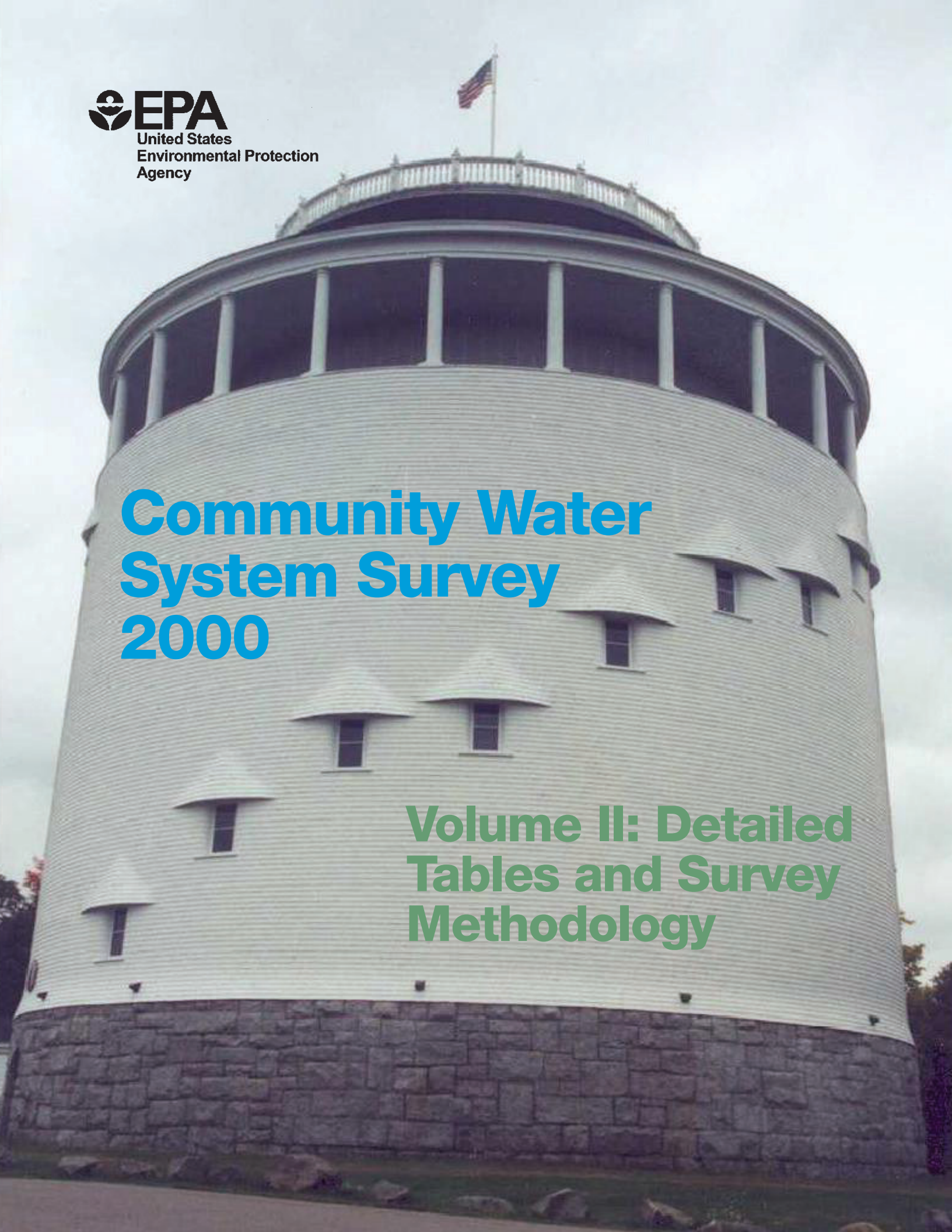

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Community Water System Survey 2000

Volume II: Detailed Tables and Survey Methodology

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Cover Photo: *Bangor, Maine Water District Thomas Hill Standpipe*. Designed by Ashley B. Tower of Tower and Wallace of New York and Holyoke, MA, the standpipe was built during 1897 by Major James M. Davis on land once owned by the Thomas brothers.

The standpipe is actually two structures: a 1.75 million gallon riveted steel tank enclosed by a 110-foot tall wooden jacket. The tank itself is 75 feet in diameter and 50 feet tall. It is topped by a "carousel," a three-ton steel drum from which 24 iron trusses reach to the sides of the building.

The wooden jacket is 85 feet in diameter. It consists of twenty-four 1-foot x 1-foot x 48-foot hard pine main posts covered by 42,000 board-feet of hard pine and 220,000 cedar shingles. The jacket sits atop a stone foundation 9 feet high and 3 1/2 feet thick. A 100-step winding staircase leads to the 12-foot wide promenade deck overlooking the City of Bangor and surrounding communities.

The standpipe is topped by a 38-foot high flagpole and a railing consisting of 192 banisters that give it the look of a large wedding cake or crown when lit at night. The entire structure was built in just 6 months.

Listed on the National Register of Historic Places and designated as an American Water Works Landmark, the standpipe continues to store water and regulate water pressure for Bangor's downtown.

Photo by Brian Rourke

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List of Tables

(Tables are by primary source of water and system service population, unless otherwise noted.)

Part 1

Detailed Survey Results

INTERPRETING THE SURVEY RESULTS

This volume presents extensive and detailed tabulations of the wide variety of data collected by the survey. The tables in this volume summarize the survey results at very fine levels, breaking out the data by eight different population size categories of water systems, and then further breaking out each size category by other system characteristics, such as type of ownership or primary water source.

The report consists of 82 tables that summarize the data, many of which include confidence intervals for each calculation presented. In these tables, each confidence interval appears immediately below the calculation to which it applies. Please familiarize yourself with the interpretive notes when you review the tables themselves.

The tabulations presented in this report are based on data collected from a sample of U.S. water systems, not from a census of every water system in the United States. A confidence interval is one way to gauge how precisely a given tabulation of survey data can be generalized to the entirety of U.S. systems represented by the surveyed systems. Any result presented in a table must be viewed as the center of a range that would encompass the precise number that would be found if every U.S. water system could have been included in the tabulation, and not only those who were sampled and responded to the survey. The confidence interval expresses this range as a "plus/minus," that is, as an amount to be added to and subtracted from the calculated data point actually presented in the table. The size of the confidence interval is designed to include the true value in the stated range 95 percent of the time; i.e., if we drew repeated samples and produced the confidence interval for each sample, the interval would include the true value 95 percent of the time.

For example, Table 60 shows as a survey result that the average publicly owned water system serving over 500,000 people has annual expenses of $131.5 million. The table also shows the confidence interval for this estimate to be ±$23.7 million. Thus, based on the sample of water systems, we can be 95 percent certain that the average annual per capita expenses of all publicly owned systems serving populations of over 500,000 is between $107.8 million and $155.2. million.

These tables always express the confidence interval in the same units as the calculation to which it applies. Thus, in Table 4 the confidence interval numbers for average daily water production represent the same units as the base calculation, namely, millions of gallons per day. In the same table, the confidence interval numbers for the percentage of production derived from different water sources are themselves expressed as percentages. In all cases, the confidence interval may be directly added to and subtracted from the corresponding calculation to determine the expected range.

These tables serve as a starting point for detailed analyses of the data. As shown in Volume I, and as will be apparent in many of the tables in this volume, water systems are a diverse group. While the mean or medians as measures of central tendency may be appropriate statistics in some cases, in others further detail will be required. As described in the notes below, outliers were dropped from

some of the tables to produce meaningful estimates of "typical" systems. Additional adjustments may be necessary to support other analyses. Some analyses may require the use of percentiles or other measures of the full distribution of the data. Other analyses may require excluding the tails of the distribution to characterize typical systems. EPA will continue to analyze the data and present results to support its various regulatory and policy development and implementation analyses.

Finally, several of the tables reports results for water systems' treatment plants and facilities. For this report, a treatment plant or facility is any location where the water system takes steps to change the quality of the water. It includes standard facilities that are clearly recognized as treatment plants, such as conventional filtration plants. It also includes smaller facilities that may not be considered treatment plants in other contexts; for example, a chemical feed on a well that adds chlorine to the water is considered a treatment facility in this report. There is one exception to the general rule that all points where the system makes changes to the water is a treatment facility. Systems that purchase water may boost disinfection or adjust pH within their distribution system; these sites are not counted as treatment facilities.

Detailed Survey Result Tables

Notes on Interpreting the Detailed Tables

1. **Weighted data**. The survey results presented in the following tables are all based on weighted data. As described in Chapter 2 of the methodology report, each water system contained in the final survey database was assigned a sample weight. These weights reflect the fact that the data come from a statistically representative sample of water systems, rather than from a census of every water system in the U.S. In effect, each sampled system represents some number of similar systems from the entire population of U.S. water systems; the number of systems so represented is equal to the sample weight. When added up, the weights of all systems in the final sample will equal the total number of U.S. Community Water Systems that meet the eligibility definition used for the survey (e.g., Federal and state-owned systems were not included). Thus, for the tables to validly represent all eligible U.S. water systems, it is necessary to incorporate each system's sample weight as an additional factor in each calculation involving a data item reported by that system. Another way of expressing this is to say that, when tabulating the data, each sampled system counts not just once as itself, but counts as many times as the numerical amount of its weight. See section 2.2 for a detailed discussion of the derivation of the sample weights.

2. **Interpretation of Table Results**. Each result presented in the tables is the weighted average of the particular data item, for the group of water systems characterized by the row and column headings labeling the table cell where the results appears. The survey data are tabulated so as to facilitate analysis of water systems. In general, this means that the report tabulates all summary results by calculating a given item for each system, factoring into that result the system's sampling weight, then presenting the mean of the weighted results for all the systems falling into the respective table categories (as defined by the table row and column headings). This has significant implications when the calculation of a specific item requires deriving the result from two or more survey variables, e.g., a ratio or a percentage breakdown of component amounts within a total amount. For example, in the case of a ratio, the reported result is the average (mean) of the ratios for each system, rather than the ratio of average values for each of the two variables across systems. This approach treats every system in the universe equally, implying that characteristics of the system are the primary unit of analysis. The alternate approach would treat the content of the component variables in each table as the unit of analysis.

   By way of example, consider two systems. One system produces 1,000,000 gallons per day, and 400,000 of those come from ground sources; hence, 40% of the system's water comes from ground sources. The other system produces 2,000,0000 gallons per day and 1,600,000 of those come from ground sources; hence, 80% of the systems water comes from ground sources. The CWS Survey report would show a result that, on average, these two systems

produce 60% of their water from ground sources: (40%+80%)÷ 2. If the alternate approach where chosen, gallons would be the unit of analysis, and the calculation would show that 67% of the water in those systems comes from ground sources: (400,000+1,600,000)÷(1,000,000+2,000,000). (To focus clearly on the point being illustrated, this example does not attempt to demonstrate the further effect that the system sample weights have on the actual calculations.)

The report has adopted the former approach because this initial view of the data is intended primarily as an analysis of system-level characteristics. There are some exceptions to this approach. Table 11 presents data on both level of the system and a water treatment plant (many systems have more than one treatment plant, while some facilities have none). Tables 12-26 and 29-32 present data on the level of a treatment plant. Tables 27 and 28 present data for test points within systems. Tables 37 and 38 present data on the amount of pipe in the nation, rather than on the system level. Tables 75, 78, and 81 present data on the share of capital funds in the nation, rather than system averages.

3. **Percentages summing to 100%**. Some percentage tables may not present results that total to 100%, as would ordinarily be expected. Such tables would be among those that present absolute or percentage breakdowns of the whole into its components, e.g., breakdowns of total revenue into different customer categories, such as Table 51. Logically, in such breakdowns, the line item amounts should sum to the total amount, and line item percentages should sum to 100 percent. However, in some instances, the tabulated results may not sum exactly to the whole. To increase the precision of each individual result, each component line item was calculated separately using all the data available for the line item. Due to differential item non-response, some component variables may actually have more or fewer observations available than other components. While including all available data in the calculation of the component increases the precision of the tabulated result for the component, it can cause a small reduction in consistency across components, since slightly different systems may be represented in the different calculations. EPA and the CWS survey analysts decided that the increased accuracy for each item outweighs the slight reduction in consistency.

In a few tables, a series of percentages may validly sum to greater than 100%. This occurs when more than one item may apply to the same system. For example, treatment plants may have more than one treatment objective, so the percentage of plants with each objective will sum to more than 100 percent. This situation is always noted on the table.

4. **Confidence Intervals**. The size of the confidence interval is designed to include the true value in the stated range 95 percent of the time. Each confidence interval presented in Part 2 is based on the assumption that the average value reported in a given table cell is normally distributed. In general, this assumption is true. However, calculations based on small numbers of systems may violate this assumption. In such cases the reported confidence intervals will not

be correct. Most of these can be identified by noticing when the plus/minus confidence interval width is larger than, or almost as large as, the calculated average itself. To compute correct confidence intervals for such situations requires examination of the empirical distributions for each variable in the tabulation and is beyond the scope of this report.

Because of the foregoing issue, the reader should take note of results where the lower end of the confidence interval is below zero, as negative numbers are not meaningful in any of the tabulations presented in this report. Similarly, for calculations of percentages, high ends of ranges above 100% are not meaningful. While the reader should be on the lookout for these conditions when any number is near zero or any percentage is near 100%, they can occur at other times, particularly when the confidence interval is large. As stated in note 3, a series of percentages may validly sum to greater than 100% in some tables, when more than one item may apply to the same system. This situation is not related to the issue of confidence intervals extending an individual percentage beyond 100%.

5. Treatment of outliers. For several of the tables, one or two observations have values well above the mean or even the 90th percentile. These outliers would tend to distort the estimates presented in the table and would lead to a misrepresentation of the central tendency for the characteristics in question. For example, 3 systems serving greater than 500,000 people in the sample have more than 100 entry points to the distribution system from ground water sources. Other systems of similar size, on average, have 14 entry points from ground water. If the three outliers are included, the average number of entry points is over 65.

In cases like this, the outliers are dropped from the analysis. It is noted at the bottom of the table when outliers are dropped. The note also will show how the exclusion of the outliers affect the estimate,

6. Interpretation of blank cells and cells with calculated results of zero.

Empty Cells: Throughout the tables, some individual cells or blocks of continuous cells have an asterisk, to denote the cell does not contain an estimate. Any empty cell or block of cells means that there were no observations with data for the cell(s) in question. Generally, this occurs for one of three reasons.

- There are no systems in the cell. The most common illustration of this occurs in all tables that break out the data by ownership type. When data are reported for ancillary systems, the cells for the systems serving more than 3,300 people are always blank for ancillary systems, since there are no ancillary systems in these size categories.

- The item does not apply to the group of systems belonging to that cell. For example, in table 82, the cell SRF loans for private systems serving 100 or fewer people is empty.

This is because no private systems of this size made use of SRF loans.

C The item applies to the group of systems belonging to the cell, but no systems provided data for the item (sometimes referred to as "missing data" in terms of the analytical data file and as "item non-response" in terms of the data collection process that led to the final data file). For example, in Table 13, none of the mixed-water treatment plants in systems serving 25-100 customers provided data on their flows, so these cells are empty on the table.

It is not always possible to distinguish between the last two reasons from the information available in the table. Sometimes the reason is apparent for the table itself. Often, however, further analysis of the database would be needed to determine which particular reason is the basis for a blank cell.

Zero Results: In discussing Table 82 above, it was noted that certain cells are blank for customer categories of private systems. However, other tables have cells which specifically report a zero result and are zero instead of blank. This illustrates an important distinction when interpreting the tables. Blank cells and cells reporting a zero result are not the same thing, and should not be interpreted as such. A reported result of zero means that data were available to produce a calculation, and the calculation resulted in zero.

It should also be noted that occasionally a report of a zero result is a function of the level of precision chosen as appropriate for presenting the data in a given table. In a few instances, items appearing as zero results are actually very small numbers that round to zero within the precision limits of the respective table.

7. **Observations**. The term "observations" refers to the actual number of sampled water systems that provided data for a given tabulated item. Some tables present the number of observations on which the tabulated results are based. In these as in all the tables, the results are still based on the weighted data, not on the simple means of the unweighted observations. The report of the number of observations can be used as a very approximate indication of the sampling precision of the tabulated result. Results based on a small number of observations may not be precise estimates of the universe of water systems represented by the sampling systems. They are included because they may be useful indicators of areas worth further investigation.

8. **Individual table notes**. Additional specific notes and definitions appear on individual tables. The specific CWS Survey questionnaire item(s) on which each tabulation is based are cited below the table. The citation refers to the corresponding question number(s) on the CWS Survey mail questionnaire, which can be found in this report as an Appendix to the Methodology Report. The citations are in the format "Q.#;" the question numbering is identical in both questionnaire versions.

9. **Variables for row and column headings**. In addition to the data sources for the specific tabulations, several data items are used repeatedly throughout the tables as the break-out variables for the table row and column headings. Their sources are not cited on the individual tables. These items and their data sources are

- Population served , from question 20. (If data were not reported in the survey, the population data from SDWIS are used.
- Water source, from question 7.
- Ownership, from questions 3 and 4. Note: for the sake of brevity in the table headings, privately owned community water systems are labeled as "Private Systems" and publicly owned community water systems are labeled as "Public Systems." This use of the label "Public Systems" should not be confused with the CFR definitional term Public Water System, which is a broad class of water systems providing the public with piped drinking water for human consumption. A Community Water System means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. (40 CFR 141.2)
- Treatment facility flow, from question 12.

For population served and water source, data from SDWIS are used if the system did not provide the data in the survey. Approximately 10 percent of the sample were assigned population data from SDWIS because of missing or incomplete responses to the population served questions. An additional 5 percent were assigned source data from SDWIS.

10. **Estimate of the number of systems in the nation**. The report provides an estimate of the national number of community water systems, 52,186. This estimates is a weighted estimate based on sample, and is slightly different from the count of systems in the first quarter of 2002 SDWIS database. The total count is 166 lower than in SDWIS; the count of systems by source and population served is different as well. Table 1 of this Volume presents a detailed crosswalk from count of systems in the latest SDWIS database and the estimate based on the 2000 CWS Survey. The differences between the SDWIS counts and the CWSS estimate can be divided into 5 groups.

First the latest SDWIS draw is a snapshot of systems in 2002. The survey describes systems as they existed in 2000. The data used for the frame for the survey was drawn in 1998; this frame had approximately 3,700 fewer systems in it then the 2002 SDWIS. Second, to prepare for the survey (and the 1999 Drinking Water Infrastructure Needs Survey, DWINS, which used the same frame), the states conducted a thorough review of the database. As part of the states' review the population of consecutive systems were adjusted to account for the total number of people served by each system. While SDWIS

includes only direct retail populations in its estimate of each systems' population-served, the CWS Survey classifies systems by the total population they serve. Also, several major cities had multiple records in SDWIS; independent of the states' review, the multiple records were removed from the data base and replaced with a single record. The net result of this step adds 4,800 systems to the database; it also moves several systems across population served categories.

The third step adjusts for inactive systems. As part of the data collection effort, several systems in the sample were not active water systems. In some cases, they merged with other systems; in other cases, they were no longer community water systems (e.g., they were no longer in business, or they served fewer than 25 people or 15 connections at least 6 months of the year). In these cases, steps were taken to confirm the status of the systems. For example, site visitors went to the system to confirm its status. Approximately 1,200 systems were dropped from the inventory for this reason.

The remaining two changes do not affect the total count of systems; rather, they affect the number of systems classified as ground, surface, or purchased, and they affect the number of systems in each population-served category. SDWIS uses a hierarchy to classify systems by source; basically, a system is classified as a surface water system if it uses any surface water. The survey classifies systems by its primary source of water; a system is classified as a surface water system if surface water is its largest source. It is a ground water system if its largest source is ground water. It is a purchased system otherwise. The systems' responses to the survey are used to classify their source. The final adjustment changes the population-served based on the reported population in the survey.

11. Use of the terms expenses and expenditures. Systems use the terms expenses or expenditures to refer to their spending. Private systems generally use the term "expenses" in accounting as a term for the spending done by a system. Public systems refer to spending as "expenditures"; they reserve the term "expense" for when a cost is incurred, and use the term "expenditure" for when the spending takes place. Tables 49, 59-66, and 73-78 use the term expenses to report spending by both public and private systems.

Table 1
Crosswalk from SDWIS to CWSS 2000 Sample

		Universe of Systems						
		SDWIS			CWSS Projected Universe			CWSS
Classification		1	2	3	4	5	6	Sample
Year data represents		2002	2000	2000	2000	2000	2000	2000
Adjust for state review, and consecutive and grouped systems		No	No	Yes	Yes	Yes	Yes	Yes
Adjust for inactive systems		No	No	No	Yes	Yes	Yes	Yes
Adjust water source definition		No	No	No	No	Yes	Yes	Yes
Adjust population served		No	No	No	No	No	Yes	Yes
Water source	System Service Population							
Ground water	25 - 100	12,838	13,073	13,901	12,740	12,713	11,756	104
	101 - 500	13,238	12,329	13,960	12,894	12,845	13,145	93
	501 - 3,300	9,367	8,933	9,459	9,069	8,960	8,970	92
	3,301 - 10,000	2,368	2,126	2,348	2,333	2,557	3,071	67
	10,001 - 50,000	1,211	1,019	1,221	1,274	1,296	1,340	50
	50,001 - 100,000	136	94	157	149	138	136	29
	100,001 - 500,000	55	42	68	72	68	161	44
	Over 500,000	6	6	12	18	12	10	7
Surface water	25 - 100	417	386	396	827	823	833	46
	101 - 500	635	437	688	1,150	1,150	1,136	55
	501 - 3,300	1,450	1,245	1,479	1,355	1,351	1,212	69
	3,301 - 10,000	998	834	970	1,040	964	1,008	76
	10,001 - 50,000	921	791	930	941	918	988	83
	50,001 - 100,000	191	150	209	202	190	210	58
	100,001 - 500,000	172	144	189	191	168	178	110
	Over 500,000	38	29	65	59	54	53	38
Purchased water	25 - 100	1,028	867	776	679	710	69	6
	101 - 500	2,176	1,840	1,972	2,030	2,079	2,180	23
	501 - 3,300	3,059	2,678	2,815	3,441	3,553	3,834	50
	3,301 - 10,000	1,049	886	925	894	746	973	27
	10,001 - 50,000	773	590	678	650	652	685	28
	50,001 - 100,000	121	76	101	119	142	125	30
	100,001 - 500,000	67	31	58	53	80	92	48
	Over 500,000	5	2	5	6	17	21	13
Total		52,319	48,608	53,382	52,186	52,186	52,186	1,246

Notes: For a more detailed discussion, refer to Note 10 in the introduction to the tables.

Each column represents the following:
1: Current SDWIS universe
2: Unadjusted SDWIS universe when CWSS sample was drawn.
3: Adjusted SDWIS universe when CWSS sample was drawn.
4-6: CWSS projected Universe.

Classification 3 served as the sample frame. (The frame did not separate purchased systems.)
The universe of systems for classifications 4-6 are estimates, based on the sample.

