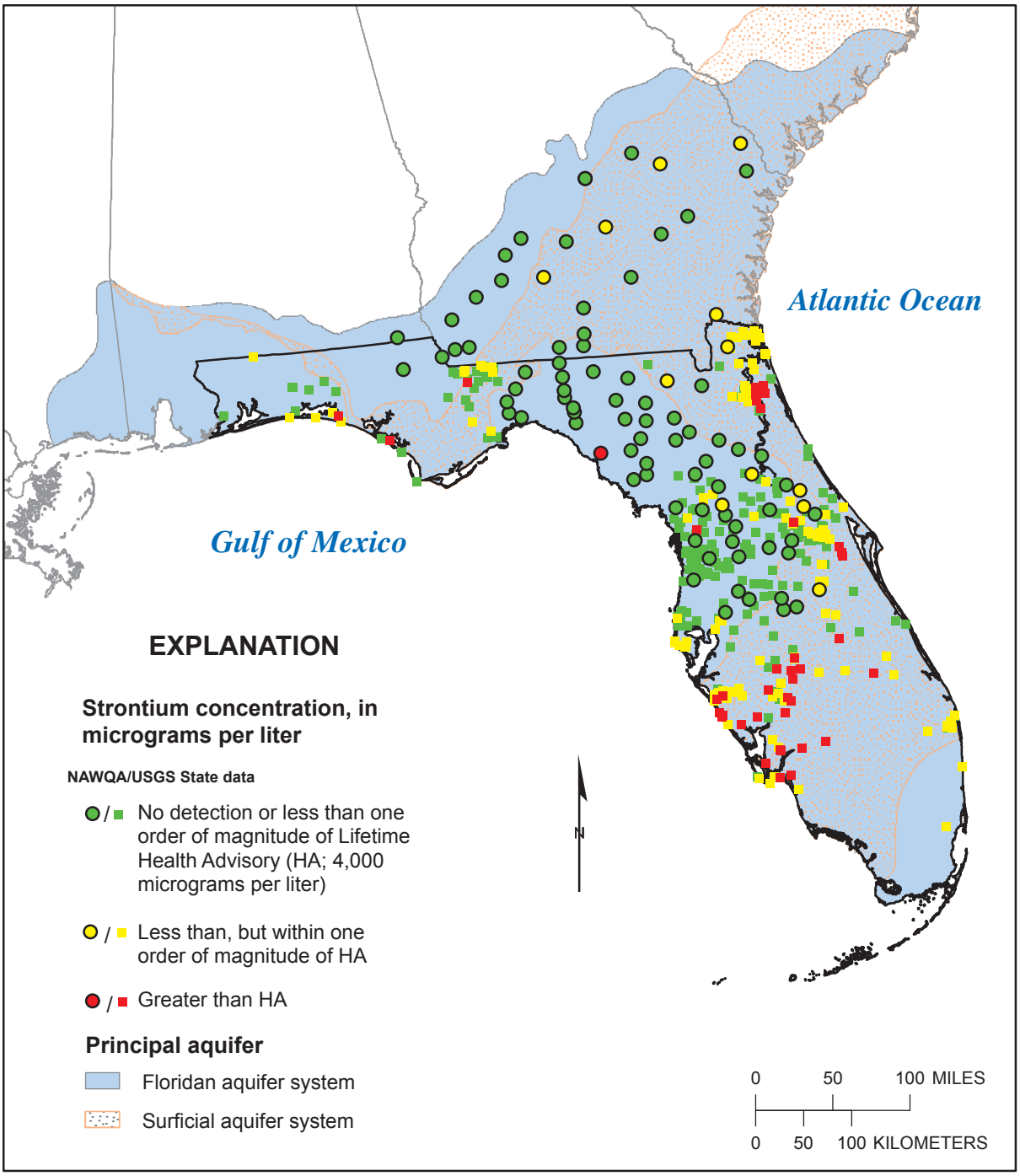
Figure FL12. Concentration of perchloroethene (PCE) in samples in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