(Continued)

Table 1 (Cont.)
Crosswalk from SDWIS to CWSS 2000 Sample

Classification definitions

Year

2002 Represents the count of systems in the fourth quarter of 2001
2000 Represents the number of systems in the inventory in 2000.

State Review

The States reviewed the inventory for the 1999 Drinking Water Infrastructure Needs Survey.

Consecutive systems

SDWIS counts the population served directly by the water system as the population served by the system. In consecutive systems, only the retail population is counted -- customers served by systems who purchase the water from the wholesaler are not include in the wholesaler's population served. The adjustment counts the wholesale and retail population as part of the population served. This adjustment was made by the states as part of their review of their inventories.

Amalgamated systems

Some systems contain more than one PWSID in SDWIS and are therefore counted as multiple systems. These systems are counted as a single system for the survey.

Inactive systems

Some systems in SDWIS are no longer active community water systems. Others have been combined with existing systems. These inactive systems are dropped from the inventory.

Water Source

SDWIS classifies water systems as surface water if they contain any surface water sources.
CWSS classifies systems by the primary source of water -- i.e., the source that provides most of the system's water.

Population served

The population served in SDWIS is as reported, adjusted for consecutive systems. The population served is adjusted for the systems' responses to the survey.

Table 2
Number and Percentage of Systems
By Primary Source of Water

Primary Source of Water	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
100% Ground Water									
Number	10,358	12,521	8,687	2,576	971	80	108	7	35,308
Percent	82	76	62	51	32	17	25	8	68
Mostly Ground Water									
Number	1,398	624	283	495	368	56	53	3	3,280
Percent	11	4	2	10	12	12	12	4	6
Primarily Surface Water Systems									
100% Surface Water									
Number	790	897	1,015	835	769	140	113	36	4,595
Percent	6	5	7	17	26	30	26	43	9
Mostly Surface Water									
Number	43	239	197	173	220	70	65	17	1,024
Percent	0	1	1	3	7	15	15	20	2
Primarily Purchased Water Systems									
100% Purchased Water									
Number	69	2,050	3,412	773	476	94	46	13	6,933
Percent	1	12	24	15	16	20	11	15	13
Mostly Purchased Water									
Number	*	130	423	200	209	31	45	8	1,046
Percent	*	1	3	4	7	7	10	10	2
All									
Number	12,658	16,461	14,017	5,052	3,013	471	430	84	52,186
Percent	100	100	100	100	100	100	100	100	100

Data: Q.7

Notes: * No purchased water systems of this size in sample.

Table 3
Number of Systems
By Ownership and Primary Source of Water

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public									
Primarily Ground Water Systems	489	3,556	6,694	2,560	1,080	124	143	9	14,655
Primarily Surface Water Systems	245	683	1,139	935	894	182	162	49	4,289
Primarily Purchased Water Systems	*	1,513	3,449	819	568	109	89	19	6,566
All Public	734	5,752	11,282	4,314	2,542	415	394	77	25,510
Private									
Primarily Ground Water Systems	11,267	9,590	2,276	511	259	12	17	1	23,933
Primarily Surface Water Systems	588	453	73	73	95	28	16	4	1,330
Primarily Purchased Water Systems	69	666	386	154	117	16	3	2	1,413
All Private	11,924	10,709	2,735	738	471	56	36	7	26,676
All									
Primarily Ground Water Systems	11,756	13,146	8,970	3,071	1,339	136	160	10	38,588
Primarily Surface Water Systems	833	1,136	1,212	1,008	989	210	178	53	5,619
Primarily Purchased Water Systems	69	2,179	3,835	973	685	125	92	21	7,979
All	12,658	16,461	14,017	5,052	3,013	471	430	84	52,186

Data: Q.3, Q.7

Notes: * No purchased water systems of this size in sample.

Table 4
Average Daily Production (MGD)
By Primary Source of Water

Primary Source of Water	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
100% Ground Water									
Average Daily Production	0.011	0.034	0.158	1.053	2.628	11.892	17.631	125.642	0.313
Confidence interval	+|- *0.009*	+|- *0.009*	+|- *0.034*	+|- *0.193*	+|- *0.382*	+|- *1.643*	+|- *13.186*	+|- *23.115*	+|- *0.052*
Mostly Ground Water									
Average Daily Production	0.003	0.019	0.524	0.872	3.718	11.225	29.778	144.963	3.587
Confidence interval	+|- *0.004*	+|- *0.000*	+|- *0.552*	+|- *0.365*	+|- *1.154*	+|- *1.490*	+|- *4.390*	+|- *32.023*	+|- *1.236*
% Ground Water	66.7	83.3	58.1	78.0	84.5	74.1	73.0	83.5	78.6
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *4.9*	+|- *11.1*	+|- *9.3*	+|- *3.6*	+|- *5.5*	+|- *14.8*	+|- *5.9*
% Surface Water	0.0	0.0	41.9	7.4	2.1	12.4	6.1	0.0	6.0
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *4.9*	+|- *7.3*	+|- *3.9*	+|- *6.1*	+|- *3.1*	+|- *0.0*	+|- *3.9*
% Purchased Water	33.3	16.7	0.0	14.7	13.4	13.5	20.9	16.5	15.4
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *9.6*	+|- *8.8*	+|- *6.4*	+|- *5.8*	+|- *14.8*	+|- *5.3*
Observations	86	88	88	53	35	20	20	5	395
Primarily Surface Water Systems									
100% Surface Water									
Average Daily Production	0.010	0.071	0.279	0.935	4.766	11.041	31.875	271.287	4.280
Confidence interval	+|- *0.007*	+|- *0.031*	+|- *0.059*	+|- *0.153*	+|- *1.430*	+|- *2.681*	+|- *2.733*	+|- *79.561*	+|- *0.995*
Mostly Surface Water									
Average Daily Production	0.014	0.013	0.269	0.779	4.253	11.537	42.431	219.892	8.636
Confidence interval	+|- *0.012*	+|- *0.010*	+|- *0.141*	+|- *0.318*	+|- *1.325*	+|- *1.682*	+|- *5.065*	+|- *96.067*	+|- *4.026*
% Ground Water	35.2	24.0	13.5	18.9	14.3	10.4	14.0	8.9	15.6
Confidence Interval	+|- *19.6*	+|- *6.5*	+|- *10.3*	+|- *10.6*	+|- *6.5*	+|- *4.7*	+|- *2.9*	+|- *4.1*	+|- *4.1*
% Surface Water	64.8	76.0	69.4	76.7	81.5	85.4	82.8	86.4	77.7
Confidence Interval	+|- *19.6*	+|- *6.5*	+|- *8.0*	+|- *8.5*	+|- *5.8*	+|- *5.0*	+|- *3.0*	+|- *4.1*	+|- *3.6*
% Purchased Water	0.0	0.0	17.0	4.4	4.1	4.3	3.3	4.7	6.6
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *13.0*	+|- *4.4*	+|- *4.3*	+|- *3.4*	+|- *1.6*	+|- *2.3*	+|- *3.7*
Observations	41	49	56	63	64	35	70	26	404

(Continued)

Table 4 (Cont.)
Average Daily Production (MGD)
By Primary Source of Water

Primary Source of Water	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Purchased Water Systems									
100% Purchased Water									
Average Daily Production	0.008	0.017	0.150	0.886	2.302	9.595	23.975	129.602	0.866
Confidence interval	*+|- 0.008*	*+|- 0.004*	*+|- 0.046*	*+|- 0.445*	*+|- 0.918*	*+|- 1.417*	*+|- 3.277*	*+|- 69.896*	*+|- 0.309*
Mostly Purchased Water									
Average Daily Production	*	0.016	0.103	1.407	5.595	16.498	32.220	280.185	5.538
Confidence interval	*	*+|- 0.000*	*+|- 0.093*	*+|- 0.490*	*+|- 1.969*	*+|- 8.407*	*+|- 4.606*	*+|- 68.668*	*+|- 3.383*
% Ground Water	*	33.3	42.8	28.4	12.8	22.4	19.5	11.2	31.0
Confidence Interval	*	*+|- 0.0*	*+|- 4.6*	*+|- 10.9*	*+|- 7.3*	*+|- 10.8*	*+|- 4.4*	*+|- 5.8*	*+|- 7.3*
% Surface Water	*	0.0	0.0	3.9	6.9	8.1	8.3	13.1	2.8
Confidence Interval	*	*+|- 0.0*	*+|- 0.0*	*+|- 6.1*	*+|- 8.0*	*+|- 9.2*	*+|- 3.6*	*+|- 6.0*	*+|- 2.5*
% Purchased Water	*	66.7	57.2	67.7	80.3	69.5	72.2	75.7	66.2
Confidence Interval	*	*+|- 0.0*	*+|- 4.6*	*+|- 9.7*	*+|- 10.3*	*+|- 7.2*	*+|- 4.7*	*+|- 8.2*	*+|- 6.1*
Observations	6	22	47	19	17	22	23	7	163
All Systems									
Average Daily Production	0.011	0.033	0.166	0.995	3.589	11.305	28.811	222.672	1.103
Confidence Interval	*+|- 0.008*	*+|- 0.007*	*+|- 0.024*	*+|- 0.131*	*+|- 0.518*	*+|- 1.093*	*+|- 5.427*	*+|- 41.741*	*+|- 0.124*
Observations	138	166	208	170	159	116	201	58	1,216

Data: Q.7

Notes: * No purchased water systems of this size in sample.

Definitions: Production is the amount of water drawn from each source. It includes water delivered to customers and system losses.

Table 5
Unaccounted for Water (MGD)
By Ownership

Ownership Type	System Service Population Category								
	100 or Less	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Average Unaccounted for Water	0.003	0.001	0.017	0.113	0.296	1.166	2.152	18.272	0.188
Confidence Interval	+|- *0.006*	+|- *0.000*	+|- *0.006*	+|- *0.032*	+|- *0.074*	+|- *0.268*	+|- *0.567*	+|- *4.405*	+|- *0.032*
% of Total Water Produced	1.140	5.990	9.935	11.562	8.528	9.693	6.306	7.959	8.949
Confidence Interval	+|- *1.419*	+|- *7.067*	+|- *3.763*	+|- *3.161*	+|- *1.861*	+|- *2.044*	+|- *1.556*	+|- *1.027*	+|- *2.211*
Private Systems									
Average Unaccounted for Water	0.000	0.001	0.012	0.100	0.287	1.055	3.050	7.347	0.019
Confidence Interval	+|- *0.000*	+|- *0.000*	+|- *0.009*	+|- *0.061*	+|- *0.110*	+|- *0.395*	+|- *0.835*	+|- *2.972*	+|- *0.006*
% of Total Water Produced	0.187	2.188	6.237	10.686	12.330	11.093	10.636	7.744	2.323
Confidence Interval	+|- *0.269*	+|- *2.660*	+|- *3.940*	+|- *4.252*	+|- *4.511*	+|- *4.317*	+|- *2.582*	+|- *4.017*	+|- *1.237*
All Systems									
Average Unaccounted for Water	0.000	0.001	0.016	0.111	0.294	1.152	2.227	17.258	0.098
Confidence Interval	+|- *0.000*	+|- *0.000*	+|- *0.006*	+|- *0.028*	+|- *0.064*	+|- *0.238*	+|- *0.536*	+|- *4.031*	+|- *0.012*
% of Total Water Produced	0.258	3.355	9.136	11.435	9.135	9.867	6.670	7.939	5.561
Confidence interval	+|- *0.269*	+|- *2.859*	+|- *3.218*	+|- *2.724*	+|- *1.747*	+|- *1.864*	+|- *1.508*	+|- *1.001*	+|- *1.305*

Data: Q.5D

Definitions: Unaccounted for water includes system losses, water for fire suppression, and water used in the treatment process.

Table 6
Average Number of Wells
By Primary Source of Water

Primary Source of Water	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Wells									
Mean	1.4	1.9	2.6	4.1	7.8	18.1	20.5	132.2	2.5
Confidence interval	+|- *0.1*	+|- *0.2*	+|- *0.4*	+|- *0.7*	+|- *1.5*	+|- *3.6*	+|- *10.1*	+|- *36.9*	+|- *0.2*
Median	1	2	2	4	7	18	19	179	2
Observations	101	93	90	67	49	28	43	6	477
Primarily Surface Water Systems									
Wells									
Mean	1.5	1.3	1.3	3.5	6.9	11.1	20.9	29.3	5.4
Confidence interval	+|- *0.8*	+|- *0.6*	+|- *0.4*	+|- *1.7*	+|- *3.5*	+|- *5.5*	+|- *7.3*	+|- *11.4*	+|- *2.5*
Median	1	1	1	5	6	7	7	27	2
Observations	2	5	6	9	11	16	33	8	90
Primarily Purchased Water Systems									
Wells									
Mean	*	1.0	1.5	3.7	5.2	15.9	16.6	83.9	3.9
Confidence interval	*	+|- *0.0*	+|- *0.6*	+|- *1.7*	+|- *2.7*	+|- *10.5*	+|- *3.3*	+|- *26.0*	+|- *1.6*
Median	*	1	2	3	4	9	15	66	2
Observations	*	1	3	6	11	6	22	3	52
All Systems									
Wells									
Mean	1.4	1.9	2.5	4.1	7.4	16.2	19.9	76.9	2.5
Confidence interval	+|- *0.1*	+|- *0.2*	+|- *0.4*	+|- *0.6*	+|- *1.3*	+|- *3.2*	+|- *6.4*	+|- *18.0*	+|- *0.2*
Median	1	2	2	4	6	12	15	69	2
Observations	103	99	99	82	71	50	98	17	619

Data: Q.10

Notes: * No purchased water systems of this size in sample.

Excludes systems with zero wells.

One surface water system serving 3,301-10,000 with 64 wells was dropped from the estimate. If included, the mean number of wells are 18.8 for this category.

Drops 2 outliers from the over 500,000 population category, each with over 200 wells. If outliers were included, the average number of wells for ground water systems are 185 and surface water 49 for this size category

Table 7
Average Number of Entry Points to the Distribution System
By Primary Source of Water

Primary Source of Water	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Entry Points from Ground Water Sources	1.2	1.4	1.8	2.8	4.2	6.3	7.2	13.9	1.7
Confidence interval	+|- *0.1*	+|- *0.2*	+|- *0.3*	+|- *0.4*	+|- *1.1*	+|- *2.1*	+|- *4.0*	+|- *7.6*	+|- *0.1*
Entry Points from Surface Water Sources	0.1	0.1	0.0	0.1	0.1	0.9	0.1	0.0	0.1
Confidence interval	+|- *0.1*	+|- *0.1*	+|- *0.0*	+|- *0.1*	+|- *0.1*	+|- *0.8*	+|- *0.1*	+|- *0.0*	+|- *0.0*
Observations	104	93	92	67	50	29	43	5	483
Primarily Surface Water Systems									
Entry Points from Ground Water Sources	0.1	0.3	0.2	0.4	0.8	1.2	1.4	1.9	0.4
Confidence interval	+|- *0.1*	+|- *0.3*	+|- *0.1*	+|- *0.4*	+|- *0.7*	+|- *1.3*	+|- *0.5*	+|- *1.8*	+|- *0.2*
Entry Points from Surface Water Sources	1.3	1.2	1.1	1.2	1.3	1.6	1.6	2.7	1.2
Confidence interval	+|- *0.4*	+|- *0.3*	+|- *0.1*	+|- *0.2*	+|- *0.1*	+|- *0.2*	+|- *0.1*	+|- *0.3*	+|- *0.1*
Observations	46	55	69	76	83	58	109	37	533
Primarily Purchased Water Systems									
Entry Points from Ground Water Sources	0.0	0.1	0.2	0.3	1.1	2.6	4.5	6.9	0.3
Confidence interval	+|- *0.0*	+|- *0.1*	+|- *0.2*	+|- *0.3*	+|- *0.7*	+|- *2.5*	+|- *2.1*	+|- *5.5*	+|- *0.2*
Entry Points from Surface Water Sources	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.5	0.0
Confidence interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.1*	+|- *0.1*	+|- *0.3*	+|- *0.0*
Observations	6	23	50	27	28	30	48	12	224
All Systems									
Entry Points from Ground Water Sources	1.1	1.1	1.2	1.8	2.4	3.1	4.2	4.3	1.3
Confidence interval	+|- *0.1*	+|- *0.2*	+|- *0.0*	+|- *0.0*	+|- *0.6*	+|- *1.1*	+|- *1.2*	+|- *2.0*	+|- *0.1*
Entry Points from Surface Water Sources	0.2	0.1	0.1	0.3	0.5	1.0	0.8	1.9	0.2
Confidence interval	+|- *0.1*	+|- *0.1*	+|- *0.0*	+|- *0.1*	+|- *0.1*	+|- *0.2*	+|- *0.2*	+|- *0.2*	+|- *0.0*
Observations	156	171	211	170	161	117	200	54	1,240

Data: Q.10

Notes: Drops 3 outliers from the over 500,000 population category, each with over 100 ground water entry points. The number of entry points are 68 for ground water systems and 5 for surface water systems if included in the estimate.

Table 8
Number of Systems Selling to Other Public Water Suppliers
By Primary Source of Water

Primary Source of Water	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Treated Water	0	334	655	465	325	44	67	11	1,901
Untreated Water	0	0	63	0	0	4	6	1	75
Observations	104	91	87	66	47	28	44	7	474
Primarily Surface Water Systems									
Treated Water	25	17	172	426	521	150	148	47	1,507
Untreated Water	19	0	0	11	39	3	12	8	93
Observations	44	53	68	73	80	56	105	36	515
Primarily Purchased Water Systems									
Treated Water	0	0	463	208	255	49	39	16	1,029
Untreated Water	0	0	0	0	16	0	7	3	26
Observations	5	23	50	26	27	30	47	12	220
All Systems									
Treated Water	25	351	1,290	1,099	1,101	243	255	73	4,438
Untreated Water	19	0	63	11	55	7	26	13	194
Observations	153	167	205	165	154	114	196	55	1,209

Data: Q.5a

Table 9
Water Systems Not Providing Any Treatment
By Primary Source of Water

Primary Source of Water	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Percent of Systems	35.2	22.1	14.8	13.9	2.0	3.0	2.6	0.0	22.9
Confidence Interval	+|- *13.1*	+|- *11.2*	+|- *9.3*	+|- *10.1*	+|- *3.9*	+|- *5.2*	+|- *4.3*	+|- *0.0*	+|- *6.1*
Number of Entry Points	1.2	1.4	2.6	3.3	2.0	20.0	3.0	0	1.6
Confidence Interval	+|- *0.1*	+|- *0.3*	+|- *1.1*	+|- *1.3*	+|- *0.0*	+|- *0.0*	+|- *0.0*	0	+|- *0.2*
Observations	104	93	92	67	50	29	44	7	486
Primarily Surface Water Systems									
Percent of Systems	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*
Number of Entry Points	1.0	0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Confidence Interval	+|- *0.0*	0	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*
Observations	46	55	69	76	83	58	110	38	535
Primarily Purchased Water Systems									
Percent of Systems	0.0	100.0	0.0	0.0	0.0	26.7	8.0	0.0	13.5
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *27.4*	+|- *8.7*	+|- *0.0*	+|- *22.3*
Number of Entry Points	0.0	1.0	0.0	0.0	0.0	10.5	5.0	0.0	1.7
Confidence Interval	0.0	+|- *0.0*	0.0	0.0	0.0	+|- *7.9*	+|- *4.6*	0.0	+|- *1.4*
Observations		1	3	8	10	8	25	6	61
All Systems									
Percent of Systems	33.0	21.1	12.5	9.9	1.1	3.3	2.0	0.0	19.9
Confidence Interval	+|- *12.3*	+|- *10.3*	+|- *7.8*	+|- *7.3*	+|- *2.1*	+|- *3.2*	+|- *2.1*	+|- *0.0*	+|- *5.3*
Number of Entry Points	1.2	1.4	2.6	3.3	2.0	13.7	3.9	0	1.6
Confidence Interval	+|- *0.1*	+|- *0.3*	+|- *1.1*	+|- *1.3*	+|- *0.0*	+|- *6.9*	+|- *2.4*	0	+|- *0.2*
Observations	150	149	164	151	143	95	179	51	1,082

Data: Q.10, Q.11

Notes: *No data for these cells.

Estimate of number of entry points for systems that do not treat. Categories where all systems treat are denoted as zero.

Excludes systems that purchase 100% of their water.

Table 10
Ground Water Entry Points Not Receiving Treatment
By System Service Population

Primary Source of Water	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
# of Ground Water Entry Points Untreated per System	0.4	0.3	0.5	0.6	0.2	2.2	2.6	1.8	0.4
Confidence Interval	+|- *0.2*	+|- *0.2*	+|- *0.3*	+|- *0.4*	+|- *0.2*	+|- *1.4*	+|- *2.3*	+|- *1.8*	+|- *0.1*
% of Ground Water Entry Points Untreated per System	35.3	24.7	17.7	16.6	7.2	36.2	12.3	25.7	25.2
Confidence Interval	+|- *13.1*	+|- *11.2*	+|- *9.9*	+|- *11.3*	+|- *6.3*	+|- *25.3*	+|- *9.1*	+|- *20.7*	+|- *6.3*
Observations	104	93	92	60	44	26	42	6	467
Primarily Surface Water Systems									
# of Ground Water Entry Points Untreated per System	0.1	0.0	0.1	0.1	0.6	1.1	1.1	1.8	0.2
Confidence Interval	+|- *0.1*	+|- *0.0*	+|- *0.1*	+|- *0.1*	+|- *0.7*	+|- *1.3*	+|- *0.5*	+|- *1.8*	+|- *0.1*
% of Ground Water Entry Points Untreated per System	82.4	11.3	77.5	24.0	54.3	64.4	49.2	37.5	42.2
Confidence Interval	+|- *34.5*	+|- *20.8*	+|- *26.7*	+|- *20.6*	+|- *24.6*	+|- *19.5*	+|- *10.0*	+|- *18.7*	+|- *18.3*
Observations	46	55	69	76	83	58	109	37	533
Primarily Purchased Water Systems									
# of Ground Water Entry Points Untreated per System	0.0	0.1	0.0	0.0	0.5	0.7	1.2	2.8	0.1
Confidence Interval	+|- *0.0*	+|- *0.1*	+|- *0.0*	+|- *0.0*	+|- *0.5*	+|- *1.0*	+|- *0.8*	+|- *2.9*	+|- *0.1*
% of Ground Water Entry Points Untreated per System	0.0	100.0	0.0	0.0	45.6	44.5	28.4	56.9	26.0
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *33.2*	+|- *39.3*	+|- *15.2*	+|- *33.0*	+|- *26.1*
Observations	6	23	50	25	26	29	45	13	217
All Systems									
# of Ground Water Entry Points Untreated per System	0.4	0.3	0.3	0.3	0.4	1.3	1.7	2.1	0.3
Confidence Interval	+|- *0.1*	+|- *0.1*	+|- *0.2*	+|- *0.2*	+|- *0.3*	+|- *0.8*	+|- *0.8*	+|- *1.4*	+|- *0.1*
% of Ground Water Entry Points Untreated per System	35.5	25.1	18.0	16.4	17.9	44.5	23.5	36.6	25.6
Confidence Interval	+|- *13.0*	+|- *11.0*	+|- *9.5*	+|- *10.2*	+|- *7.6*	+|- *15.6*	+|- *9.4*	+|- *13.1*	+|- *6.0*
Observations	156	171	211	161	153	113	196	56	1,217

Data: Q.10, Q.11, Q.12

Notes: * No observations.

Number of entry points that are not treating for all systems include treated and untreated entry points.

Drops 2 outliers from the over 500,000 population category, each with over 100 ground water entry points. If included, ground water entry points not receiving treatment are 27.5 and surface water entry points not receiving treatment are 4.4 for this size category .

Please note that the unit of analysis changes for the following tables. Tables 11-32 report data for treatment plants rather than water systems.

Table 11
Treatment Plants per System
By Primary Source of Water

Primary Source of Water	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
100% Ground Water Systems									
# Water Treatment Plants/System	1.1	1.4	1.5	2.3	2.4	6.3	5.2	17.3	1.5
Confidence Interval	+|- *0.1*	+|- *0.2*	+|- *0.3*	+|- *0.5*	+|- *0.7*	+|- *3.3*	+|- *4.0*	+|- *11.6*	+|- *0.1*
# Wells /Plant	1.2	1.4	1.5	2.0	3.0	2.6	2.8	4.3	1.6
Confidence Interval	+|- *0.1*	+|- *0.2*	+|- *0.3*	+|- *0.6*	+|- *1.1*	+|- *1.4*	+|- *1.5*	+|- *4.8*	+|- *0.1*
Observations	62	66	75	39	31	18	20	3	314
Mostly Ground Water Systems									
# Water Treatment Plants/System	1.3	1.4	2.1	2.0	4.7	1.4	3.5	2.0	2.0
Confidence Interval	+|- *0.4*	+|- *0.5*	+|- *0.5*	+|- *0.6*	+|- *2.0*	+|- *0.5*	+|- *1.2*	+|- *0.0*	+|- *0.5*
# Wells /Plant	1.0	1.0	1.0	1.8	1.6	4.1	6.1	41.3	1.6
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.6*	+|- *0.6*	+|- *2.8*	+|- *3.8*	+|- *23.3*	+|- *0.3*
% of Plants Treating Surface Water	0.4	26.1	10.0	17.4	2.9	57.9	11.4	25.0	11.0
Confidence Interval	+|- *1.0*	+|- *29.4*	+|- *17.5*	+|- *11.0*	+|- *4.2*	+|- *33.5*	+|- *7.0*	+|- *22.8*	+|- *8.5*
Observations	9	4	3	13	12	8	21	2	72
Primarily Surface Water Systems									
100% Surface Water Systems									
# Water Treatment Plants/System	1.0	1.0	1.0	1.1	1.0	1.2	1.3	2.6	1.1
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.1*	+|- *0.0*	+|- *0.2*	+|- *0.1*	+|- *0.3*	+|- *0.0*
Observations	40	48	56	61	64	35	68	25	397
Mostly Surface Water Systems									
# Water Treatment Plants/System	1.0	1.8	1.2	1.6	1.5	1.5	2.2	2.8	1.6
Confidence Interval	+|- *0.0*	+|- *0.3*	+|- *0.4*	+|- *0.6*	+|- *0.5*	+|- *0.3*	+|- *0.2*	+|- *0.5*	+|- *0.2*
# Wells /Plant	2.0	1.1	1.3	2.6	2.9	3.6	17.0	19.3	3.0
Confidence Interval	+|- *0.0*	+|- *0.3*	+|- *0.5*	+|- *1.3*	+|- *1.6*	+|- *1.8*	+|- *7.2*	+|- *8.0*	+|- *1.8*
% of Plants Treating Surface Water	76.9	54.7	88.5	62.0	74.8	84.4	75.0	88.3	70.4
Confidence Interval	+|- *40.0*	+|- *9.1*	+|- *12.8*	+|- *22.2*	+|- *25.6*	+|- *10.4*	+|- *7.8*	+|- *5.9*	+|- *11.7*
Observations	5	6	13	13	19	23	40	12	131

(Continued)

Table 11 (Cont.)
Treatment Plants per System
By Primary Source of Water

Primary Source of Water	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Purchased Water Systems									
100% Purchased Water Systems									
# Water Treatment Plants/System	1.0	1.0	1.0	1.0	1.2	1.6	1.4	2.2	1.1
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.3*	+|- *0.6*	+|- *0.4*	+|- *0.6*	+|- *0.1*
Observations	4	6	6	3	6	6	9	3	43
Mostly Purchased Water Systems									
# Water Treatment Plants/System	*	*	1.5	1.6	2.6	11.5	3.7	2.8	2.1
Confidence Interval	*	*	+|- *0.6*	+|- *0.4*	+|- *0.9*	+|- *14.1*	+|- *2.4*	+|- *0.6*	+|- *0.6*
# Wells /Plant	*	*	1.0	3.2	1.3	1.2	3.4	18.0	1.6
Confidence Interval	*	*	+|- *0.0*	+|- *2.8*	+|- *0.4*	+|- *0.3*	+|- *2.6*	+|- *18.6*	+|- *0.5*
% of Plants Treating Surface Water	*	*	0.0	9.4	10.7	3.9	21.6	81.8	7.3
Confidence Interval	*	*	+|- *0.0*	+|- *14.9*	+|- *15.4*	+|- *6.9*	+|- *16.6*	+|- *14.2*	+|- *6.0*
Observations	*	*	3	6	8	5	20	6	48
All Systems									
# Water Treatment Plants/System	1.1	1.4	1.5	1.9	2.1	2.8	3.0	3.6	1.5
Confidence Interval	+|- *0.1*	+|- *0.2*	+|- *0.2*	+|- *0.3*	+|- *0.4*	+|- *1.0*	+|- *0.9*	+|- *1.0*	+|- *0.1*
# Wells /Plant	1.2	1.3	1.5	2.0	2.4	2.3	4.3	7.4	1.6
Confidence Interval	+|- *0.1*	+|- *0.2*	+|- *0.2*	+|- *0.5*	+|- *0.6*	+|- *1.0*	+|- *1.5*	+|- *6.3*	+|- *0.1*
% of Plants Treating Surface Water	8.9	8.6	9.5	17.8	22.7	30.3	27.3	61.9	12.5
Confidence Interval	+|- *5.4*	+|- *4.3*	+|- *3.3*	+|- *3.9*	+|- *4.6*	+|- *11.4*	+|- *7.1*	+|- *17.9*	+|- *2.1*
Observations	120	130	156	135	140	95	178	51	1,005

Data: Q.10, Q.12

Notes: *No data available for these cells.

Includes systems with at least one treatment plant only.

Some systems have surface water with ground water feeding into it which then run through surface water plants.

There are only 5 systems serving over 500,000 people with 100% ground water. Two of these systems have over 190 treatment plants and are excluded from the estimate. If included, the average number of treatment plants per system are 92 for this stratum.

Definitions: See "Plant" definition in introduction.

Table 12
Number of Wells Treated per Treatment Plant
By Treatment Plant's Water Source

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Ground Water Plants									
# Wells /Plant	1.2	1.3	1.5	2.4	2.3	2.3	3.8	7.4	1.6
Confidence Interval	+|- *0.1*	+|- *0.2*	+|- *0.2*	+|- *1.0*	+|- *0.6*	+|- *1.0*	+|- *1.4*	+|- *6.3*	+|- *0.2*
Observations	83	98	127	125	168	186	394	62	1,243
Mixed Plants									
# Wells /Plant	2.0	1.2	2.0	4.5	3.7	3.4	15.4	4.0	3.6
Confidence Interval	+|- *0.0*	+|- *0.5*	+|- *0.0*	+|- *1.9*	+|- *2.1*	+|- *1.6*	+|- *8.1*	+|- *0.0*	+|- *2.1*
Observations	1	3	1	8	10	4	21	1	49
All Plants									
# Wells /Plant	1.2	1.3	1.5	2.4	2.4	2.3	4.3	7.4	1.6
Confidence Interval	+|- *0.1*	+|- *0.1*	+|- *0.2*	+|- *1.0*	+|- *0.6*	+|- *1.0*	+|- *1.5*	+|- *6.2*	+|- *0.2*
Observations	84	101	128	133	178	190	415	63	1,292

Data: Q.10, Q.12

Notes: This table reports number of wells treated per ground water plant (ie: plants with zero wells are excluded).

Two systems serving over 500,000 people have over 190 wells, each with its own treatment. They are excluded from this estimate; if included the number of wells per ground water plant for systems serving over 500,000 are 1.9.

Table 13
Treatment Plant Flow Characteristics
By Type of Water Source
(Thousands of Gallons/Day)

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Ground Water Plants									
Average Daily Flow	6	30	106	461	1,148	3,142	4,251	15,649	312
Confidence Interval	*+|- 1*	*+|- 9*	*+|- 24*	*+|- 103*	*+|- 267*	*+|- 1,199*	*+|- 1,724*	*+|- 2,827*	*+|- 60*
Peak Daily Flow	18	71	241	821	1,949	5,231	6,810	32,000	558
Confidence Interval	*+|- 8*	*+|- 27*	*+|- 41*	*+|- 187*	*+|- 430*	*+|- 1,624*	*+|- 2,809*	*+|- 5,967*	*+|- 99*
Design Capacity	66	206	406	1,239	2,751	6,584	8,909	28,541	824
Confidence Interval	*+|- 26*	*+|- 80*	*+|- 95*	*+|- 229*	*+|- 747*	*+|- 2,376*	*+|- 3,174*	*+|- 5,806*	*+|- 130*
Surface Water Plants									
Average Daily Flow	15	67	272	867	3,661	7,869	21,137	84,020	4,474
Confidence Interval	*+|- 9*	*+|- 32*	*+|- 54*	*+|- 138*	*+|- 769*	*+|- 1,266*	*+|- 1,671*	*+|- 10,820*	*+|- 704*
Peak Daily Flow	24	130	498	1,420	5,936	13,184	34,104	138,713	7,351
Confidence Interval	*+|- 8*	*+|- 73*	*+|- 117*	*+|- 218*	*+|- 1,041*	*+|- 2,184*	*+|- 2,620*	*+|- 19,450*	*+|- 1,165*
Design Capacity	39	227	888	2,146	8,404	17,129	42,530	173,283	9,544
Confidence Interval	*+|- 16*	*+|- 145*	*+|- 260*	*+|- 414*	*+|- 1,617*	*+|- 2,739*	*+|- 3,322*	*+|- 25,220*	*+|- 1,507*
Mixed Plants									
Average Daily Flow	*	11	120	522	4,017	6,272	22,112	54,700	4,023
Confidence Interval	*	*+|- 8*	*+|- 0*	*+|- 240*	*+|- 2,445*	*+|- 2,369*	*+|- 3,463*	*+|- 7,708*	*+|- 3,177*
Peak Daily Flow	*	28	135	1,041	8,260	8,383	38,680	75,750	6,942
Confidence Interval	*	*+|- 31*	*+|- 0*	*+|- 562*	*+|- 7,580*	*+|- 3,015*	*+|- 6,423*	*+|- 8,792*	*+|- 5,606*
Design Capacity	*	46	154	1,717	11,986	13,492	60,581	85,833	10,156
Confidence Interval	*	*+|- 29*	*+|- 0*	*+|- 796*	*+|- 10,098*	*+|- 6,623*	*+|- 10,534*	*+|- 11,955*	*+|- 8,129*

(Continued)

Table 13 (Cont.)
Treatment Plant Flow Characteristics
By Type of Water Source
(Thousands of Gallons/Day)

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
All Plants									
Average Daily Flow	8	32	126	544	2,017	5,686	10,847	72,523	1,025
Confidence Interval	*+|- 2*	*+|- 9*	*+|- 25*	*+|- 92*	*+|- 369*	*+|- 1,158*	*+|- 2,076*	*+|- 10,637*	*+|- 148*
Peak Daily Flow	19	75	272	945	3,383	9,471	17,645	119,940	1,727
Confidence Interval	*+|- 7*	*+|- 25*	*+|- 39*	*+|- 166*	*+|- 597*	*+|- 1,785*	*+|- 3,303*	*+|- 18,076*	*+|- 242*
Design Capacity	61	204	464	1,431	4,794	12,257	22,978	147,722	2,342
Confidence Interval	*+|- 22*	*+|- 73*	*+|- 96*	*+|- 215*	*+|- 922*	*+|- 2,457*	*+|- 4,368*	*+|- 24,301*	*+|- 311*

Data: Q.7, Q.10, Q.12

Notes: *No data available for these cells.

Excludes plants that treat only purchased treated water.

Table presents average flows for plants in the sample. It includes only plants that reported complete data for average daily production, peak daily production, and design capacity.

One ground water system serving 25-100 people with four plants all having an average daily flow greater than 4 MGD, a peak daily flow greater than 8 MGD, and a design capacity greater than 11 MGD was dropped. If included, average daily flow is 16,000 gallons of water per day, peak daily flow is 37,000 gallons of water per day, and design capacity is 94,000 gallons of water per day.

One surface water plant with a capacity of 1.5 MGD in a system serving 25-100 people was excluded from this estimate. If included, average daily flow is 17,000 gallons of water per day, peak daily flow is 27,000 gallons of water per day, & design capacity of 90,000 gallons of water per day.

One ground water plant with a capacity of more than 400 MGD in a system serving greater than 500,000 people was excluded from this estimate. If included, average daily flow is 25 MGD, peak daily flow is 54 MGD, and design capacity is 50 MGD.

Table 14
Comparison of Average Daily Treated Production to Treatment Design Capacity for Plants
By Primary Source of Water

Water Source	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Ground Water Plants									
Ratio: Average Daily Production to Design Capacity	0.20	0.26	0.34	0.42	0.47	0.47	0.51	0.54	0.32
Confidence interval	+|- *0.09*	+|- *0.10*	+|- *0.07*	+|- *0.11*	+|- *0.07*	+|- *0.06*	+|- *0.08*	+|- *0.11*	+|- *0.04*
Ratio: Peak Daily Production to Design Capacity	0.43	0.52	0.71	0.69	0.78	0.89	0.91	1.10	0.62
Confidence interval	+|- *0.19*	+|- *0.14*	+|- *0.09*	+|- *0.12*	+|- *0.06*	+|- *0.06*	+|- *0.13*	+|- *0.23*	+|- *0.06*
Observations	31	64	90	93	85	68	205	17	653
Surface Water Plants									
Ratio: Average Daily Production to Design Capacity	0.53	0.42	0.36	0.45	0.45	0.46	0.53	0.50	0.44
Confidence interval	+|- *0.35*	+|- *0.10*	+|- *0.05*	+|- *0.04*	+|- *0.04*	+|- *0.04*	+|- *0.02*	+|- *0.02*	+|- *0.06*
Ratio: Peak Daily Production to Design Capacity	0.78	0.72	0.63	0.74	0.73	0.76	0.83	0.83	0.72
Confidence interval	+|- *0.26*	+|- *0.07*	+|- *0.08*	+|- *0.06*	+|- *0.05*	+|- *0.05*	+|- *0.03*	+|- *0.03*	+|- *0.04*
Observations	36	48	71	81	81	79	157	98	651
Mixed Plants									
Ratio: Average Daily Production to Design Capacity	*	0.24	0.78	0.30	0.44	0.51	0.41	0.65	0.34
Confidence interval	*	+|- *0.04*	+|- *0.00*	+|- *0.02*	+|- *0.15*	+|- *0.10*	+|- *0.05*	+|- *0.07*	+|- *0.09*
Ratio: Peak Daily Production to Design Capacity	*	0.52	0.88	0.61	0.65	0.70	0.70	0.91	0.60
Confidence interval	*	+|- *0.13*	+|- *0.00*	+|- *0.15*	+|- *0.18*	+|- *0.18*	+|- *0.07*	+|- *0.03*	+|- *0.12*
Observations	*	3	1	7	9	4	27	6	57
All Plants									
Ratio: Average Daily Production to Design Capacity	0.25	0.28	0.34	0.43	0.46	0.46	0.51	0.52	0.34
Confidence interval	+|- *0.12*	+|- *0.09*	+|- *0.06*	+|- *0.08*	+|- *0.05*	+|- *0.03*	+|- *0.05*	+|- *0.03*	+|- *0.04*
Ratio: Peak Daily Production to Design Capacity	0.49	0.54	0.70	0.70	0.76	0.82	0.87	0.87	0.64
Confidence interval	+|- *0.06*	+|- *0.08*	+|- *0.05*	+|- *0.03*	+|- *0.05*	+|- *0.03*	+|- *0.04*	+|- *0.17*	+|- *0.05*
Observations	67	115	162	181	175	151	389	121	1,361

Data: Q.10, Q.12

Notes:

* No data available for these cells.

Table presents average ratios for plants in the sample. It includes only plants that reported complete data for average daily production, peak daily production, and design capacity.

Excludes plants that treat only purchased treated water.

One ground water system serving 25-100 people with four plants was dropped. This system has little impact on the ratios.

One surface water plant with a capacity of 1.5 MGD in a system serving 25-100 people was excluded from this estimate. This system has little impact on the ratios.

One ground water plant with a capacity of more than 400 MGD in a system serving greater than 500,000 people was excluded from this estimate. This system has little impact on the ratios.

Table 15
Treatment Plants and Operator Hours per Week
By Primary Source of Water and System Service Population

Water Source	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Ground Water Plants									
% of Plants with 24/7 Operator	0.8	1.6	0.5	0.9	4.2	15.3	20.9	14.6	1.7
Avg. hours/week for systems without a 24/7 Operator	4.0	5.2	12.4	18.5	21.2	9.1	18.3	9.7	10.0
Observations	68	88	109	116	112	85	294	19	891
Surface Water Plants									
% of Plants with 24/7 Operator	0.0	0.0	0.9	15.8	51.4	65.6	84.1	96.5	22.1
Avg. hours/week for systems without a 24/7 Operator	8.4	21.0	45.1	60.4	102.3	65.6	32.8	36.3	43.5
Observations	46	55	74	80	84	78	165	111	693
Mixed Plants									
% of Plants with 24/7 Operator	0.0	0.0	0.0	8.9	53.1	71.5	68.7	100.0	22.4
Avg. hours/week for systems without a 24/7 Operator	3.0	3.4	43.0	54.8	59.4	48.0	40.9	*	27.4
Observations	1	3	1	8	10	4	27	6	60
All Plants									
% of Plants with 24/7 Operator	0.7	1.5	0.5	3.6	17.5	39.7	41.1	84.6	4.6
Avg. hours/week for systems without a 24/7 Operator	4.4	6.3	16.2	25.4	34.2	24.5	20.0	15.2	13.8
Observations	115	146	184	204	206	167	486	136	1,644

Data: Q.17

Notes: *No plants without a 24/7 operator in mixed plants serving greater than 500,000 people.

Excludes plants treating only purchased treated water.

Some plants are not run 24 hours a day, 7 days a week and therefore do not require an operator 24 hours a day, 7 days a week.

Definitions: "24/7" means that an Operator is on site 24 hours per day, 7 days per week.

Table 16
Treatment Plants and Operator Hours per Week
By Primary Source of Water and Average Daily Production

	Plant Average Daily Production (MGD)						
Water Source	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Ground Water Plants							
% of Plants with 24/7 Operator	2.5	0.2	0.7	12.7	52.0	0.0	1.7
Avg. hours/week for systems without a 24/7 Operator	3.3	6.6	18.3	28.4	20.6	8.0	10.0
Observations	106	157	303	275	49	1	891
Surface Water Plants							
% of Plants with 24/7 Operator	0.3	0.0	4.2	48.4	92.8	100.0	22.1
Avg. hours/week for systems without a 24/7 Operator	5.8	18.3	49.6	91.5	50.6	*	43.5
Observations	28	79	138	178	245	25	693
Mixed Plants							
% of Plants with 24/7 Operator	5.8	0.0	0.0	50.2	83.2	*	22.4
Avg. hours/week for systems without a 24/7 Operator	2.0	17.6	49.0	68.2	42.8	*	27.4
Observations	3	3	8	16	30	*	60
All Plants							
% of Plants with 24/7 Operator	2.5	0.1	1.2	28.7	84.3	95.7	4.6
Avg. hours/week for systems without a 24/7 Operator	3.4	7.6	23.6	48.9	33.0	8.0	13.8
Observations	137	239	449	469	324	26	1,644

Data: Q.17

Notes: *No observations.

Excludes plants treating only purchased treated water.

Some plants are not run 24 hours a day, 7 days a week and therefore do not require an operator 24 hours a day, 7 days a week.

Definitions: "24/7" means that an Operator is on site 24 hours per day, 7 days per week.

Table 17
Plants Lacking 24/7 Operator that Have SCADA Systems
By Primary Source of Water and System Service Population

Water Source	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Ground Water Plants									
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Monitoring	4.4	1.4	14.0	58.7	64.4	81.3	85.6	82.8	19.4
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Control	5.4	3.8	15.5	20.1	53.2	57.6	42.4	82.8	14.1
Observations	63	82	106	113	108	71	234	16	793
Surface Water Plants									
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Monitoring	6.3	21.6	43.7	50.6	74.5	96.0	96.4	100.0	39.1
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Control	3.0	18.5	31.9	26.4	61.0	93.0	67.5	75.0	28.0
Observations	46	55	73	65	38	20	25	4	326
Mixed Plants									
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Monitoring	0.0	0.0	0.0	39.1	46.0	100.0	100.0	*	20.7
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Control	0.0	89.8	0.0	29.3	0.0	0.0	85.7	*	57.6
Observations	1	3	1	7	5	1	8	*	26
All Plants									
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Monitoring	4.6	2.8	17.2	57.1	65.6	85.4	86.7	86.0	21.5
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Control	5.1	6.2	17.3	21.2	53.6	66.7	45.3	81.4	16.0
Observations	110	140	180	185	151	92	267	20	1,145

Data: Q.17

Notes: *No observations.

Definitions: "24/7" means that an Operator is on site 24 hours per day, 7 days per week.

Table 18
Systems Lacking 24/7 Operator that Have SCADA Systems
By Primary Source of Water and Average Daily Production

Water Source	Plant Average Daily Production (MGD) 0 - 0.01	0.01 - 0.1	0.1 - 1.0	1.0 - 10.0	10.0 - 100.0	Over 100	All Sizes
Ground Water Plants							
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Monitoring	4.2	8.1	39.8	81.7	79.6	100.0	19.4
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Control	7.0	8.8	21.8	53.9	61.7	100.0	14.1
Observations	101	153	298	209	31	1	793
Surface Water Plants							
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Monitoring	5.5	20.5	45.7	69.8	100.0	*	39.1
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Control	2.4	14.7	31.9	53.2	69.7	*	28.0
Observations	27	79	127	75	18	*	326
Mixed Plants							
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Monitoring	0.0	6.7	26.8	71.8	100.0	*	20.7
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Control	97.9	6.7	26.8	5.5	77.4	*	57.6
Observations	2	3	8	8	5	*	26
All Plants							
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Monitoring	4.2	9.1	40.6	77.9	88.1	100.0	21.5
% of Plants without a 24/7 Operator that Have SCADA Systems for Process Control	8.5	9.2	23.4	52.6	65.6	100.0	16.0
Observations	130	235	433	292	54	1	1,145

Data: Q.7, Q.17

Notes: *No observations.