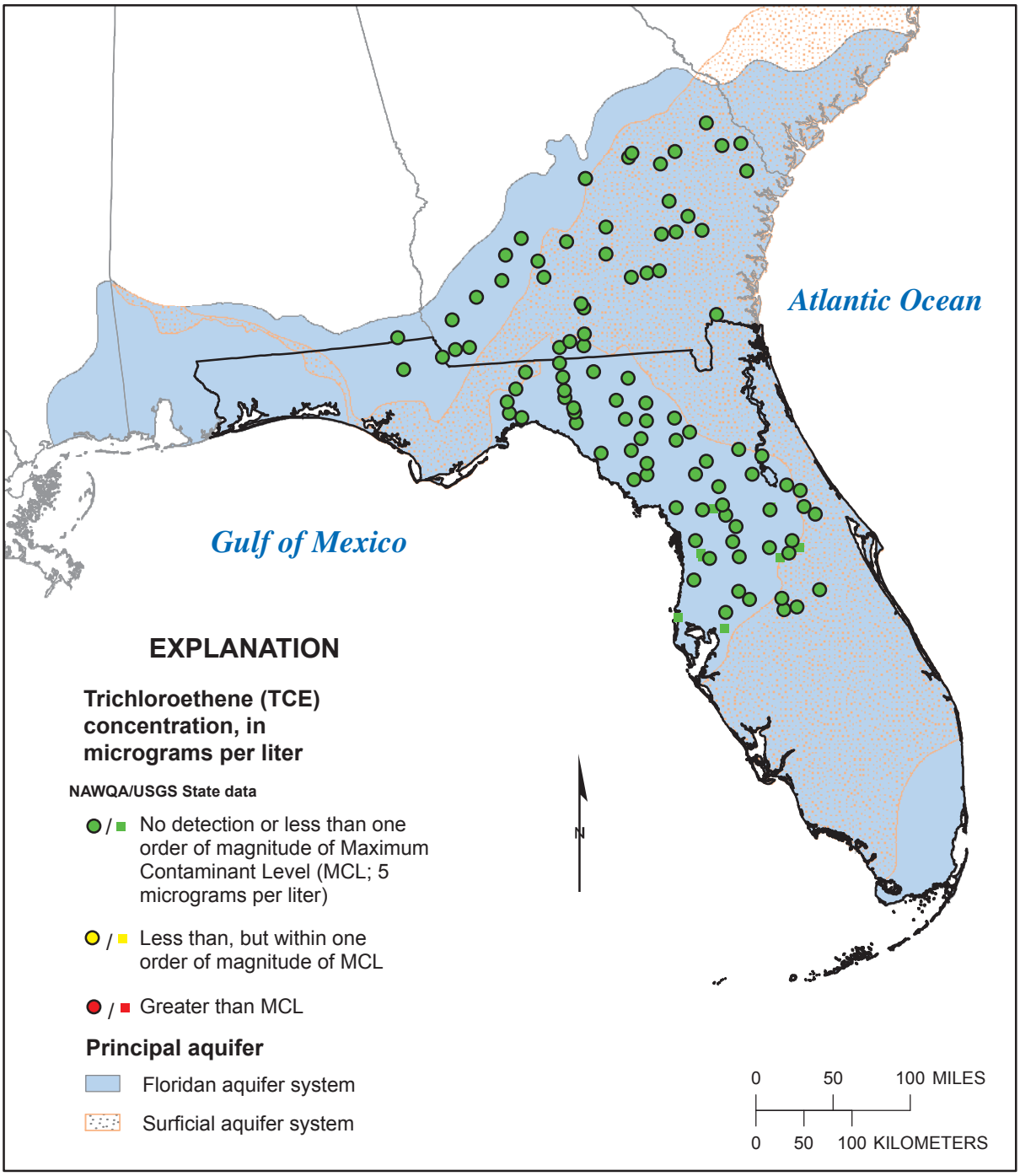
Figure FL13. Concentration of radon in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