Definitions: "24/7" means that an Operator is on site 24 hours per day, 7 days per week.

Table 19
Treatment Objectives
Percentage of Plants Having Each Treatment Objective
By Primary Source of Water and System Service Population

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Ground Water Plants									
Algae control	0.0	0.0	0.0	4.3	0.0	2.3	5.5	0.2	0.9
Corrosion control	4.9	14.7	38.1	31.9	43.2	24.5	23.5	49.5	26.3
Disinfection	98.2	95.7	100.0	99.2	92.3	97.0	97.6	100.0	97.6
Dechlorination	0.0	0.0	0.0	0.0	2.3	1.2	3.2	0.0	0.4
Oxidation	2.3	8.0	17.0	12.1	16.9	2.7	15.7	2.3	10.9
Iron Removal/Sequestration	31.9	55.5	57.6	35.0	22.6	26.9	21.8	4.0	43.4
Manganese Removal/ Sequestration	0.0	17.3	24.4	23.8	17.5	26.9	19.0	2.1	17.4
Fluoridation	0.0	4.0	19.3	37.9	20.0	30.5	24.5	5.1	14.6
Taste/odor control	0.0	8.1	12.8	9.9	9.9	2.8	13.4	2.3	8.3
TOC removal	0.0	0.0	0.2	3.8	0.8	3.1	9.1	0.0	1.1
Particulate/ Turbidity Removal	16.4	3.5	6.8	15.2	6.6	6.3	13.0	2.5	9.0
Softening	15.8	7.6	21.5	11.7	13.1	6.5	11.0	0.4	13.3
Recarbonation	0.0	0.0	0.0	3.5	2.3	1.8	7.5	0.2	1.1
Organic contaminant removal	1.7	0.0	2.2	4.4	3.3	6.0	8.5	1.1	2.3
Inorganic contaminant removal	0.0	6.0	0.9	6.8	5.1	2.7	3.4	0.4	3.7
Radionuclides contaminant removal	0.0	2.2	2.2	3.2	2.0	3.2	1.4	0.0	1.9
Other	0.0	0.0	0.0	1.1	7.0	3.9	0.4	0.0	1.2
Observations	83	98	125	124	166	191	394	469	1,650
Surface Water Plants									
Algae control	0.0	3.5	19.9	52.8	57.2	55.1	57.7	55.2	33.6
Corrosion control	3.7	22.3	67.5	70.7	84.2	80.8	77.7	86.8	57.6
Disinfection	97.6	99.3	100.0	99.0	100.0	100.0	100.0	100.0	99.4
Dechlorination	0.0	0.0	1.4	3.7	3.7	6.2	3.5	7.0	2.4
Oxidation	0.0	2.7	7.2	30.3	34.8	40.5	46.4	39.7	20.6
Iron Removal/Sequestration	0.0	27.0	35.5	35.5	37.3	42.3	26.2	17.8	29.4
Manganese Removal/ Sequestration	0.0	27.0	27.1	34.7	39.6	47.0	29.2	28.9	29.1
Fluoridation	0.0	6.0	52.1	56.7	73.4	67.9	65.0	82.9	45.4
Taste/odor control	6.3	9.4	46.6	71.2	74.0	73.7	67.4	79.7	49.2
TOC removal	0.8	0.0	6.9	44.1	63.8	54.3	64.1	51.0	31.2
Particulate/ Turbidity Removal	47.5	73.5	95.6	97.9	98.7	98.0	92.7	87.1	85.9
Softening	16.8	0.0	14.5	25.2	19.8	12.4	5.3	9.6	14.6
Recarbonation	0.0	0.0	7.3	12.0	6.9	8.3	5.8	5.8	5.8
Organic contaminant removal	0.0	0.0	4.8	34.4	34.4	42.0	19.3	19.6	18.8
Inorganic contaminant removal	1.2	20.7	2.7	22.7	25.2	29.1	15.6	12.7	16.6
Radionuclides contaminant removal	0.0	0.0	1.3	8.3	9.8	17.1	3.4	4.7	5.2
Other	0.0	0.0	0.0	1.2	5.8	1.4	1.2	9.3	1.9
Observations	50	58	76	82	85	81	167	106	705

(Continued)

Table 19(Cont.)
Treatment Objectives
Percentage of Plants Having Each Treatment Objective
By Primary Source of Water and System Service Population

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Mixed Plants									
Algae control	*	0.0	*	30.2	31.8	60.1	41.6	66.7	19.9
Corrosion control	*	0.0	*	50.4	68.2	60.1	74.2	83.3	35.9
Disinfection	100.0	100.0	100.0	100.0	97.3	100.0	100.0	100.0	99.4
Dechlorination	*	0.0	*	0.0	0.0	0.0	3.3	20.0	0.6
Oxidation	*	0.0	*	40.3	54.5	39.9	41.6	40.0	26.3
Iron Removal/Sequestration	*	3.4	*	40.3	42.7	0.0	24.1	0.0	22.2
Manganese Removal/ Sequestration	*	0.0	*	40.3	53.6	0.0	26.8	0.0	23.3
Fluoridation	*	0.0	*	60.5	64.5	100.0	57.4	0.0	34.9
Taste/odor control	*	6.8	*	50.4	65.4	60.1	63.1	100.0	37.4
TOC removal	*	0.0	*	10.1	75.4	100.0	44.7	100.0	27.1
Particulate/ Turbidity Removal	100.0	10.2	*	65.1	86.3	100.0	82.6	100.0	50.4
Softening	*	0.0	*	10.1	43.6	20.2	30.6	0.0	15.2
Recarbonation	*	0.0	*	10.1	32.7	20.2	23.5	0.0	12.1
Organic contaminant removal	*	0.0	*	10.1	20.9	20.2	29.0	16.7	10.3
Inorganic contaminant removal	*	0.0	*	10.1	20.9	0.0	16.3	16.7	8.8
Radionuclides contaminant removal	*	0.0	*	20.2	10.0	0.0	6.3	16.7	7.6
Other	*	0.0	*	10.1	0.0	0.0	0.0	0.0	2.2
Observations	1	3	1	9	11	4	29	6	64
All Plants									
Algae control	0.0	0.4	2.7	13.6	13.9	21.8	19.4	10.1	6.5
Corrosion control	4.8	15.2	41.8	39.0	53.2	45.0	38.6	56.1	31.3
Disinfection	98.2	96.0	100.0	99.2	94.1	98.1	98.3	100.0	97.8
Dechlorination	0.0	0.0	0.2	0.7	2.6	2.7	3.2	1.3	0.7
Oxidation	2.0	7.2	15.9	16.0	21.8	14.3	24.0	8.9	12.7
Iron Removal/Sequestration	28.8	52.2	55.2	35.2	26.4	31.3	22.9	7.6	41.3
Manganese Removal/ Sequestration	0.0	17.9	24.7	26.2	23.2	32.6	21.8	6.6	19.3
Fluoridation	0.0	4.1	23.5	41.7	33.2	42.1	35.5	25.0	19.4
Taste/odor control	0.9	8.2	17.7	22.7	26.2	24.7	28.4	16.4	15.5
TOC removal	0.1	0.0	1.0	11.3	17.2	19.4	23.6	9.4	6.3
Particulate/ Turbidity Removal	20.9	12.8	23.1	32.7	29.8	35.1	35.2	17.8	23.3
Softening	15.9	6.6	20.7	14.1	15.3	8.4	10.5	1.9	13.5
Recarbonation	0.0	0.0	0.9	5.1	4.1	3.9	7.8	1.1	2.0
Organic contaminant removal	1.5	0.0	2.6	10.4	10.8	16.8	11.9	6.2	5.1
Inorganic contaminant removal	0.2	7.4	1.1	9.7	10.0	10.5	6.9	3.9	5.8
Radionuclides contaminant removal	0.0	1.9	2.1	4.5	4.0	8.2	2.1	0.9	2.5
Other	0.0	0.0	0.0	1.3	6.6	2.9	0.6	1.6	1.3
Observations	134	159	202	215	262	276	590	581	2,419

Data: Q.13

Notes: *No observations.

Excludes plants that treat purchased water.

Table 20
Treatment Objectives
Percentage of Plants Having Each Treatment Objective
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Water Source	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Ground Water Plants							
Algae control	0.0	0.0	2.3	1.3	12.7	0.0	1.0
Corrosion control	9.6	26.9	36.2	39.3	18.7	0.0	27.1
Disinfection	95.8	98.1	99.6	97.7	97.0	100.0	97.9
Dechlorination	0.0	0.0	0.7	2.2	7.8	0.0	0.5
Oxidation	2.2	9.3	19.0	24.5	26.5	0.0	12.4
Iron Removal/Sequestration	34.3	51.2	43.9	39.7	74.1	0.0	44.1
Manganese Removal/ Sequestration	0.3	23.7	22.9	30.2	81.2	0.0	19.6
Fluoridation	2.4	11.2	27.9	37.9	32.2	0.0	16.8
Taste/odor control	0.0	8.1	14.5	17.1	29.1	0.0	9.5
TOC removal	0.0	0.1	2.1	4.5	14.0	0.0	1.2
Particulate/ Turbidity Removal	8.7	2.6	11.9	18.3	24.7	0.0	8.5
Softening	18.1	10.4	16.1	20.6	20.4	0.0	15.0
Recarbonation	0.0	0.0	1.3	8.7	14.4	0.0	1.3
Organic contaminant removal	1.5	1.6	2.5	10.7	2.6	0.0	2.6
Inorganic contaminant removal	0.0	4.9	5.0	8.4	4.0	0.0	4.2
Radionuclides contaminant removal	0.0	1.1	3.2	4.2	1.2	0.0	1.6
Other	0.0	0.5	2.0	11.9	3.2	0.0	1.4
Observations	118	161	347	333	84	1	1,044
Surface Water Plants							
Algae control	3.3	1.0	37.5	55.6	61.2	45.8	35.2
Corrosion control	7.3	24.2	65.0	84.2	83.4	79.2	59.8
Disinfection	95.2	100.0	99.5	100.0	100.0	100.0	99.5
Dechlorination	0.0	0.0	2.4	4.2	5.7	4.2	2.6
Oxidation	1.5	1.0	17.8	35.3	47.1	20.8	21.3
Iron Removal/Sequestration	3.6	18.6	40.5	36.3	27.7	8.3	30.6
Manganese Removal/ Sequestration	3.6	18.6	34.4	40.2	31.0	16.0	30.3
Fluoridation	3.9	10.4	51.6	68.8	79.8	70.8	47.4
Taste/odor control	14.5	14.0	56.4	75.0	71.5	72.0	51.3
TOC removal	5.2	2.6	27.2	56.0	58.6	37.5	32.4
Particulate/ Turbidity Removal	61.2	72.7	97.8	98.0	94.6	80.0	89.0
Softening	35.3	4.5	15.3	21.2	8.2	8.3	15.1
Recarbonation	0.0	0.0	9.5	8.3	7.0	4.2	6.1
Organic contaminant removal	0.0	2.6	22.1	33.1	19.5	8.3	19.3
Inorganic contaminant removal	5.9	16.8	15.3	21.9	17.1	8.3	17.1
Radionuclides contaminant removal	0.0	0.0	4.1	9.8	5.1	0.0	4.4
Other	0.0	3.7	1.3	3.6	2.6	12.0	2.5
Observations	28	80	138	179	247	25	697

(Continued)

Table 20 (Cont.)
Treatment Objectives
Percentage of Plants Having Each Treatment Objective
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Water Source	0 - 0.01	0.01 - 0.1	0.1 - 1.0	1.0 - 10.0	10.0 - 100.0	Over 100	All Sizes
Mixed Plants							
Algae control	0.0	6.7	22.2	46.9	42.9	*	20.2
Corrosion control	5.9	6.7	56.5	64.2	57.2	*	35.0
Disinfection	100.0	100.0	100.0	100.0	100.0	*	100.0
Dechlorination	0.0	0.0	0.0	0.0	5.5	*	0.6
Oxidation	5.9	0.0	56.5	26.5	60.4	*	26.7
Iron Removal/Sequestration	0.0	31.3	33.3	42.6	43.3	*	22.5
Manganese Removal/ Sequestration	0.0	0.0	45.4	41.4	45.7	*	23.6
Fluoridation	5.9	0.0	44.4	82.1	50.6	*	35.4
Taste/odor control	5.9	62.0	56.5	51.7	82.7	*	37.9
TOC removal	5.9	6.7	23.2	52.1	71.3	*	27.5
Particulate/ Turbidity Removal	7.8	100.0	62.0	89.2	91.4	*	51.1
Softening	5.9	0.0	0.0	44.9	27.0	*	15.4
Recarbonation	5.9	0.0	0.0	33.8	20.7	*	12.3
Organic contaminant removal	0.0	0.0	11.1	22.7	27.4	*	10.5
Inorganic contaminant removal	0.0	0.0	11.1	21.3	16.5	*	8.9
Radionuclides contaminant removal	0.0	0.0	17.9	7.7	7.9	*	6.8
Other	0.0	0.0	8.9	0.0	0.0	*	2.0
Observations	3	3	8	17	30	*	61
All Plants							
Algae control	0.2	0.1	8.1	25.8	44.2	43.8	7.2
Corrosion control	9.3	26.6	40.9	59.0	60.7	75.6	32.7
Disinfection	95.8	98.2	99.6	98.7	99.0	100.0	98.1
Dechlorination	0.0	0.0	1.0	2.9	6.4	4.0	0.8
Oxidation	2.3	8.4	19.2	29.1	41.4	19.9	14.1
Iron Removal/Sequestration	32.2	48.0	43.3	38.4	44.1	8.0	41.8
Manganese Removal/ Sequestration	0.4	23.1	24.9	34.7	48.2	15.3	21.4
Fluoridation	2.6	11.0	31.8	52.3	62.1	67.7	22.0
Taste/odor control	1.1	9.0	22.2	43.1	58.6	68.9	17.4
TOC removal	0.5	0.4	6.2	28.3	45.0	35.8	7.0
Particulate/ Turbidity Removal	12.2	12.5	29.9	54.8	71.9	76.6	24.7
Softening	18.5	9.7	15.8	21.6	13.5	8.0	15.0
Recarbonation	0.2	0.0	2.6	9.3	10.3	4.0	2.3
Organic contaminant removal	1.4	1.7	5.8	20.7	14.6	8.0	5.6
Inorganic contaminant removal	0.3	6.2	6.7	14.4	12.8	8.0	6.4
Radionuclides contaminant removal	0.0	1.0	3.5	6.6	4.1	0.0	2.0
Other	0.0	0.7	2.0	8.2	2.6	11.5	1.5
Observations	149	244	493	529	361	26	1,802

Data: Q.13

Notes: *No observations.

Excludes plants that treat purchased water.

Table 21
Treatment Schemes
Percentage of Plants Using Each Treatment Scheme
By Primary Source of Water and System Service Population

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Ground Water Plants									
Disinfection with no additional treatment	68.7	55.5	52.1	37.4	43.5	54.2	60.3	84.1	54.5
Other chemical addition	7.7	21.7	11.4	30.5	15.8	15.0	2.7	0.6	16.1
Ion exchange, Activated Alumina, Aeration	0.0	9.8	22.0	18.7	23.1	25.3	14.1	14.9	13.7
Other filtration (not direct or conventional)	12.3	9.5	3.9	4.6	9.0	0.6	7.0	0.2	7.6
Direct filtration	0.1	0.0	0.1	0.2	0.3	0.6	0.2	0.0	0.1
Conventional filtration	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.3
Membranes	1.1	0.0	0.1	0.5	0.0	0.6	0.6	0.0	0.3
Softening	10.0	3.6	6.9	5.5	6.9	1.4	3.7	0.2	6.1
Observations	83	98	127	125	168	191	394	469	1,655
Surface Water Plants									
Disinfection with no additional treatment	50.0	14.3	3.6	1.0	0.3	0.0	2.4	2.6	10.7
Other chemical addition	0.0	0.0	4.3	1.0	0.0	1.0	4.2	6.0	1.5
Ion exchange, Activated Alumina, Aeration	0.0	2.3	2.1	7.1	6.5	5.3	4.6	10.2	4.0
Other filtration (not direct or conventional)	12.8	28.4	14.5	6.0	0.0	11.1	2.3	0.0	11.8
Direct filtration	7.2	18.8	9.2	16.9	15.5	8.9	13.5	15.4	13.5
Conventional filtration	11.9	8.9	37.4	35.7	59.2	60.7	64.5	45.4	34.7
Membranes	6.4	5.8	1.3	1.0	0.0	0.0	0.6	0.9	2.5
Softening	11.7	20.8	27.6	30.2	16.3	12.9	6.7	12.0	20.6
Observations	50	58	76	82	85	81	169	115	716
Mixed Plants									
Disinfection with no additional treatment	0.0	89.8	100.0	46.7	14.2	0.0	3.2	0.0	51.5
Other chemical addition	0.0	0.0	0.0	0.0	2.7	0.0	14.2	0.0	1.8
Ion exchange, Activated Alumina, Aeration	0.0	0.0	0.0	14.6	0.0	28.5	16.3	0.0	5.9
Other filtration (not direct or conventional)	0.0	3.4	0.0	0.0	0.0	0.0	3.2	0.0	1.6
Direct filtration	0.0	6.8	0.0	7.3	9.6	0.0	3.2	0.0	6.8
Conventional filtration	100.0	0.0	0.0	16.8	31.5	57.1	40.5	100.0	17.9
Membranes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Softening	0.0	0.0	0.0	14.6	42.0	14.4	16.3	0.0	14.2
Observations	1	3	1	9	11	4	29	6	64

(Continued)

Table 21 (Cont.)
Treatment Schemes
Percentage of Plants Using Each Treatment Scheme
By Primary Source of Water and System Service Population

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
All Plants									
Disinfection with no additional treatment	67.0	52.9	47.5	31.8	33.5	37.3	43.9	68.6	49.4
Other chemical addition	7.0	19.8	10.7	25.1	12.1	10.6	3.6	1.5	14.3
Ion exchange, Activated Alumina, Aeration	0.0	9.1	20.1	16.7	19.0	19.3	11.9	13.9	12.5
Other filtration (not direct or conventional)	12.4	10.8	4.9	4.7	6.9	3.7	5.7	0.2	8.0
Direct filtration	0.7	1.5	1.0	3.1	3.8	3.1	3.6	2.8	1.7
Conventional filtration	1.1	0.7	3.5	8.2	13.5	18.9	17.3	9.1	4.4
Membranes	1.6	0.4	0.2	0.6	0.0	0.4	0.6	0.2	0.5
Softening	10.2	4.8	8.9	9.6	9.7	5.0	4.9	2.3	7.8
Observations	134	159	204	216	264	276	592	590	2,435

Data: Q.14A

Notes: Excludes plants that treat purchased water.

Definitions: See treatment scheme description in Volume I.

Table 22
Treatment Schemes
Percentage of Plants Using Each Treatment Scheme
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Water Source	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Ground Water Plants							
Disinfection with no additional treatment	64.3	57.7	37.9	41.2	14.5	100.0	52.9
Other chemical addition	11.0	16.9	18.4	12.2	6.5	0.0	15.5
Ion exchange, Activated Alumina, Aeration	0.0	14.4	29.4	24.7	72.3	0.0	15.7
Other filtration (not direct or conventional)	13.1	5.1	5.6	9.1	1.4	0.0	7.5
Direct filtration	0.0	0.1	0.2	0.3	0.7	0.0	0.1
Conventional filtration	0.0	0.0	1.3	0.0	0.0	0.0	0.4
Membranes	0.9	0.1	0.3	0.4	0.0	0.0	0.4
Softening	10.7	4.6	4.1	10.1	4.7	0.0	6.3
Observations	118	161	347	333	84	1	1044
Surface Water Plants							
Disinfection with no additional treatment	32.6	26.9	5.5	0.3	0.9	8.0	10.7
Other chemical addition	0.0	2.0	1.5	1.0	3.0	12.0	1.6
Ion exchange, Activated Alumina, Aeration	0.0	2.8	3.6	6.7	6.0	0.0	4.1
Other filtration (not direct or conventional)	15.6	28.1	11.8	2.3	0.6	0.0	12.4
Direct filtration	11.8	16.6	14.2	10.5	18.9	20.0	14.1
Conventional filtration	7.2	14.3	34.5	60.0	58.2	48.0	36.4
Membranes	8.7	4.1	2.2	0.9	0.0	0.0	2.6
Softening	24.2	5.1	26.2	16.3	11.2	12.0	17.3
Observations	28	80	138	179	247	25	697
Mixed Plants							
Disinfection with no additional treatment	92.2	0.0	42.8	30.5	2.7	*	52.1
Other chemical addition	0.0	0.0	0.0	0.0	5.9	*	0.6
Ion exchange, Activated Alumina, Aeration	0.0	0.0	17.9	3.3	11.4	*	6.0
Other filtration (not direct or conventional)	0.0	31.3	0.0	0.0	2.7	*	1.6
Direct filtration	0.0	62.0	0.0	15.4	2.7	*	6.9
Conventional filtration	2.0	6.7	30.4	16.8	57.7	*	18.1
Membranes	0.0	0.0	0.0	0.0	0.0	*	0.0
Softening	5.8	0.0	8.9	34.0	14.1	*	14.4
Observations	3	3	8	17	30	*	61

(Continued)

Table 22 (Cont.)
Treatment Schemes
Percentage of Plants Using Each Treatment Scheme
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Water Source	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
All Plants							
Disinfection with no additional treatment	63.6	55.3	32.8	24.6	5.4	12.0	47.6
Other chemical addition	10.4	15.7	15.5	7.3	4.3	11.5	13.5
Ion exchange, Activated Alumina, Aeration	0.0	13.5	25.2	16.8	27.8	0.0	14.1
Other filtration (not direct or conventional)	12.9	6.9	6.6	6.0	1.0	0.0	8.0
Direct filtration	0.5	1.4	2.4	4.9	11.9	19.1	2.0
Conventional filtration	0.3	1.1	6.8	24.4	39.4	45.9	5.1
Membranes	1.2	0.4	0.6	0.6	0.0	0.0	0.6
Softening	11.1	4.6	7.7	13.5	9.3	11.5	7.8
Observations	149	244	493	529	361	26	1802

Data: Q.14A

Notes: *No data available for these cells.

Excludes plants that treat purchased water.

Definitions: See treatment scheme description in Volume I.

Table 23
Treatment Practices for Surface Water Plants
Percentage of Plants Performing Each Treatment
By Primary Source of Water and System Service Population

	System Service Population Category								
Surface Water Treatment Practice	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Chlorination only	49.5	32.4	7.9	6.0	0.3	1.0	6.8	10.2	16.2
Raw water storage/Presedimentation basin	12.5	20.5	11.5	16.3	20.5	29.8	19.1	26.5	17.3
Predisinfection/oxidation prior to sedimentation									
Chlorine	18.6	2.9	37.6	50.9	51.7	45.8	52.2	45.4	34.5
Chlorine dioxide	0.0	0.0	0.0	3.0	3.9	11.4	7.4	4.3	2.2
Chloramines	0.0	0.0	0.0	1.0	8.3	0.0	10.0	11.1	2.4
Ozone	0.5	0.9	0.0	1.0	0.0	5.3	3.9	6.0	1.0
Potassium permanganate	0.0	1.1	24.9	29.4	37.1	29.2	27.8	26.6	20.3
Other Predisinfection	0.0	0.0	4.8	1.0	0.0	0.0	1.7	0.0	1.3
Predisinfection/Oxidation prior to filtration									
Chlorine	7.4	11.9	24.2	24.3	35.4	38.3	31.5	37.7	23.0
Chlorine dioxide	0.0	2.0	0.0	0.0	1.1	2.0	2.8	0.0	0.8
Chloramines	0.0	0.0	0.0	0.0	4.6	1.3	6.9	7.7	1.4
Ozone	0.0	15.3	0.0	0.0	1.1	2.3	4.1	6.0	3.5
Potassium permanganate	0.0	1.2	6.9	10.1	5.5	7.8	3.9	2.6	5.0
Other Predisinfection	0.0	0.0	4.4	0.0	0.0	2.0	0.0	0.0	1.0
Rapid mix	7.8	13.1	43.3	67.5	90.9	75.6	77.8	62.4	48.9
Coagulation/ Flocculation	11.0	22.6	63.1	87.9	96.4	82.0	85.2	77.0	60.8
Polymers	15.5	21.5	54.4	63.7	62.1	53.4	58.4	53.9	46.0
Settling/Sedimentation	11.9	15.9	60.8	67.9	79.8	74.7	71.7	63.3	51.5
Softening									
Lime/soda ash	0.0	20.8	27.6	34.2	20.7	12.9	7.2	12.0	20.5
Recarbonation	0.0	0.0	0.0	6.1	7.7	5.0	4.4	3.4	2.9
Ion exchange	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Filtration									
Direct filtration	2.6	2.3	0.8	8.1	5.3	4.0	9.6	6.8	4.1
Micro strainer	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.9	0.1
Slow sand	4.9	10.8	4.8	3.1	0.0	0.0	1.7	0.0	4.3
Bag and Cartridge	18.9	18.6	0.0	0.0	1.0	0.0	0.6	0.0	6.3
Rapid sand	0.0	9.4	24.5	32.5	17.6	7.9	16.2	23.2	17.3
Green sand	0.7	0.0	3.0	1.0	0.0	0.0	0.6	0.0	0.9
Diatomaceous earth	2.6	1.0	2.5	2.0	0.0	13.1	2.9	0.0	2.2
Dual/Multi media	13.7	14.0	51.8	46.6	73.2	68.7	59.3	52.1	43.5
Pressure filtration	9.5	20.7	2.2	2.6	0.0	2.0	0.0	0.0	6.2
Other filtration	0.6	0.8	4.1	0.0	3.9	2.3	3.0	2.6	2.1

(Continued)

Table 23 (Cont.)
Treatment Practices for Primarily Surface Water Systems
Percentage of Plants Performing Each Treatment
By Primary Source of Water and System Service Population

	System Service Population Category								
Surface Water Treatment Practice	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Post-disinfection after filters									
Chlorine	27.8	58.3	77.4	85.3	83.7	75.3	74.5	53.9	68.7
Chlorine dioxide	0.0	0.0	0.0	1.0	5.0	1.5	0.6	0.0	1.1
Chloramines	0.0	0.0	0.0	4.1	22.5	18.9	23.6	21.3	7.1
Ozone	0.0	0.7	0.0	0.0	0.0	5.3	0.0	1.7	0.4
UV	11.7	0.0	0.0	0.0	0.0	0.0	0.6	0.0	1.6
Other post disinfection	0.0	0.0	7.9	0.0	2.1	1.0	1.1	0.0	2.1
Clearwell	11.0	37.4	80.0	81.0	82.7	85.4	82.0	64.1	63.2
Membranes									
Reverse osmosis	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Micro filtration	6.4	5.8	1.3	1.0	0.0	0.0	0.6	0.9	2.5
Ultrafiltration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanofiltration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corrosion Control	1.5	14.1	40.8	48.9	70.6	62.9	69.7	72.6	40.2
Miscellaneous									
Ion exchange	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.2
Granular activated carbon	2.2	2.6	0.8	21.1	14.9	15.9	11.0	6.0	8.6
Activated Alumina	0.0	2.3	0.0	1.0	0.0	1.3	1.1	0.9	0.7
Aeration	0.0	0.0	2.1	6.1	7.6	5.0	5.7	10.2	3.6
Other									
Flouride	0.0	2.5	37.4	57.3	69.4	60.4	64.4	71.0	38.0
PAC	0.0	1.1	5.7	6.1	18.7	12.3	18.1	20.5	7.6
Ph Adjust	0.0	0.0	6.1	1.0	1.1	1.0	3.3	2.5	1.9
Iron/Mag. removal/seq.	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Taste/oder	0.0	0.0	0.0	1.0	0.3	0.0	1.2	0.0	0.3
Filter aid	0.0	0.0	7.7	5.9	2.2	1.0	0.0	0.0	3.1
Clarify	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Blending	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Data: Q.14A

Notes: Represents treatment practices for plants treating water that comes entirely or partly from surface sources.

Percentages may not sum to 100 percent because systems may perform more than one treatment.

Definition: Cholorination only is indicated when a plant chlorinated but did not filter. It includes plants that only chlorinated and plants that chlorinated and used other non-filtration practices.

Table 24
Treatment Practices for Ground Water Plants
Percentage of Plants Performing Each Treatment
By Primary Source of Water and System Service Population

	System Service Population Category								
Ground Water Treatment Practice	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Chlorination only	81.4	73.2	72.7	72.5	67.8	71.1	68.6	96.9	74.3
Raw water storage/Presedimentation basin	1.5	0.0	0.4	1.6	1.4	1.2	5.8	0.0	0.8
Predisinfection/oxidation prior to sedimentation									
Chlorine	0.0	7.5	9.4	10.6	11.3	5.9	9.5	0.0	7.2
Chlorine dioxide	0.0	0.0	0.0	0.0	0.7	10.5	0.4	0.0	0.2
Chloramines	0.0	0.0	0.0	0.0	0.0	0.6	4.5	0.0	0.1
Ozone	0.5	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.1
Potassium permanganate	0.0	3.7	3.2	4.4	0.7	1.2	0.4	0.0	2.6
Other Predisinfection	1.3	0.0	0.0	0.0	0.7	0.0	4.9	0.0	0.4
Predisinfection/Oxidation prior to filtration									
Chlorine	1.5	7.1	10.0	7.5	10.8	1.2	3.0	2.5	6.9
Chlorine dioxide	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Chloramines	0.0	0.0	0.0	0.0	0.0	1.2	0.4	0.0	0.0
Ozone	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potassium permanganate	1.0	1.4	5.0	2.4	4.0	0.0	0.4	0.0	2.6
Other Predisinfection	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Rapid mix	0.0	0.0	2.4	5.0	0.0	3.0	2.7	0.0	1.3
Coagulation/ Flocculation	0.0	0.0	4.3	6.0	2.6	4.7	1.7	0.0	2.1
Polymers	0.1	0.0	8.4	3.5	2.2	2.2	1.0	0.0	2.9
Settling/Sedimentation	0.0	0.0	4.3	8.1	5.4	3.6	3.0	0.2	2.6
Softening									
Lime/soda ash	3.4	2.5	10.3	8.2	9.1	4.7	12.7	0.4	6.1
Recarbonation	0.0	0.0	1.0	5.1	2.2	1.8	7.1	0.2	1.2
Ion exchange	6.6	2.2	6.0	2.3	3.6	0.6	0.0	0.0	4.1
Filtration									
Direct filtration	1.1	0.0	0.0	2.5	0.0	1.2	0.2	0.0	0.5
Micro strainer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slow sand	0.0	0.0	1.0	3.4	0.0	0.0	0.2	0.0	0.7
Bag and Cartridge	8.9	0.1	0.4	0.0	0.0	0.0	0.2	0.0	1.8
Rapid sand	0.0	0.9	2.7	7.2	4.4	1.2	2.0	0.0	2.2
Green sand	1.6	7.5	4.2	4.4	2.9	0.0	0.4	0.0	4.5
Diatomaceous earth	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Dual/Multi media	0.1	0.0	4.6	3.4	5.7	3.2	10.5	2.5	2.4
Pressure filtration	0.0	3.7	8.1	2.6	7.2	1.2	1.0	0.0	4.2
Other filtration	0.8	2.1	0.0	0.3	0.3	0.8	0.0	0.0	0.8

(Continued)

Table 24 (Cont.)
Treatment Practices for Primarily Ground Water Systems
Percentage of Plants Performing Each Treatment
By Primary Source of Water and System Service Population

	System Service Population Category								
Ground Water Treatment Practice	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Post-disinfection after filters									
Chlorine	8.5	7.8	15.3	21.0	19.9	3.3	11.5	2.7	12.3
Chlorine dioxide	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.1
Chloramines	0.0	0.0	0.0	0.8	1.4	1.8	3.4	0.0	0.3
Ozone	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other post disinfection	0.0	0.0	1.4	0.0	0.0	5.8	0.0	0.0	0.5
Clearwell	11.4	15.4	24.7	23.6	16.0	6.9	13.3	0.4	17.7
Membranes									
Reverse osmosis	1.1	0.0	0.1	0.5	0.0	0.6	0.6	0.0	0.3
Micro filtration	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Ultrafiltration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanofiltration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corrosion Control	8.0	17.6	17.4	28.9	21.2	19.0	7.3	0.8	16.9
Miscellaneous									
Ion exchange	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.1
Granular activated carbon	0.0	0.0	0.0	0.8	1.9	0.6	8.6	0.2	0.4
Activated Alumina	0.0	0.0	0.0	0.0	0.0	18.1	0.0	0.0	0.3
Aeration	0.0	9.8	22.0	19.0	21.7	7.9	17.4	14.9	13.4
Other									
Flouride	0.0	4.4	18.3	27.6	20.5	9.4	12.1	0.6	11.4
PAC	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
Ph Adjust	0.0	1.2	4.7	0.0	2.2	0.0	0.0	0.0	1.8
Iron/Mag. removal/seq.	2.3	3.8	3.0	4.7	1.4	0.6	0.0	0.0	3.1
Taste/oder	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.2
Filter aid	0.0	0.0	3.5	0.0	0.0	0.0	5.8	0.0	1.0
Clarify	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Blending	0.0	2.0	0.0	6.0	0.7	1.2	0.2	0.0	1.4

Data: Q.14A

Notes: Represents treatment practices for plants treating water that comes entirely or partly from ground sources.

Percentages may not sum to 100 percent because systems may perform more than one treatment.

Definition: Cholorination only is indicated when a plant chlorinated but did not filter. It includes plants that only chlorinated and plants that chlorinated and used other non-filtration practices.

Table 25
Treatment Practices for Surface Water Plants
Percentage of Plants Performing Each Treatment
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Surface Water Treatment Practice	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Chlorination only	32.6	28.9	9.0	1.3	4.6	20.0	13.0
Raw water storage/Presedimentation basin	25.9	19.5	11.3	22.0	23.0	28.0	18.1
Predisinfection/oxidation prior to sedimentation							
Chlorine	30.5	5.7	44.5	47.7	53.9	52.0	36.2
Chlorine dioxide	0.0	0.0	1.5	4.1	8.4	4.0	2.3
Chloramines	0.0	0.0	1.8	4.9	6.3	12.0	2.5
Ozone	0.0	0.8	0.0	1.1	5.1	4.0	0.9
Potassium permanganate	2.6	3.7	24.9	33.3	33.6	12.0	21.2
Other Predisinfection	0.0	0.0	3.0	0.8	0.6	0.0	1.3
Predisinfection/Oxidation prior to filtration							
Chlorine	12.3	15.6	22.5	32.2	39.9	32.0	24.1
Chlorine dioxide	0.0	0.0	1.1	1.1	1.9	0.0	0.8
Chloramines	0.0	0.0	0.0	3.8	5.7	4.0	1.5
Ozone	0.3	13.0	0.0	0.9	3.7	8.0	3.6
Potassium permanganate	0.0	1.0	7.9	7.8	3.0	4.0	5.3
Other Predisinfection	0.0	0.0	2.8	0.2	0.6	0.0	1.1
Rapid mix	11.5	15.2	54.5	80.6	81.9	60.0	51.3
Coagulation/ Flocculation	17.1	27.5	70.7	91.1	89.4	76.0	63.7
Polymers	12.3	30.9	56.9	56.0	59.8	60.0	47.7
Settling/Sedimentation	7.9	19.6	61.2	80.8	71.2	60.0	53.6
Softening							
Lime/soda ash	0.7	5.1	28.3	19.5	11.5	12.0	17.2
Recarbonation	0.0	0.0	1.6	8.4	4.5	0.0	3.1
Ion exchange	23.5	0.0	0.0	0.0	0.0	0.0	1.7
Filtration							
Direct filtration	1.8	2.5	3.8	6.8	5.6	12.0	4.3
Micro strainer	0.0	0.0	0.0	0.3	0.3	0.0	0.1
Slow sand	7.2	7.9	5.0	1.6	0.6	0.0	4.6
Bag and Cartridge	35.0	16.8	0.0	0.7	0.3	0.0	6.6
Rapid sand	0.4	9.1	24.7	20.8	20.8	28.0	18.1
Green sand	0.0	1.9	1.0	0.7	0.0	0.0	1.0
Diatomaceous earth	0.0	2.5	2.2	3.4	1.2	0.0	2.3
Dual/Multi media	16.7	21.1	49.3	62.1	66.4	48.0	45.1
Pressure filtration	9.2	20.2	3.0	0.0	0.0	0.0	6.4
Other filtration	1.1	1.1	2.3	3.1	1.6	8.0	2.1

(Continued)

Table 25 (Cont.)
Treatment Practices for Primarily Surface Water Systems
Percentage of Plants Performing Each Treatment
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Surface Water Treatment Practice	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Post-disinfection after filters							
Chlorine	29.0	58.1	80.6	82.2	72.7	44.0	71.2
Chlorine dioxide	0.0	0.0	1.3	2.5	1.3	0.0	1.2
Chloramines	0.0	0.0	2.3	18.7	20.4	40.0	7.5
Ozone	0.0	0.0	0.4	0.4	1.8	0.0	0.4
UV	23.5	0.0	0.0	0.0	0.3	0.0	1.7
Other post disinfection	0.0	3.7	2.6	1.5	1.3	0.0	2.3
Clearwell	10.9	42.6	76.6	83.7	79.9	68.0	66.1
Membranes							
Reverse osmosis	4.0	0.0	0.0	0.0	0.0	0.0	0.3
Micro filtration	8.7	4.1	2.2	0.9	0.0	0.0	2.6
Ultrafiltration	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanofiltration	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corrosion Control	2.9	17.9	38.5	68.7	73.9	68.0	42.0
Miscellaneous							
Ion exchange	0.0	0.0	0.5	0.0	0.0	0.0	0.2
Granular activated carbon	1.8	3.0	10.0	14.9	10.8	4.0	9.1
Activated Alumina	0.0	2.8	0.0	0.4	0.6	0.0	0.8
Aeration	0.0	0.0	3.6	7.3	7.0	0.0	3.7
Other							
Flouride	2.9	8.0	40.8	64.8	75.7	72.0	39.7
PAC	0.0	0.0	7.1	15.6	16.7	32.0	8.1
Ph Adjust	0.0	0.0	4.4	1.0	2.7	0.0	2.0
Iron/Mag. removal/seq.	0.0	0.0	1.1	0.0	0.0	0.0	0.4
Taste/oder	0.0	0.0	0.0	0.9	0.7	0.0	0.3
Filter aid	0.0	3.7	5.5	1.8	0.0	0.0	3.2
Clarify	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Blending	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Data: Q.14A

Notes: Represents treatment practices for plants treating water that comes entirely or partly from ground sources. Percentages may not sum to 100 percent because systems may perform more than one treatment.

Definition: Cholorination only is indicated when a plant chlorinated but did not filter. It includes plants that only chlorinated and plants that chlorinated and used other non-filtration practices.

Table 26
Treatment Practices for Ground Water Plants
Percentage of Plants Performing Each Treatment
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Ground Water Treatment Practice	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Chlorination only	80.7	72.5	66.5	52.8	67.6	100.0	71.9
Raw water storage/Presedimentation basin	1.2	0.0	1.3	4.4	2.3	0.0	0.9
Predisinfection/oxidation prior to sedimentation							
Chlorine	0.0	9.1	13.3	17.2	7.7	0.0	8.3
Chlorine dioxide	0.0	0.0	0.2	0.1	0.0	0.0	0.1
Chloramines	0.0	0.0	0.0	1.4	3.9	0.0	0.1
Ozone	0.0	0.2	0.0	0.4	0.0	0.0	0.1
Potassium permanganate	0.5	3.1	5.1	3.4	2.8	0.0	3.0
Other Predisinfection	1.1	0.0	0.1	2.7	0.7	0.0	0.5
Predisinfection/Oxidation prior to filtration							
Chlorine	6.3	6.7	9.0	20.5	8.5	0.0	7.9
Chlorine dioxide	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chloramines	0.0	0.0	0.0	0.2	3.0	0.0	0.0
Ozone	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potassium permanganate	1.1	3.7	3.3	3.5	0.0	0.0	2.9
Other Predisinfection	0.0	1.0	0.0	0.0	0.0	0.0	0.4
Rapid mix	0.0	0.0	4.8	3.3	5.3	0.0	1.5
Coagulation/ Flocculation	0.0	0.8	6.3	7.8	5.3	0.0	2.5
Polymers	0.1	3.4	6.3	3.9	4.6	0.0	3.4
Settling/Sedimentation	0.0	0.0	9.5	8.8	5.6	0.0	3.1
Softening							
Lime/soda ash	3.5	3.6	11.0	18.1	22.0	0.0	6.5
Recarbonation	0.0	0.0	3.4	7.4	13.5	0.0	1.4
Ion exchange	7.2	2.7	5.8	1.5	0.0	0.0	4.6
Filtration							
Direct filtration	0.0	0.6	0.9	2.2	1.6	0.0	0.6
Micro strainer	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slow sand	0.0	0.0	2.9	0.0	0.0	0.0	0.8
Bag and Cartridge	3.3	0.3	0.0	0.1	0.0	0.0	1.0
Rapid sand	0.0	1.5	5.3	10.3	4.3	0.0	2.6
Green sand	8.1	4.2	4.6	0.3	0.0	0.0	5.1
Diatomaceous earth	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Dual/Multi media	0.0	0.1	7.4	10.6	22.9	0.0	2.8
Pressure filtration	0.0	4.3	9.4	10.8	0.0	0.0	4.9
Other filtration	1.6	1.2	0.3	0.2	0.0	0.0	1.0

(Continued)

Table 26 (Cont.)
Treatment Practices for Primarily Ground Water Systems
Percentage of Plants Performing Each Treatment
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Ground Water Treatment Practice	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Post-disinfection after filters							
Chlorine	7.1	10.9	25.0	23.1	7.4	0.0	14.3
Chlorine dioxide	0.0	0.0	0.0	1.3	10.4	0.0	0.1
Chloramines	0.0	0.0	0.4	3.6	5.9	0.0	0.3
Ozone	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UV	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other post disinfection	0.0	0.0	1.7	1.2	0.0	0.0	0.5
Clearwell	8.0	21.4	26.6	27.5	24.0	0.0	19.7
Membranes							
Reverse osmosis	0.9	0.1	0.3	0.4	0.0	0.0	0.4
Micro filtration	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Ultrafiltration	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nanofiltration	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corrosion Control	11.9	13.3	26.3	21.4	12.3	0.0	16.9
Miscellaneous							
Ion exchange	0.0	0.0	0.0	2.5	0.0	0.0	0.1
Granular activated carbon	0.0	0.0	0.6	2.2	1.4	0.0	0.3
Activated Alumina	0.0	0.0	0.0	0.0	48.9	0.0	0.3
Aeration	0.0	14.4	29.7	23.2	23.4	0.0	15.3
Other							
Flouride	1.2	9.1	25.3	29.6	24.2	0.0	12.6
PAC	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Ph Adjust	0.0	3.2	2.0	3.8	0.0	0.0	2.1
Iron/Mag. removal/seq.	1.9	4.8	3.5	2.0	1.6	0.0	3.5
Taste/oder	0.0	0.0	0.4	2.0	0.0	0.0	0.2
Filter aid	0.0	1.2	2.7	0.0	0.0	0.0	1.2
Clarify	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Blending	0.0	1.7	2.6	3.7	0.0	0.0	1.6

Data: Q.14A

Notes: Represents treatment practices for plants treating water that comes entirely or partly from ground sources. Percentages may not sum to 100 percent because systems may perform more than one treatment.

Definition: Cholorination only is indicated when a plant chlorinated but did not filter. It includes plants that only chlorinated and plants that chlorinated and used other non-filtration practices.

Table 27
Concentration of Various Contaminants in Very Large Ground Water and Surface Water Systems
Across All Wells and Intakes By Primary Source of Water
(Average Raw Water Concentration in Parts per Million, Except for Radon, Which is pCi/L)

Water Source and Contaminant	% Reporting N/A	% Reporting No Detect	Mean Concentration	Median Concentration	90th Percentile Concentration	Observations
Ground Water						
Arsenic	19.2	11.5	0.010	0.007	0.025	51
Radon	80.8	2.6	371.1	417.5	554.5	10
MTBE	33.3	48.7	0.175	0.004	0.050	12
Atrazine	33.3	57.7	0.043	0.001	0.210	5
Metolachlor	47.4	44.9	0.053	0.001	0.210	4
Boron	51.3	2.6	0.173	0.120	0.273	34
2,4-D	34.6	57.7	0.001	0.001	0.001	4
Simazine	32.1	59.0	0.043	0.001	0.210	5
Glyphosate	34.6	56.4	0.002	0.001	0.006	5
Surface water						
Arsenic	31.1	17.8	0.004	0.002	0.005	41
Radon	67.8	13.3	75.3	51.0	219.0	10
MTBE	24.4	41.1	0.005	0.001	0.005	27
Atrazine	40.0	34.4	0.014	0.000	0.043	17
Metolachlor	44.4	36.7	0.001	0.001	0.005	12
Boron	55.6	22.2	0.082	0.059	0.180	15
2,4-D	33.3	46.7	0.006	0.001	0.010	13
Simazine	38.9	40.0	0.001	0.000	0.001	14
Glyphosate	45.6	38.9	0.016	0.016	0.025	10

Data: Q.15A

Notes: The data presented in this table were requested only of systems serving populations of more than 500,000.