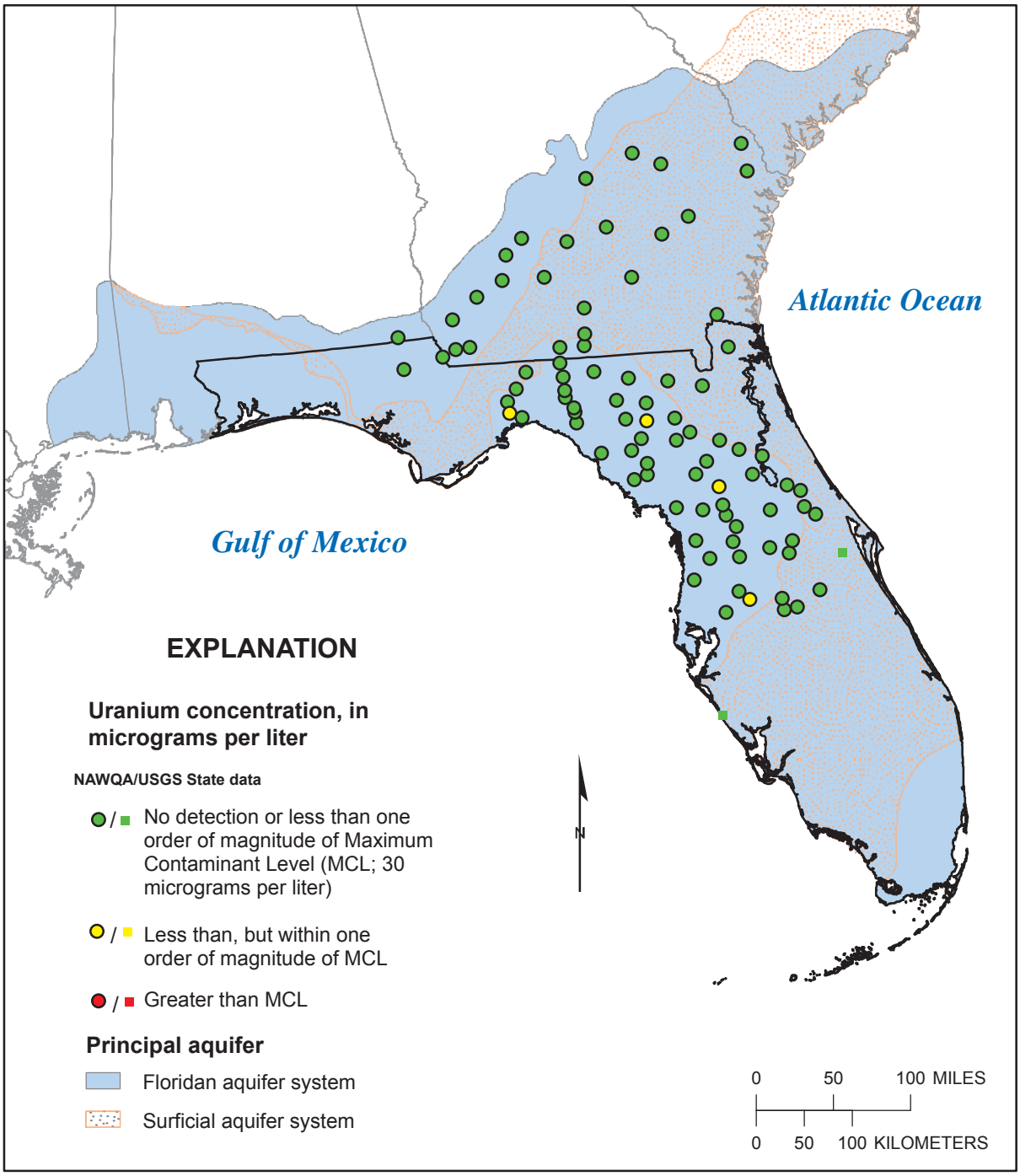
Figure FL14. Concentration of strontium in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure FL15. Concentration of trichloroethene (TCE) in samples in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



Base information from U.S. Geological Survey digital data, 1:2,000,000
Albers Equal-Area projection
Standard Parallels 29°30' and 45°30', central meridian -96°

Principal aquifer data from U.S. Geological Survey, 2003

Figure FL16. Concentration of uranium in samples from domestic wells in Florida and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).