Unweighted data. Data are for wells and surface water intakes reported by systems in the survey. Mean, median, 90th percentile, and number of observations are for wells and surface water intakes with positive concentrations.

This table reports results for the type of raw water treated, not the primary source of water of the sytem.

Two systems reported very high arsenic concentrations and are excluded from the analysis.

Table 28
Concentration of Various Contaminants in Very Large Systems
Across All Entry Points By Primary Source of Water
(Average Finished Water Concentration in Parts per Million, Except for Radon, Which is pCi/L)

Primary Source of Water and Contaminant	% Reporting N/A	% Reporting No Detect	Mean Concentration	Median Concentration	90th Percentile Concentration	Observations
Primarily Ground Water Systems						
Arsenic	79.5	2.3	0.004	0.004	0.008	5
Radon	90.9	0.0	118.0	118.0	118.0	1
MTBE	79.5	13.6	0.000	0.000	0.000	0
Atrazine	79.5	9.1	0.205	0.205	0.210	2
Metolachlor	79.5	9.1	0.205	0.205	0.210	2
Boron	81.8	0.0	0.132	0.102	0.234	5
2,4-D	84.1	9.1	0.000	0.000	0.000	0
Simazine	79.5	9.1	0.205	0.205	0.210	2
Glyphosate	84.1	9.1	0.000	0.000	0.000	0
Primarily Surface Water Systems						
Arsenic	9.1	40.4	0.003	0.002	0.005	43
Radon	52.5	23.2	60.4	47.0	189.0	17
MTBE	21.2	40.4	0.005	0.001	0.005	29
Atrazine	19.2	40.4	0.011	0.000	0.001	29
Metolachlor	21.2	49.5	0.001	0.000	0.004	20
Boron	60.6	9.1	0.123	0.056	0.500	14
2,4-D	18.2	52.5	0.029	0.001	0.015	20
Simazine	21.2	39.4	0.001	0.000	0.001	25
Glyphosate	33.3	39.4	0.013	0.006	0.025	13
Primarily Purchased Water Systems						
Arsenic	0.0	5.5	0.009	0.010	0.014	44
Radon	21.8	10.9	460.1	447.0	646.0	26
MTBE	5.5	74.5	0.001	0.001	0.001	3
Atrazine	0.0	65.5	0.040	0.040	0.080	2
Metolachlor	1.8	67.3	0.000	0.000	0.000	0
Boron	78.2	1.8	0.155	0.164	0.200	6
2,4-D	0.0	61.8	0.000	0.000	0.000	13
Simazine	0.0	83.6	0.001	0.001	0.001	1
Glyphosate	0.0	83.6	0.006	0.006	0.006	1

Data: Q.15B

Notes: The data presented in this table were requested only of systems serving populations of more than 500,000.

Unweighted data. Data are for wells and surface water intakes reported by systems in the survey. Mean, median, 90th percentile, and number of observations are for test points with positive concentrations.

(Continued)

Table 28 (Cont.)
Concentration of Various Contaminants in Very Large Systems

Because the test points for finished water may be in the distribution system, this table does not report results for the type of water treated; instead, it reports results by the primary source of water for the system.

Four systems were excluded because 1) reported arsenic concentrations may be incorrect, 2) reported boron concentrations may be incorrect, or 3) they reported finished but not raw water concentrations.

Table 29
Residual Management Process Options
Percentage of Plants Using Each Residual Management Process
By Primary Source of Water and Water System Service Population

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Ground Water Plants									
Mechanical dewatering	3.9	0.0	0.0	0.0	8.3	0.0	5.6	0.0	2.1
Non-mechanical dewatering	3.6	0.0	3.5	5.7	5.2	4.8	17.8	0.0	3.6
Chemical precipitation	0.0	0.0	0.0	0.3	1.0	5.5	4.3	0.0	0.3
Land application	3.5	3.0	10.8	8.3	6.7	7.8	15.0	0.0	6.3
Non-hazardous waste landfill	16.4	0.0	6.1	1.9	3.1	5.5	4.1	0.0	5.2
Deep well Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evaporation Pond	0.0	0.0	8.4	9.6	3.5	7.4	2.7	2.1	4.1
French Drain	0.0	1.9	3.2	0.0	0.0	0.0	0.4	0.0	1.0
Direct Discharge to Surface Water	6.6	4.4	11.7	3.3	7.0	4.0	17.0	0.4	6.5
Septic system	0.0	2.8	0.0	0.0	0.0	1.6	0.0	0.0	0.7
Sanitary Sewer	0.8	6.0	12.5	7.0	15.1	12.4	6.0	4.2	7.7
Surface Water Plants									
Mechanical dewatering	0.0	1.1	5.7	13.4	10.7	17.1	20.1	29.1	9.3
Non-mechanical dewatering	3.6	21.4	34.4	44.9	36.2	58.2	51.1	49.9	34.1
Chemical precipitation	0.0	0.0	1.4	22.0	7.2	18.2	16.8	17.2	8.8
Land application	7.1	18.2	27.1	27.4	42.2	52.4	29.4	21.0	28.2
Non-hazardous waste landfill	4.4	9.5	21.3	25.2	24.5	35.1	37.2	21.4	20.8
Deep well Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Evaporation Pond	17.4	60.1	23.4	46.2	37.8	47.3	47.8	21.7	38.1
French Drain	3.6	2.1	4.3	0.0	2.4	6.5	3.1	0.0	2.6
Direct Discharge to Surface Water	8.4	32.5	29.5	32.4	17.2	16.2	14.7	14.3	23.3
Septic system	1.4	3.4	2.5	3.6	0.0	4.4	1.4	0.0	2.0
Sanitary sewer	0.0	5.6	23.0	15.2	29.1	22.2	13.1	28.2	16.0

(Continued)

Table 29 (Cont.)
Residual Management Process Options
Percentage of Plants Using Each Residual Management Process
By Primary Source of Water and Water System Service Population

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Mixed Plants									
Mechanical dewatering	0.0	0.0	0.0	8.1	21.0	39.9	16.3	33.3	14.5
Non-mechanical dewatering	0.0	0.0	0.0	31.4	41.1	71.5	56.8	0.0	36.6
Chemical precipitation	0.0	0.0	0.0	8.1	0.0	39.9	24.2	0.0	7.7
Land application	0.0	0.0	0.0	8.1	10.5	20.2	34.7	0.0	12.4
Non-hazardous waste landfill	0.0	0.0	0.0	8.1	10.5	57.1	38.4	33.3	15.0
Deep well Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evaporation Pond	0.0	66.4	0.0	32.2	41.1	39.9	48.3	33.3	40.0
French Drain	0.0	0.0	0.0	0.0	10.5	0.0	3.2	0.0	4.0
Direct Discharge to Surface Water	100.0	33.6	0.0	24.1	31.5	39.9	19.5	66.7	28.6
Septic system	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sanitary sewer	0.0	0.0	0.0	14.6	10.5	0.0	19.5	0.0	7.8
All Plants									
Mechanical dewatering	3.5	0.1	1.0	2.3	9.2	10.5	11.4	8.6	3.4
Non-mechanical dewatering	3.6	2.3	9.4	12.7	13.5	36.9	32.2	13.3	9.3
Chemical precipitation	0.0	0.0	0.2	4.0	2.4	13.3	10.0	4.4	1.9
Land application	4.0	4.7	14.0	11.3	15.2	33.9	21.5	5.7	10.2
Non-hazardous waste landfill	15.0	1.0	8.8	6.0	8.3	23.5	17.8	6.3	8.0
Deep well Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Evaporation Pond	2.1	6.8	11.1	16.1	12.7	30.9	21.7	7.6	10.5
French Drain	0.4	1.9	3.4	0.0	0.8	3.7	1.5	0.0	1.3
Direct Discharge to Surface Water	6.9	7.5	15.0	8.8	10.0	11.6	16.3	5.2	9.7
Septic system	0.2	2.9	0.4	0.4	0.0	3.0	0.5	0.0	0.9
Sanitary sewer	0.7	5.9	13.4	8.5	18.0	16.4	8.8	11.3	8.6

Data: Q.16A

Notes: Excludes plants that treat purchased water.

Table 30
Residual Management Process Options
Percentage of Plants Using Each Residual Management Process
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Water Source	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Ground Water Plants							
Mechanical dewatering	1.7	0.0	1.1	7.3	3.0	0.0	1.1
Non-mechanical dewatering	1.5	0.1	3.5	9.4	13.6	0.0	2.0
Chemical precipitation	0.0	0.0	0.3	1.2	3.9	0.0	0.2
Land application	1.4	2.0	6.1	9.9	11.8	0.0	3.5
Non-hazardous waste landfill	2.1	0.3	2.8	6.2	3.4	0.0	1.8
Deep well Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evaporation Pond	0.0	0.0	6.6	7.9	5.8	0.0	2.2
French Drain	1.0	0.0	1.1	0.0	0.7	0.0	0.5
Direct Discharge to Surface Water	2.8	2.1	5.3	10.4	3.9	0.0	3.6
Septic system	0.0	1.4	0.0	0.0	1.2	0.0	0.6
Sanitary Sewer	2.2	7.5	15.0	16.1	8.2	0.0	8.6
Surface Water Plants							
Mechanical dewatering	1.6	0.0	6.9	11.0	20.1	12.0	7.1
Non-mechanical dewatering	1.1	12.8	29.5	36.9	45.4	44.0	26.9
Chemical precipitation	1.1	0.0	7.4	11.0	12.8	16.0	6.7
Land application	2.4	9.3	20.6	42.4	25.0	16.0	22.6
Non-hazardous waste landfill	4.9	8.4	15.6	21.2	32.8	8.0	16.0
Deep well Injection	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Evaporation Pond	10.3	26.8	30.2	34.7	42.5	28.0	30.2
French Drain	3.2	3.0	0.8	1.5	2.5	0.0	1.8
Direct Discharge to Surface Water	9.3	14.8	26.2	16.4	14.3	16.0	18.8
Septic system	2.9	1.1	2.4	0.6	1.9	0.0	1.6
Sanitary sewer	2.6	6.7	17.3	28.7	18.7	24.0	16.9

(Continued)

Table 30 (Cont.)
Residual Management Process Options
Percentage of Plants Using Each Residual Management Process
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Water Source	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Mixed Plants							
Mechanical dewatering	5.8	0.0	8.9	11.7	16.2	*	8.9
Non-mechanical dewatering	5.8	6.7	38.5	34.0	36.4	*	23.6
Chemical precipitation	0.0	0.0	8.9	6.2	10.9	*	4.7
Land application	0.0	0.0	0.0	19.0	25.5	*	7.6
Non-hazardous waste landfill	0.0	6.7	8.9	15.0	29.9	*	9.2
Deep well Injection	0.0	0.0	0.0	0.0	0.0	*	0.0
Evaporation Pond	0.0	68.7	27.6	48.3	27.1	*	24.3
French Drain	0.0	0.0	0.0	8.4	2.7	*	2.5
Direct Discharge to Surface Water	7.8	31.3	29.6	20.1	23.8	*	18.5
Septic system	2.0	0.0	0.0	0.0	0.0	*	0.7
Sanitary Sewer	0.0	0.0	27.6	0.0	16.8	*	7.9
All Plants							
Mechanical dewatering	1.7	0.0	2.1	8.9	14.3	11.5	2.0
Non-mechanical dewatering	1.6	1.0	8.0	21.2	34.5	42.1	5.3
Chemical precipitation	0.0	0.0	1.5	5.3	9.8	15.3	1.0
Land application	1.4	2.6	8.4	23.1	20.8	15.3	5.9
Non-hazardous waste landfill	2.2	0.9	4.9	12.4	23.1	7.7	3.6
Deep well Injection	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Evaporation Pond	0.4	2.1	10.6	20.0	29.6	26.8	6.0
French Drain	1.0	0.2	1.0	0.9	1.9	0.0	0.7
Direct Discharge to Surface Water	3.2	3.1	8.9	13.1	11.6	15.3	5.7
Septic system	0.1	1.4	0.4	0.2	1.5	0.0	0.7
Sanitary sewer	2.2	7.4	15.5	20.5	15.2	23.0	9.6

Data: Q.16A

Notes: *No data available for these cells.

Excludes plants that treat only purchased treated water.

Table 31
Residual Management Process Options
Percentage of Plants That Discharge to Surface Water, Septic Systems, or Sanitary Sewers
By Primary Source of Water and Water System Service Population

	System Service Population Category								
Water Source	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Ground Water Plants									
Direct Discharge to Surface Water	100.0	100.0	100.0	63.9	66.7	100.0	95.9	100.0	88.1
Septic system	100.0	100.0	*	0.0	*	100.0	*	*	84.7
Sanitary sewer	100.0	100.0	97.4	87.8	81.9	94.2	61.1	91.8	93.5
Surface Water Plants									
Direct Discharge to Surface Water	100.0	100.0	92.1	80.2	48.7	54.1	62.2	82.5	76.2
Septic system	100.0	100.0	100.0	75.0	0.0	100.0	80.0	0.0	47.7
Sanitary sewer	*	100.0	93.9	66.9	69.0	88.2	62.6	94.3	78.3
Mixed Plants									
Direct Discharge to Surface Water	100.0	100.0	*	40.2	61.0	100.0	75.5	100.0	56.0
Septic system	100.0	*	*	0.0	0.0	*	0.0	0.0	6.8
Sanitary sewer	*	*	*	33.8	50.0	*	60.7	0.0	40.5
All Plants									
Direct Discharge to Surface Water	100.0	100.0	97.0	69.7	57.6	59.4	80.2	86.4	81.1
Septic system	100.0	100.0	100.0	25.3	0.0	100.0	66.7	0.0	62.3
Sanitary sewer	100.0	100.0	96.8	76.3	76.2	90.6	61.7	89.8	88.7

Data: Q.16A

Notes: *No observations for these plants

Excludes plants that treat purchased water.

These are the systems with the option to discard to surface water, septic systems, or sanitary sewers, and make use of these options.

Table 32
Residual Management Process Options
Percentage of Plants That Do Discharge to Surface Water, Septic Systems, or Sanitary Sewers
By Primary Source of Water and Plant Average Daily Production

	Plant Average Daily Production (MGD)						
Water Source	**0 - 0.01**	**0.01 - 0.1**	**0.1 - 1.0**	**1.0 - 10.0**	**10.0 - 100.0**	**Over 100**	**All Sizes**
Ground Water Plants							
Direct Discharge to Surface Water	100.0	100.0	77.8	89.2	76.8	*	88.1
Septic system	*	100.0	0.0	0.0	100.0	*	84.7
Sanitary sewer	100.0	99.8	90.3	84.7	81.1	*	93.4
Surface Water Plants							
Direct Discharge to Surface Water	100.0	89.2	92.3	54.9	48.2	100.0	76.1
Septic system	100.0	100.0	56.3	12.9	75.9	0.0	47.7
Sanitary sewer	100.0	100.0	80.7	81.6	50.8	75.0	78.3
Mixed Plants							
Direct Discharge to Surface Water	100.0	100.0	35.5	72.3	81.4	*	56.0
Septic system	100.0	*	0.0	0.0	0.0	*	6.8
Sanitary sewer	*	*	44.1	0.0	56.3	*	40.5
All Plants							
Direct Discharge to Surface Water	100.0	95.8	80.8	67.5	53.5	100.0	81.1
Septic system	100.0	100.0	28.4	11.0	73.3 *		62.3
Sanitary sewer	100.0	99.8	86.9	81.8	54.8	75.0	88.6

Data: Q.16A

Notes: *No observations for these plants

Excludes plants that treat purchased water.

These are the systems with the option to discard to surface water, septic systems, or sanitary sewers, and make use of these options.

Please note that the unit of analysis changes for the following tables.
The remaining tables report data for water systems except where noted.

Table 33
Treated-Water Storage Information
Percentage of Systems That Have Each Type of Treated-Water Storage
By Primary Source of Water

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Ground Water Systems									
Clearwell storage after treatment	16.3	21.3	26.9	28.9	45.6	56.2	40.4	13.1	22.8
Confidence Interval	*+|- 10.2*	*+|- 9.8*	*+|- 10.7*	*+|- 12.6*	*+|- 14.1*	*+|- 19.7*	*+|- 26.0*	*+|- 15.7*	*+|- 5.3*
Storage after treatment, before distribution system									
With Dedicated Entry and Exit Points	26.4	36.7	17.0	23.1	18.5	33.9	22.3	42.6	27.2
Confidence Interval	*+|- 9.6*	*+|- 12.7*	*+|- 8.3*	*+|- 10.1*	*+|- 11.0*	*+|- 17.4*	*+|- 14.3*	*+|- 23.9*	*+|- 5.8*
With a Common Inlet and Outlet	18.4	15.3	15.6	8.8	10.1	23.0	8.0	42.6	15.6
Confidence Interval	*+|- 9.8*	*+|- 8.8*	*+|- 11.4*	*+|- 9.5*	*+|- 8.3*	*+|- 26.8*	*+|- 6.9*	*+|- 23.9*	*+|- 5.0*
Storage within the distribution system									
With Dedicated Entry and Exit Points	2.9	3.0	10.0	16.5	25.4	38.4	46.2	57.4	6.8
Confidence Interval	*+|- 4.4*	*+|- 3.5*	*+|- 7.0*	*+|- 8.9*	*+|- 12.4*	*+|- 18.6*	*+|- 27.2*	*+|- 23.9*	*+|- 2.5*
With a Common Inlet and Outlet	6.9	17.0	68.6	54.0	67.1	74.4	93.6	72.1	31.1
Confidence Interval	*+|- 6.3*	*+|- 8.6*	*+|- 15.0*	*+|- 12.9*	*+|- 13.4*	*+|- 15.0*	*+|- 5.7*	*+|- 21.5*	*+|- 6.1*
Primarily Surface Water Systems									
Clearwell storage after treatment	48.5	33.7	86.2	85.3	93.7	97.1	93.9	89.5	71.8
Confidence Interval	*+|- 35.7*	*+|- 21.0*	*+|- 8.8*	*+|- 10.3*	*+|- 5.0*	*+|- 3.5*	*+|- 2.7*	*+|- 5.2*	*+|- 9.5*
Storage after treatment, before distribution system									
With Dedicated Entry and Exit Points	36.8	45.9	16.6	27.7	31.2	33.5	37.3	28.9	31.5
Confidence Interval	*+|- 31.4*	*+|- 24.4*	*+|- 8.7*	*+|- 10.4*	*+|- 10.0*	*+|- 13.8*	*+|- 5.9*	*+|- 7.7*	*+|- 7.8*
With a Common Inlet and Outlet	4.4	8.7	18.3	16.7	7.8	7.1	12.8	13.1	11.5
Confidence Interval	*+|- 4.9*	*+|- 7.6*	*+|- 10.3*	*+|- 10.9*	*+|- 6.6*	*+|- 9.4*	*+|- 4.3*	*+|- 5.7*	*+|- 3.9*
Storage within the distribution system									
With Dedicated Entry and Exit Points	1.3	10.8	4.1	29.2	33.9	45.7	54.0	63.3	18.5
Confidence Interval	*+|- 2.8*	*+|- 13.0*	*+|- 4.0*	*+|- 11.1*	*+|- 10.0*	*+|- 13.6*	*+|- 5.9*	*+|- 8.2*	*+|- 4.4*
With a Common Inlet and Outlet	10.2	30.8	73.6	73.0	69.5	76.2	72.9	71.1	54.8
Confidence Interval	*+|- 9.7*	*+|- 26.7*	*+|- 12.0*	*+|- 11.9*	*+|- 10.1*	*+|- 15.0*	*+|- 5.3*	*+|- 7.7*	*+|- 8.4*

(Continued)

Table 33 (Cont.)
Treated-Water Storage Information
Percentage of Systems That Have Each Type of Treated-Water Storage
By Primary Source of Water

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Purchased Water Systems									
Clearwell storage after treatment	23.1	0.7	3.1	12.1	14.0	12.4	33.4	57.6	5.3
Confidence Interval	*+|- 46.9*	*+|- 1.5*	*+|- 4.1*	*+|- 12.4*	*+|- 13.3*	*+|- 10.0*	*+|- 10.5*	*+|- 17.6*	*+|- 3.1*
Storage after treatment, before distribution system									
With Dedicated Entry and Exit Points	0.0	21.3	5.3	13.5	12.5	11.4	33.7	33.6	11.7
Confidence Interval	*+|- 0.0*	*+|- 34.8*	*+|- 7.5*	*+|- 12.1*	*+|- 12.8*	*+|- 9.7*	*+|- 11.0*	*+|- 16.2*	*+|- 11.2*
With a Common Inlet and Outlet	10.0	11.1	7.6	15.3	0.6	2.5	0.0	0.0	8.7
Confidence Interval	*+|- 22.7*	*+|- 16.5*	*+|- 7.6*	*+|- 17.4*	*+|- 1.2*	*+|- 4.2*	*+|- 0.0*	*+|- 0.0*	*+|- 6.2*
Storage within the distribution system									
With Dedicated Entry and Exit Points	0.0	7.1	8.8	22.6	34.2	36.9	53.6	60.0	13.2
Confidence Interval	*+|- 0.0*	*+|- 11.2*	*+|- 11.2*	*+|- 17.1*	*+|- 20.0*	*+|- 15.6*	*+|- 11.8*	*+|- 17.4*	*+|- 6.8*
With a Common Inlet and Outlet	0.0	28.9	55.4	61.6	72.3	55.6	70.8	58.4	50.1
Confidence Interval	*+|- 0.0*	*+|- 25.9*	*+|- 17.5*	*+|- 19.0*	*+|- 18.6*	*+|- 16.4*	*+|- 10.9*	*+|- 17.8*	*+|- 12.8*
All Systems									
Clearwell storage after treatment	18.5	19.5	25.5	36.9	54.2	62.8	61.0	71.9	25.4
Confidence Interval	*+|- 10.0*	*+|- 8.2*	*+|- 7.5*	*+|- 8.7*	*+|- 8.2*	*+|- 6.7*	*+|- 11.9*	*+|- 5.5*	*+|- 4.2*
Storage after treatment, before distribution system									
With Dedicated Entry and Exit Points	26.9	35.3	13.8	22.2	21.3	27.8	30.9	31.8	25.3
Confidence Interval	*+|- 9.2*	*+|- 10.9*	*+|- 6.8*	*+|- 7.0*	*+|- 6.7*	*+|- 8.5*	*+|- 7.6*	*+|- 7.0*	*+|- 4.7*
With a Common Inlet and Outlet	17.4	14.3	13.6	11.6	7.2	10.5	8.3	13.4	14.1
Confidence Interval	*+|- 9.1*	*+|- 7.3*	*+|- 7.8*	*+|- 7.1*	*+|- 4.3*	*+|- 9.9*	*+|- 3.2*	*+|- 5.1*	*+|- 3.9*
Storage within the distribution system									
With Dedicated Entry and Exit Points	2.8	4.1	9.1	20.2	30.2	41.3	51.0	61.7	9.0
Confidence Interval	*+|- 4.1*	*+|- 3.3*	*+|- 5.3*	*+|- 6.8*	*+|- 7.8*	*+|- 9.2*	*+|- 11.2*	*+|- 7.3*	*+|- 2.2*
With a Common Inlet and Outlet	7.1	19.5	65.4	59.2	69.0	70.2	80.2	68.0	36.6
Confidence Interval	*+|- 5.9*	*+|- 8.0*	*+|- 11.1*	*+|- 9.1*	*+|- 8.1*	*+|- 8.8*	*+|- 5.5*	*+|- 7.0*	*+|- 5.1*

Data: Q.18

Notes: Column totals do not sum to 100.

Table 34
Treated-Water Storage Information - Average Capacity for Each Type of Treated-Water Storage
By Primary Source of Water
(In Millions of Gallons)

Primary Source of Water	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Clearwell storage after treatment	0.010	0.047	0.118	0.371	1.284	1.267	2.557	190.000	0.237
Confidence Interval	+|- *0.007*	+|- *0.047*	+|- *0.071*	+|- *0.153*	+|- *0.665*	+|- *0.868*	+|- *0.706*	+|- *0.000*	+|- *0.079*
Storage after treatment, before distribution system									
With Dedicated Entry and Exit Points	0.012	0.633	0.295	0.826	4.030	8.925	14.903	71.788	0.613
Confidence Interval	+|- *0.010*	+|- *1.152*	+|- *0.206*	+|- *0.255*	+|- *2.158*	+|- *5.902*	+|- *4.545*	+|- *27.293*	+|- *0.548*
With a Common Inlet and Outlet	0.073	0.085	0.130	1.258	1.400	3.670	35.461	45.248	0.270
Confidence Interval	+|- *0.140*	+|- *0.054*	+|- *0.072*	+|- *0.342*	+|- *1.314*	+|- *0.689*	+|- *48.457*	+|- *48.974*	+|- *0.121*
Storage within the distribution system									
With Dedicated Entry and Exit Points	0.009	0.038	0.175	0.931	1.932	6.316	13.202	53.785	1.131
Confidence Interval	+|- *0.003*	+|- *0.048*	+|- *0.205*	+|- *0.412*	+|- *1.280*	+|- *3.237*	+|- *4.115*	+|- *24.077*	+|- *0.419*
With a Common Inlet and Outlet	0.187	0.097	0.221	1.002	3.947	12.387	9.783	71.228	0.835
Confidence Interval	+|- *0.187*	+|- *0.037*	+|- *0.055*	+|- *0.282*	+|- *1.576*	+|- *5.451*	+|- *6.516*	+|- *22.441*	+|- *0.215*
Total Storage Capacity	0.050	0.325	0.271	1.092	4.652	17.232	21.170	157.065	0.723
Confidence Interval	+|- *0.047*	+|- *0.507*	+|- *0.065*	+|- *0.210*	+|- *1.299*	+|- *4.946*	+|- *11.816*	+|- *54.295*	+|- *0.209*
Primarily Surface Water Systems									
Clearwell storage after treatment	0.131	0.102	0.162	0.421	1.379	3.075	11.626	63.908	1.819
Confidence Interval	+|- *0.143*	+|- *0.084*	+|- *0.058*	+|- *0.116*	+|- *0.474*	+|- *0.772*	+|- *2.138*	+|- *17.437*	+|- *0.337*
Storage after treatment, before distribution system									
With Dedicated Entry and Exit Points	0.030	0.109	0.374	1.061	2.874	6.438	29.628	114.200	3.001
Confidence Interval	+|- *0.026*	+|- *0.080*	+|- *0.178*	+|- *0.360*	+|- *0.933*	+|- *3.805*	+|- *7.982*	+|- *36.100*	+|- *0.871*
With a Common Inlet and Outlet	0.042	0.217	0.359	1.556	2.653	1.023	7.356	27.000	1.414
Confidence Interval	+|- *0.035*	+|- *0.176*	+|- *0.183*	+|- *1.096*	+|- *0.746*	+|- *1.801*	+|- *2.003*	+|- *11.778*	+|- *0.382*
Storage within the distribution system									
With Dedicated Entry and Exit Points	*	0.350	0.995	0.774	4.057	17.252	46.256	153.748	12.156
Confidence Interval	*	+|- *0.127*	+|- *0.593*	+|- *0.195*	+|- *1.456*	+|- *12.894*	+|- *17.009*	+|- *47.937*	+|- *2.969*
With a Common Inlet and Outlet	0.214	0.192	0.487	1.294	4.088	6.775	17.810	98.164	3.601
Confidence Interval	+|- *0.153*	+|- *0.035*	+|- *0.132*	+|- *0.389*	+|- *1.138*	+|- *1.535*	+|- *2.454*	+|- *34.980*	+|- *0.680*
Total Storage Capacity	0.113	0.203	0.682	2.034	6.576	17.992	60.729	249.612	6.718
Confidence Interval	+|- *0.097*	+|- *0.077*	+|- *0.124*	+|- *0.346*	+|- *1.367*	+|- *6.486*	+|- *10.636*	+|- *47.716*	+|- *1.155*

(Continued)

Table 34 (Cont.)
Treated-Water Storage Information - Average Capacity for Each Type of Treated-Water Storage
By Primary Source of Water
(In Millions of Gallons)

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Purchased Water Systems									
Clearwell storage after treatment	0.018	0.028	0.192	0.299	0.931	1.529	7.965	57.720	2.463
Confidence Interval	+|- *0.000*	+|- *0.000*	+|- *0.043*	+|- *0.327*	+|- *0.972*	+|- *1.829*	+|- *1.855*	+|- *41.554*	+|- *1.478*
Storage after treatment, before distribution system									
With Dedicated Entry and Exit Points	*	0.017	0.654	1.087	1.083	7.639	26.495	30.041	1.488
Confidence Interval	*	+|- *0.001*	+|- *0.252*	+|- *0.410*	+|- *0.574*	+|- *3.860*	+|- *11.631*	+|- *22.275*	+|- *1.519*
With a Common Inlet and Outlet	0.053	0.046	0.227	0.184	116.500	3.000	*	*	0.855
Confidence Interval	+|- *0.000*	+|- *0.048*	+|- *0.096*	+|- *0.197*	+|- *0.000*	+|- *0.000*	*	*	+|- *1.409*
Storage within the distribution system									
With Dedicated Entry and Exit Points	*	0.020	0.228	1.053	3.118	8.256	26.016	122.328	3.794
Confidence Interval	*	+|- *0.025*	+|- *0.118*	+|- *0.501*	+|- *1.236*	+|- *3.604*	+|- *6.367*	+|- *115.137*	+|- *2.308*
With a Common Inlet and Outlet	*	0.175	0.289	0.845	4.045	15.510	23.809	81.896	1.668
Confidence Interval	*	+|- *0.155*	+|- *0.153*	+|- *0.300*	+|- *1.498*	+|- *6.176*	+|- *5.711*	+|- *35.725*	+|- *0.656*
Total Storage Capacity	0.029	0.088	0.313	1.116	5.626	17.403	44.501	182.287	2.244
Confidence Interval	+|- *0.021*	+|- *0.073*	+|- *0.133*	+|- *0.494*	+|- *2.356*	+|- *5.954*	+|- *7.554*	+|- *83.215*	+|- *0.820*
All Systems									
Clearwell storage after treatment	0.031	0.054	0.134	0.389	1.316	2.533	9.075	65.773	0.794
Confidence Interval	+|- *0.022*	+|- *0.043*	+|- *0.050*	+|- *0.094*	+|- *0.371*	+|- *0.660*	+|- *1.854*	+|- *16.542*	+|- *0.125*
Storage after treatment, before distribution system									
With Dedicated Entry and Exit Points	0.013	0.537	0.343	0.912	3.083	7.470	25.156	85.899	0.997
Confidence Interval	+|- *0.009*	+|- *0.963*	+|- *0.154*	+|- *0.191*	+|- *0.982*	+|- *3.157*	+|- *5.140*	+|- *23.167*	+|- *0.448*
With a Common Inlet and Outlet	0.073	0.087	0.172	1.052	4.408	2.826	13.961	35.175	0.432
Confidence Interval	+|- *0.137*	+|- *0.048*	+|- *0.076*	+|- *0.458*	+|- *5.542*	+|- *1.874*	+|- *11.235*	+|- *22.967*	+|- *0.170*
Storage within the distribution system									
With Dedicated Entry and Exit Points	0.009	0.091	0.224	0.915	3.053	12.093	30.863	133.088	4.169
Confidence Interval	+|- *0.003*	+|- *0.069*	+|- *0.154*	+|- *0.242*	+|- *0.827*	+|- *6.310*	+|- *8.935*	+|- *41.981*	+|- *0.888*
With a Common Inlet and Outlet	0.190	0.122	0.263	1.040	4.018	10.363	15.448	90.937	1.453
Confidence Interval	+|- *0.169*	+|- *0.042*	+|- *0.055*	+|- *0.194*	+|- *0.850*	+|- *2.515*	+|- *4.410*	+|- *24.049*	+|- *0.222*
Total Storage Capacity	0.055	0.289	0.318	1.286	5.518	17.637	42.835	222.130	1.696
Confidence Interval	+|- *0.043*	+|- *0.411*	+|- *0.053*	+|- *0.175*	+|- *0.902*	+|- *3.689*	+|- *9.901*	+|- *36.962*	+|- *0.220*

Data: Q.18

Notes: *No data available for these cells.

Clearwell storage after treatment for ground water systems serving over 500,000 people is based on 1 observation.

Table 35
Distribution System Summary - Pipes
By Ownership

Ownership Type	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Miles of Pipe in Place	3	5	25	61	203	339	560	2,382	61
Confidence interval	+|- *2*	+|- *1*	+|- *11*	+|- *22*	+|- *77*	+|- *46*	+|- *149*	+|- *281*	+|- *12*
Service Connections per Mile	24	33	49	58	68	69	58	61	48
Confidence interval	+|- *11*	+|- *9*	+|- *10*	+|- *9*	+|- *20*	+|- *5*	+|- *11*	+|- *6*	+|- *6*
Average Annual Pipe Replaced in the Past 5 Years (miles)	0	0	1	2	5	8	20	58	1
Confidence interval	+|- *0*	+|- *0*	+|- *0*	+|- *1*	+|- *2*	+|- *2*	+|- *12*	+|- *17*	+|- *0*
Average Cost per Mile of Pipe Replaced in the Past 5 Years (thousands of dollars)	738	119	131	239	260	380	462	1,719	191
Confidence interval	+|- *557*	+|- *51*	+|- *49*	+|- *89*	+|- *67*	+|- *109*	+|- *93*	+|- *1,209*	+|- *34*
Observations	16	67	158	113	108	82	139	44	727
Private Systems									
Miles of Pipe in Place	1	4	37	217	390	871	777	2,771	20
Confidence interval	+|- *1*	+|- *2*	+|- *25*	+|- *189*	+|- *367*	+|- *834*	+|- *133*	+|- *812*	+|- *9*
Service Connections per Mile	59	71	49	37	47	66	64	103	62
Confidence interval	+|- *14*	+|- *21*	+|- *27*	+|- *18*	+|- *23*	+|- *22*	+|- *9*	+|- *7*	+|- *11*
Average Annual Pipe Replaced in the Past 5 Years (miles)	0	0	1	20	5	3	20	154	1
Confidence interval	+|- *0*	+|- *0*	+|- *1*	+|- *33*	+|- *5*	+|- *2*	+|- *11*	+|- *130*	+|- *1*
Average Cost per Mile of Pipe Replaced in the Past 5 Years (thousands of dollars)	31	90	106	62	103	438	623	*	75
Confidence interval	+|- *15*	+|- *36*	+|- *130*	+|- *51*	+|- *80*	+|- *63*	+|- *238*	*	+|- *22*
Observations	131	90	30	19	17	10	16	4	317

(Continued)

Table 35 (Cont.)
Distribution System Summary - Pipes
By Ownership

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
All Systems									
Miles of Pipe in Place	1	4	28	85	232	395	579	2,414	39
Confidence interval	+|- *1*	+|- *1*	+|- *10*	+|- *37*	+|- *85*	+|- *100*	+|- *141*	+|- *268*	+|- *7*
Service Connections per Mile	57	58	49	55	65	68	59	64	55
Confidence interval	+|- *14*	+|- *16*	+|- *9*	+|- *8*	+|- *17*	+|- *5*	+|- *10*	+|- *6*	+|- *7*
Average Annual Pipe Replaced in the Past 5 Years (miles)	0	0	1	4	5	7	20	65	1
Confidence interval	+|- *0*	+|- *0*	+|- *0*	+|- *5*	+|- *2*	+|- *2*	+|- *11*	+|- *19*	+|- *0*
Average Cost per Mile of Pipe Replaced in the Past 5 Years (thousands of dollars)	45	107	129	222	252	386	481	1,719	163
Confidence interval	+|- *27*	+|- *35*	+|- *47*	+|- *83*	+|- *65*	+|- *98*	+|- *87*	+|- *1,209*	+|- *27*
Observations	147	157	188	132	125	92	155	48	1,044

Data: Q.19A, Q.20A

Notes: *No observations.

Systems reporting zero miles of distribution pipe are included in table.

The cost per mile of pipe replaced reported by the 1999 Drinking Water Infrastructure Needs Survey is a good deal higher than reported by the CWS Survey. There are important differences in the information collected by the two surveys that account for some of the difference. The main difference is the time covered by the surveys. The CWS Survey asks about pipe replaced in the past five years, and the Needs Survey asks about plans to replace pipe in the next 20 years. Sampling error also explains some of the difference; systems that responded to both surveys report similar cost per foot, while systems that did not provide data for both surveys report very different costs.

Most publicly owned systems serving less than 100 people did not replace pipe in the last 5 years. The estimate of average cost per mile replaced is based on 3 observations.

Costs for public systems serving over 500,000 excludes one project that cost over $50 million per mile. If included, the mean cost per mile of pipe replaced in the past 5 years is $9.7 million in this category.

A public state prison serving 3,301-10,000. people was removed from calculations because of its large connections per mile.

A private system serving 3,301-10,000 people with average cost per mile of $770,000 was dropped from the estimate. If included the average cost is $206,000 for private systems of this size.

Table 36
Average Size of Distribution System
By Diameter of Pipe and Ownership
(Miles of Pipe)

Ownership Type	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Distribution Mains Less Than 6 Inches	1.5	3.3	21.4	38.5	108.8	136.0	250.4	835.1	34.7
Confidence interval	*+|- 0.7*	*+|- 1.3*	*+|- 10.1*	*+|- 18.9*	*+|- 57.4*	*+|- 33.7*	*+|- 68.7*	*+|- 119.1*	*+|- 8.6*
Distribution Mains 6 to 10 inches	1.2	1.1	3.2	17.0	58.8	122.4	175.4	864.9	16.3
Confidence interval	*+|- 1.5*	*+|- 0.6*	*+|- 1.4*	*+|- 5.1*	*+|- 26.1*	*+|- 20.8*	*+|- 49.9*	*+|- 147.7*	*+|- 3.5*
Distribution Mains Greater Than 10 Inches	0.5	0.1	0.8	4.9	34.1	80.4	137.0	704.5	9.1
Confidence interval	*+|- 0.6*	*+|- 0.3*	*+|- 0.4*	*+|- 1.4*	*+|- 11.2*	*+|- 12.8*	*+|- 35.1*	*+|- 88.5*	*+|- 1.8*
Observations	16	67	160	119	109	82	142	44	739
Private Systems									
Distribution Mains Less Than 6 Inches	1.1	3.5	33.9	190.3	191.0	192.7	361.3	676.9	13.8
Confidence interval	*+|- 0.6*	*+|- 1.5*	*+|- 23.5*	*+|- 188.0*	*+|- 150.3*	*+|- 134.0*	*+|- 83.9*	*+|- 350.9*	*+|- 6.3*
Distribution Mains 6 to 10 inches	0.0	0.1	2.4	23.8	184.6	114.1	249.5	1,484.0	4.2
Confidence interval	*+|- 0.0*	*+|- 0.1*	*+|- 2.0*	*+|- 11.7*	*+|- 232.0*	*+|- 42.8*	*+|- 67.2*	*+|- 830.2*	*+|- 3.5*
Distribution Mains Greater Than 10 Inches	0.0	0.0	0.3	2.5	14.6	63.6	166.5	454.6	0.7
Confidence interval	*+|- 0.0*	*+|- 0.0*	*+|- 0.5*	*+|- 1.3*	*+|- 8.8*	*+|- 24.5*	*+|- 33.4*	*+|- 189.7*	*+|- 0.2*
Observations	131	90	30	19	17	9	16	5	317
All Systems									
Distribution Mains Less Than 6 Inches	1.1	3.4	23.9	60.8	121.4	141.6	259.9	819.0	23.7
Confidence interval	*+|- 0.6*	*+|- 1.1*	*+|- 8.9*	*+|- 34.1*	*+|- 53.0*	*+|- 33.0*	*+|- 65.3*	*+|- 113.3*	*+|- 5.1*
Distribution Mains 6 to 10 inches	0.1	0.5	3.0	18.0	78.0	121.6	181.8	915.7	9.9
Confidence interval	*+|- 0.1*	*+|- 0.2*	*+|- 1.1*	*+|- 4.5*	*+|- 41.9*	*+|- 19.2*	*+|- 47.4*	*+|- 156.6*	*+|- 2.3*
Distribution Mains Greater Than 10 Inches	0.0	0.1	0.7	4.5	31.1	78.7	139.5	684.0	4.6
Confidence interval	*+|- 0.0*	*+|- 0.1*	*+|- 0.4*	*+|- 1.2*	*+|- 9.7*	*+|- 11.9*	*+|- 32.7*	*+|- 83.6*	*+|- 0.7*
Observations	147	157	190	138	126	91	158	49	1,056

Data: Q.19A

Notes: Systems reporting zero miles of distribution pipe are included in table.

The estimate for private systems serving greater than 500,000 people is based on 5 systems.

In private systems serving 50,000-100,000 people, one system with 6,400 miles of pipe was dropped from the estimate. If included, the average length of six inch pipe for this category is 666 miles. Changes to the estimates in other categories are insignificant.

Table 37
Distribution System Summary - Percentage of Pipe in Each Age Category
By Primary Source of Water

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Ground Water Systems									
Percentage of Pipe that is:									
Less than 40 years old	93.2	92.6	84.5	75.3	68.9	62.5	61.6	78.3	75.2
Between 40 and 80 years old	6.8	7.4	14.9	20.8	25.4	29.5	31.9	19.1	21.1
More than 80 years old	0.0	0.0	0.6	3.9	5.7	8.0	6.5	2.6	3.8
Observations	103	91	88	57	45	26	35	6	451
Primarily Surface Water Systems									
Percentage of Pipe that is:									
Less than 40 years old	67.5	65.4	68.6	73.6	80.0	70.7	55.3	48.2	67.3
Between 40 and 80 years old	32.0	34.0	23.0	19.6	15.8	22.1	30.8	39.8	24.6
More than 80 years old	0.5	0.6	8.4	6.8	4.1	7.2	13.9	11.9	8.1
Observations	46	52	67	71	72	48	95	30	481
Primarily Purchased Water Systems									
Percentage of Pipe that is:									
Less than 40 years old	100.0	84.6	88.3	96.4	92.9	79.7	73.3	69.4	89.6
Between 40 and 80 years old	0.0	15.4	11.2	3.3	6.4	18.4	23.7	26.4	9.6
More than 80 years old	0.0	0.0	0.5	0.3	0.7	1.9	3.0	4.2	0.8
Observations	6	23	49	26	26	26	44	9	209
All Systems									
Percentage of Pipe that is:									
Less than 40 years old	90.6	88.3	85.7	84.3	81.4	70.2	60.9	56.3	78.0
Between 40 and 80 years old	9.4	11.7	13.3	12.9	15.3	23.4	29.7	34.4	18.0
More than 80 years old	0.1	0.1	1.0	2.8	3.4	6.4	9.4	9.2	4.0
Observations	155	166	204	154	143	100	174	45	1,141

Data: Q.19A, Q.19B

Notes: Table reports the percentage of pipe on average in each age category in the nation. It is not the percentage of pipe per system.

Table 38
Distribution System Summary - Percentage of Pipe in Each Age Category
By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Percentage of Pipe that is:									
Less than 40 years old	76.3	81.5	81.1	77.6	76.2	65.2	61.4	54.9	72.6
Between 40 and 80 years old	23.6	18.3	17.5	18.4	19.7	26.9	29.2	35.8	22.4
More than 80 years old	0.1	0.1	1.4	4.0	4.2	7.9	9.4	9.3	5.0
Observations	18	72	173	135	122	88	160	40	808
Private Systems									
Percentage of Pipe that is:									
Less than 40 years old	92.4	92.8	98.7	96.2	95.8	86.6	56.5	67.7	92.9
Between 40 and 80 years old	7.6	7.2	1.3	3.3	3.1	12.0	34.1	23.8	5.8
More than 80 years old	0.0	0.0	0.0	0.6	1.1	1.4	9.4	8.5	1.3
Observations	137	94	31	19	21	12	14	5	333
All Systems									
Percentage of Pipe that is:									
Less than 40 years old	90.6	88.3	85.7	84.3	81.4	70.2	60.9	56.3	78.0
Between 40 and 80 years old	9.4	11.7	13.3	12.9	15.3	23.4	29.7	34.4	18.0
More than 80 years old	0.1	0.1	1.0	2.8	3.4	6.4	9.4	9.2	4.0
Observations	155	166	204	154	143	100	174	45	1,141

Data: Q.19A, Q.19B

Notes: Table reports the percentage of pipe on average in each age category in the nation. It is not the percentage of pipe per system.

Table 39
Service Connections Profile
By Ownership
(Number of Connections)

Ownership Type	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Mean Residential Connections	19	110	528	1,856	6,160	16,952	34,193	171,180	2,479
Confidence Interval	*+|- 11*	*+|- 29*	*+|- 68*	*+|- 240*	*+|- 607*	*+|- 2,140*	*+|- 7,334*	*+|- 21,895*	*+|- 329*
Median Residential Connections	20	80	440	1,725	5,367	17,498	30,600	146,482	442
Mean Non-Residential Connections	2	6	35	283	627	1,615	3,443	17,169	249
Confidence Interval	*+|- 3*	*+|- 2*	*+|- 9*	*+|- 152*	*+|- 147*	*+|- 294*	*+|- 853*	*+|- 3,842*	*+|- 46*
Median Non-Residential Connections	0	2	15	100	400	1,340	2,371	9,127	12
Observations	18	74	174	145	130	93	175	51	860
Private Systems									
Mean Residential Connections	24	105	446	1,609	6,457	20,784	44,192	222,922	427
Confidence Interval	*+|- 3*	*+|- 16*	*+|- 146*	*+|- 386*	*+|- 1,528*	*+|- 4,576*	*+|- 6,970*	*+|- 41,015*	*+|- 83*
Median Residential Connections	24	90	390	1,595	4,934	19,618	42,999	189,594	45
Mean Non-Residential Connections	1	1	9	153	631	1,512	4,207	17,956	30
Confidence Interval	*+|- 1*	*+|- 2*	*+|- 6*	*+|- 86*	*+|- 491*	*+|- 519*	*+|- 843*	*+|- 4,676*	*+|- 11*
Median Non-Residential Connections	0	0	0	82	230	1,411	3,158	21,270	0
Observations	138	92	31	22	22	16	19	6	346
All Systems									
Mean Residential Connections	23	107	512	1,819	6,205	17,434	35,082	176,431	1,425
Confidence Interval	*+|- 3*	*+|- 14*	*+|- 60*	*+|- 212*	*+|- 566*	*+|- 1,990*	*+|- 6,865*	*+|- 20,425*	*+|- 123*
Median Residential Connections	24	86	430	1,668	5,127	17,629	32,324	151,230	143
Mean Non-Residential Connections	1	3	30	264	627	1,603	3,510	17,236	137
Confidence Interval	*+|- 1*	*+|- 2*	*+|- 7*	*+|- 130*	*+|- 146*	*+|- 267*	*+|- 793*	*+|- 3,513*	*+|- 20*
Median Non-Residential Connections	0	0	12	100	386	1,401	2,788	13,590	0
Observations	156	166	205	167	152	109	194	57	1,206

Data: Q.20A

Table 40
Population Served
By Ownership and System Service Population

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Mean Population Served	61	250	1,440	5,847	21,245	71,091	211,219	1,582,013	12,939
Confidence Interval	*+|- 19*	*+|- 38*	*+|- 163*	*+|- 407*	*+|- 1,693*	*+|- 3,985*	*+|- 20,488*	*+|- 330,128*	*+|- 2,176*
Observations	18	76	179	148	138	101	183	52	895
Private Systems									
Mean Population Served	53	282	1,216	5,657	21,611	73,327	169,092	850,802	1,457
Confidence Interval	*+|- 6*	*+|- 34*	*+|- 304*	*+|- 801*	*+|- 5,626*	*+|- 5,542*	*+|- 22,632*	*+|- 101,402*	*+|- 295*
Observations	138	95	32	22	23	16	19	6	351
All Systems									
Mean Population Served	54	271	1,396	5,819	21,302	71,354	207,583	1,509,021	7,070
Confidence Interval	*+|- 6*	*+|- 26*	*+|- 140*	*+|- 372*	*+|- 1,688*	*+|- 3,586*	*+|- 19,327*	*+|- 298,260*	*+|- 871*
Observations	156	171	211	170	161	117	202	58	1,246

Data: Q.20A

Table 41
Annual Deliveries per Customer Service Connection
By Ownership
(Thousands of Gallons)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Mean Residential Deliveries	119	141	87	250	106	134	144	135	133
Confidence Interval	*+|- 66*	*+|- 91*	*+|- 11*	*+|- 203*	*+|- 12*	*+|- 21*	*+|- 16*	*+|- 12*	*+|- 44*
Median Residential Deliveries	65	70	76	84	87	107	118	119	78
Mean Non-Residential Deliveries	288	197	580	860	994	1,095	1,142	1,323	637
Confidence Interval	*+|- 637*	*+|- 128*	*+|- 508*	*+|- 304*	*+|- 516*	*+|- 396*	*+|- 297*	*+|- 190*	*+|- 244*
Median Non-Residential Deliveries	0	0	125	375	492	679	682	1,031	200
Observations	11	50	127	115	108	79	130	40	660
Private Systems									
Mean Residential Deliveries	74	109	91	100	100	112	111	117	93
Confidence Interval	*+|- 15*	*+|- 33*	*+|- 27*	*+|- 29*	*+|- 23*	*+|- 32*	*+|- 26*	*+|- 24*	*+|- 17*
Median Residential Deliveries	67	71	82	83	88	72	84	149	70
Mean Non-Residential Deliveries	35	240	256	719	1,348	718	1,315	530	308
Confidence Interval	*+|- 40*	*+|- 233*	*+|- 174*	*+|- 697*	*+|- 1,606*	*+|- 347*	*+|- 520*	*+|- 109*	*+|- 154*
Median Non-Residential Deliveries	0	0	120	341	535	413	915	534	83
Observations	85	81	23	18	17	15	16	5	260
All Systems									
Mean Residential Deliveries	76	119	88	227	105	131	141	133	113
Confidence Interval	*+|- 15*	*+|- 36*	*+|- 10*	*+|- 173*	*+|- 11*	*+|- 19*	*+|- 14*	*+|- 11*	*+|- 23*
Median Residential Deliveries	65	71	76	84	88	106	117	121	75
Mean Non-Residential Deliveries	61	210	536	844	1,040	1,047	1,159	1,254	563
Confidence Interval	*+|- 61*	*+|- 109*	*+|- 440*	*+|- 282*	*+|- 499*	*+|- 348*	*+|- 276*	*+|- 177*	*+|- 192*
Median Non-Residential Deliveries	0	0	120	364	495	635	695	1,017	169
Observations	96	131	150	133	125	94	146	45	920

Data: Q.4, Q.10, Q.20

Notes: Seven public systems with outliers greater than 123 million gallons of water in non-residential deliveries affecting population categories 3,301-10,000 people, 10,000-50,000 people and 100,000-500,000 people were dropped from the estimate. If included, non-residential deliveries are 5.9 million gallons of water, 2.6 million gallons of water, and 1.1 million gallons of water, respectively.

Table 42
Percentage of Systems that have Cross Connection Control Programs
By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Percentage of Systems	15.8	47.8	55.0	83.1	85.1	87.8	92.1	92.0	61.1
Confidence Interval	+|- *20.4*	+|- *21.2*	+|- *12.2*	+|- *7.4*	+|- *9.6*	+|- *8.0*	+|- *3.1*	+|- *4.5*	+|- *8.0*
Observations	18	73	177	144	126	98	179	50	865
Private Systems									
Percentage of Systems	15.9	26.4	39.2	77.8	82.7	94.5	91.7	100.0	25.5
Confidence Interval	+|- *10.6*	+|- *13.3*	+|- *20.8*	+|- *21.6*	+|- *18.9*	+|- *9.2*	+|- *7.2*	+|- *0.0*	+|- *7.7*
Observations	137	94	32	20	23	16	19	6	347
All Systems									
Percentage of Systems	15.9	33.7	51.9	82.4	84.7	88.6	92.0	92.8	42.7
Confidence Interval	+|- *10.1*	+|- *11.4*	+|- *11.4*	+|- *7.8*	+|- *8.6*	+|- *7.1*	+|- *2.9*	+|- *4.0*	+|- *5.7*
Observations	155	167	209	164	149	114	198	56	1,212

Data: Q.22

Table 43
Percentage of Systems that Have a Cross Connection Control Program that is Designed to Prevent Backflow from Reaching a Publicly Owned Distribution System and Provides Protection within a Customer's Premises. By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Percentage of Systems	27.9	14.9	22.6	30.3	37.1	31.6	43.3	27.5	25.7
Confidence Interval	+|- *45.1*	+|- *16.6*	+|- *9.3*	+|- *10.1*	+|- *10.2*	+|- *9.8*	+|- *12.6*	+|- *7.8*	+|- *5.6*
Observations	6	30	101	117	105	86	160	42	647
Private Systems									
Percentage of Systems	0.3	23.3	17.8	28.6	13.4	6.6	19.7	0.0	15.7
Confidence Interval	+|- *0.7*	+|- *24.7*	+|- *23.2*	+|- *24.3*	+|- *15.4*	+|- *11.0*	+|- *13.7*	+|- *0.0*	+|- *11.6*
Observations	19	24	13	15	19	13	17	5	125
All Systems									
Percentage of Systems	1.9	19.3	21.8	30.1	33.2	28.7	41.2	24.8	22.6
Confidence Interval	+|- *2.8*	+|- *17.0*	+|- *9.4*	+|- *9.4*	+|- *9.1*	+|- *8.8*	+|- *11.4*	+|- *7.1*	+|- *5.7*
Observations	25	54	114	132	124	99	177	47	772

Data: Q.23

Definitions: These systems have a Containment and Isolation program. This is often referred to as providing protection up to the tap. Containment-only programs are designed to prevent backflow from reaching a publicly owned distribution system, but do not provide protection within the premises. This is often referred to as providing protection up to the meter.

Table 44
Percentage of Systems With Each Element in their Cross Connection Control Programs
By Water System Service Population

Cross Connection Control Program Element	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Right of entry	85.7	93.3	98.6	93.1	89.6	82.8	85.2	84.6	93.6
Confidence Interval	+|- *0.0*	+|- *7.7*	+|- *1.5*	+|- *4.5*	+|- *5.6*	+|- *8.3*	+|- *4.6*	+|- *5.4*	+|- *2.7*
Surveys/inspections to identify cross connections within the system/facility	91.2	90.4	97.8	90.5	87.6	84.7	90.7	86.3	92.5
Confidence Interval	+|- *13.2*	+|- *9.2*	+|- *2.1*	+|- *5.6*	+|- *6.7*	+|- *8.0*	+|- *3.2*	+|- *5.2*	+|- *3.0*
Policy specifying which service connections must be equipped with backflow prevention device/assemblies	91.4	97.0	98.4	95.9	93.7	90.0	97.1	92.3	96.2
Confidence Interval	+|- *13.2*	+|- *3.9*	+|- *2.1*	+|- *3.8*	+|- *5.1*	+|- *7.2*	+|- *1.7*	+|- *4.1*	+|- *2.0*
Enforcement authority to install devices/assemblies	86.2	97.7	97.7	84.5	90.8	80.6	89.5	82.4	92.9
Confidence Interval	+|- *14.7*	+|- *3.4*	+|- *2.1*	+|- *7.2*	+|- *5.0*	+|- *7.8*	+|- *4.0*	+|- *5.7*	+|- *2.4*
Enforcement authority to test assemblies	85.7	98.0	94.2	85.9	84.5	75.2	76.9	78.9	91.0
Confidence Interval	+|- *15.1*	+|- *3.4*	+|- *6.7*	+|- *6.6*	+|- *6.8*	+|- *11.9*	+|- *16.0*	+|- *6.0*	+|- *3.2*
Penalties for non-compliance with ordinance	78.6	91.5	90.3	74.6	80.3	76.2	71.2	72.7	84.8
Confidence Interval	+|- *17.7*	+|- *7.9*	+|- *8.0*	+|- *9.3*	+|- *7.5*	+|- *8.3*	+|- *15.0*	+|- *6.9*	+|- *4.3*
Public education programs	68.2	49.2	47.3	52.0	39.6	48.8	51.4	52.3	49.8
Confidence Interval	+|- *23.9*	+|- *19.7*	+|- *17.3*	+|- *11.8*	+|- *9.4*	+|- *10.8*	+|- *12.6*	+|- *7.7*	+|- *8.2*
Training/certification of testers and inspectors	82.3	62.0	55.4	63.1	62.3	71.6	64.8	78.7	62.2
Confidence Interval	+|- *19.5*	+|- *18.9*	+|- *17.3*	+|- *9.9*	+|- *9.4*	+|- *9.2*	+|- *14.2*	+|- *6.3*	+|- *7.9*
Observations	24	51	113	129	126	99	174	51	767

Data: Q.24

Table 45
Mean Percentage of Backflow Prevention Assemblies that are Tested and Fail Annually During Inspection
By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Percentage of Systems	3.0	0.1	0.7	4.1	6.2	6.1	8.9	10.0	2.4
Confidence Interval	+|- *6.4*	+|- *0.1*	+|- *1.0*	+|- *2.1*	+|- *1.7*	+|- *1.8*	+|- *1.2*	+|- *2.2*	+|- *0.8*
Observations	3	20	80	72	83	60	127	29	474
Private Systems									
Percentage of Systems	0.1	0.1	0.2	6.5	6.4	3.4	6.8	4.5	1.2
Confidence Interval	+|- *0.1*	+|- *0.1*	+|- *0.4*	+|- *6.8*	+|- *3.0*	+|- *1.8*	+|- *2.5*	+|- *2.5*	+|- *0.9*
Observations	13	18	12	12	16	9	14	3	97
All Systems									
Percentage of Systems	0.1	0.1	0.7	4.5	6.2	5.8	8.7	9.5	2.0
Confidence Interval	+|- *0.2*	+|- *0.1*	+|- *0.9*	+|- *2.1*	+|- *1.5*	+|- *1.6*	+|- *1.1*	+|- *2.1*	+|- *0.6*
Observations	16	38	92	84	99	69	141	32	571

Data: Q.25

Table 46
Total Revenue
By Primary Source of Water
(Thousands of Dollars)

Primary Source of Water	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Mean	5	23	146	622	2,179	7,878	14,013	75,183	286
Confidence Interval	*+|- 2*	*+|- 6*	*+|- 31*	*+|- 118*	*+|- 431*	*+|- 982*	*+|- 7,219*	*+|- 13,978*	*+|- 42*
Median	2	20	107	605	1,862	7,126	12,670	86,082	23
% not charging directly for water	43	32	4	5	6	0	0	0	25
Confidence Interval	*+|- 17*	*+|- 13*	*+|- 4*	*+|- 7*	*+|- 8*	*+|- 0*	*+|- 0*	*+|- 0*	*+|- 7*
Observations	86	80	89	62	44	27	40	7	435
Primarily Surface Water Systems									
Mean	17	55	350	961	3,133	8,027	23,839	151,432	3,291
Confidence Interval	*+|- 10*	*+|- 20*	*+|- 85*	*+|- 147*	*+|- 502*	*+|- 1,613*	*+|- 2,122*	*+|- 31,259*	*+|- 575*
Median	10	48	269	856	2,356	6,559	19,198	89,897	331
% not charging directly for water	22	5	3	1	0	2	0	0	5
Confidence Interval	*+|- 26*	*+|- 6*	*+|- 3*	*+|- 3*	*+|- 0*	*+|- 3*	*+|- 0*	*+|- 0*	*+|- 4*
Observations	41	50	68	72	78	53	106	36	504
Primarily Purchased Water Systems									
Mean	2	30	222	971	3,534	11,716	22,869	175,305	1,511
Confidence Interval	*+|- 5*	*+|- 10*	*+|- 55*	*+|- 353*	*+|- 917*	*+|- 2,985*	*+|- 2,672*	*+|- 50,202*	*+|- 484*
Median	0	19	166	751	2,473	8,899	20,346	115,947	156
% not charging directly for water	90	1	0	4	0	0	0	0	2
Confidence Interval	*+|- 23*	*+|- 2*	*+|- 0*	*+|- 9*	*+|- 0*	*+|- 0*	*+|- 0*	*+|- 0*	*+|- 2*
Observations	6	20	48	26	27	27	45	13	212
All Systems									
Mean	6	26	185	760	2,817	8,953	19,961	147,922	814
Confidence Interval	*+|- 2*	*+|- 5*	*+|- 26*	*+|- 111*	*+|- 338*	*+|- 1,181*	*+|- 3,938*	*+|- 23,163*	*+|- 85*
Median	2	20	144	648	2,302	7,313	16,187	99,807	46
% not charging directly for water	42	26	3	4	2	1	0	0	19
Confidence Interval	*+|- 16*	*+|- 11*	*+|- 3*	*+|- 5*	*+|- 3*	*+|- 1*	*+|- 0*	*+|- 0*	*+|- 5*
Observations	133	150	205	160	149	107	191	56	1,151

Data: Q.26C

Notes: Two ground water systems serving less than 100 people with large non residential sales are dropped. If these systems are included then revenues for ground water systems systems serving 100 or less are $18,100 and average revenues for all systems of this size are $6,000

Table 47
Total Revenue
By Ownership
(Thousands of Dollars)

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Mean	14	33	186	756	2,811	8,857	19,608	148,745	1,396
Confidence Interval	+|- *8*	+|- *9*	+|- *31*	+|- *117*	+|- *340*	+|- *1,278*	+|- *4,169*	+|- *25,328*	+|- *209*
Median	10	26	134	653	2,302	7,126	16,444	89,897	146
% not charging directly for water	20	5	2	4	1	0	0	0	3
Confidence Interval	+|- *33*	+|- *6*	+|- *2*	+|- *5*	+|- *2*	+|- *0*	+|- *0*	+|- *0*	+|- *2*
Observations	13	72	176	142	132	95	176	51	15
Private Systems									
Mean	6	21	178	792	2,858	9,855	24,347	139,210	187
Confidence Interval	+|- *2*	+|- *7*	+|- *56*	+|- *302*	+|- *1,279*	+|- *2,331*	+|- *5,670*	+|- *15,984*	+|- *46*
Median	2	17	194	633	2,397	10,133	15,970	122,075	6
% not charging directly for water	43	39	6	8	12	7	0	0	36
Confidence Interval	+|- *16*	+|- *15*	+|- *11*	+|- *14*	+|- *21*	+|- *12*	+|- *0*	+|- *0*	+|- *10*
Observations	120	78	29	18	17	12	15	5	294
All Systems									
Mean	6	26	185	760	2,817	8,953	19,961	147,922	814
Confidence Interval	+|- *2*	+|- *5*	+|- *26*	+|- *111*	+|- *338*	+|- *1,181*	+|- *3,938*	+|- *23,163*	+|- *85*
Median	2	20	144	648	2,302	7,313	16,187	99,807	46
% not charging directly for water	42	26	3	4	2	1	0	0	19
Confidence Interval	+|- *16*	+|- *11*	+|- *3*	+|- *5*	+|- *3*	+|- *1*	+|- *0*	+|- *0*	+|- *5*
Observations	133	150	205	160	149	107	191	56	1,151

Data: Q.26C

Notes: Two public systems serving less than 100 people with large non residential sales are dropped. If these systems are included then revenues for public systems systems serving 100 or less are $273,300 and average revenues for all systems of this size are $17,000.

Refer to the next table for additional detail on private systems.

Table 48
Total Revenue
Private Systems, by Type
(Thousands of Dollars)

Ownership Type	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	All Small Systems
Private Systems				
Mean	9.9	34.0	191.0	49.9
Confidence Interval	+|- *3.5*	+|- *6.7*	+|- *55.2*	+|- *15.8*
Median	6.0	25.8	194.3	21.3
% not charging directly for water	11.0	0.3	0.0	4.9
Confidence Interval	+|- *10.5*	+|- *0.4*	+|- *0.0*	+|- *4.6*
Observations	71	48	26	145
Ancillary Systems				
Mean	0.7	0.8	6.6	0.9
Confidence Interval	+|- *0.9*	+|- *1.1*	+|- *16.3*	+|- *0.7*
Median	0.0	0.0	0.0	0.0
% not charging directly for water	83.3	92.7	92.0	87.6
Confidence Interval	+|- *18.6*	+|- *9.8*	+|- *19.7*	+|- *11.0*
Observations	49	30	3	82
All Private Systems				
Mean	5.8	21.0	178.4	31.2
Confidence Interval	+|- *2.4*	+|- *6.7*	+|- *55.6*	+|- *10.5*
Median	2.3	16.7	194.3	6.0
% not charging directly for water	42.9	39.1	6.3	37.4
Confidence Interval	+|- *16.3*	+|- *14.8*	+|- *11.2*	+|- *10.3*
Observations	120	78	29	227

Data: Q.26C

Table 49
Total Revenue for Systems Reporting Positive Revenue and Expenses
By Ownership
(Thousands of Dollars)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Mean	18	35	191	778	2,784	8,913	21,773	150,214	1,393
Confidence interval	*+|- 7*	*+|- 9*	*+|- 32*	*+|- 122*	*+|- 335*	*+|- 1,317*	*+|- 1,837*	*+|- 27,300*	*+|- 211*
Median	10	26	134	653	2,302	7,126	16,444	89,897	146
Observations	11	64	169	132	124	91	169	47	807
Private Systems									
Mean	10	37	191	850	3,477	9,783	23,675	115,584	257
Confidence interval	*+|- 4*	*+|- 7*	*+|- 57*	*+|- 310*	*+|- 1,331*	*+|- 2,185*	*+|- 5,618*	*+|- 5,613*	*+|- 70*
Median	2	17	194	633	2,397	10,133	15,970	122,075	6
Observations	66	43	26	16	14	9	13	3	190
All Systems									
Mean	10	36	191	786	2,857	8,982	21,915	148,186	976
Confidence interval	*+|- 3*	*+|- 6*	*+|- 27*	*+|- 115*	*+|- 337*	*+|- 1,228*	*+|- 1,754*	*+|- 25,684*	*+|- 113*
50th Percentile	2	20	144	648	2,302	7,313	16,187	99,807	46
Observations	77	107	195	148	138	100	182	50	997

Data: Q.26C

Notes: Table reports systems who reported both positive revenue and positive expenses only.

One public system serving less than 100 people with revenue of $1.8 million was dropped.
If included, the mean revenue for public systems serving less than 100 people is $305,427.

A private system serving 100 or less with revenue of $6,000 was dropped from the estimate.
If included, revenue for this category is $5,795.

Table 50
Revenue Breakdown
By Ownership
(Percentage of Systems with Each Type of Revenue)

Ownership Type	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Water Sales	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Confidence Interval	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*
Water-Related Operations	26.3	36.9	58.1	88.7	84.1	79.9	72.4	73.6	60.9
Confidence Interval	+|- *33.5*	+|- *14.4*	+|- *14.4*	+|- *7.0*	+|- *7.2*	+|- *9.9*	+|- *15.7*	+|- *7.2*	+|- *7.9*
General Fund	1.0	5.9	7.2	6.1	14.4	8.4	11.3	16.4	7.4
Confidence Interval	+|- *2.2*	+|- *7.2*	+|- *7.1*	+|- *4.6*	+|- *7.1*	+|- *4.7*	+|- *4.0*	+|- *6.0*	+|- *3.8*
Other Revenue Sources	20.6	50.4	72.0	73.8	85.0	79.7	73.8	80.2	67.7
Confidence Interval	+|- *30.7*	+|- *18.0*	+|- *10.6*	+|- *12.0*	+|- *6.9*	+|- *10.6*	+|- *16.0*	+|- *6.3*	+|- *6.5*
Private Systems									
Water Sales	100.0	99.0	100.0	100.0	100.0	100.0	100.0	100.0	99.6
Confidence Interval	+|- *0.0*	+|- *2.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.7*
Water-Related Operations	18.9	32.7	35.0	72.0	74.0	35.2	32.0	75.7	29.5
Confidence Interval	+|- *12.7*	+|- *17.9*	+|- *21.4*	+|- *24.4*	+|- *23.3*	+|- *24.9*	+|- *17.4*	+|- *26.1*	+|- *9.4*
Other Revenue Sources	10.1	31.9	52.9	55.3	61.0	70.6	70.6	80.5	27.7
Confidence Interval	+|- *7.9*	+|- *17.7*	+|- *22.1*	+|- *28.4*	+|- *26.0*	+|- *24.5*	+|- *20.4*	+|- *21.5*	+|- *9.0*
All Systems									
Water Sales	100.0	99.5	100.0	100.0	100.0	100.0	100.0	100.0	99.9
Confidence Interval	+|- *0.0*	+|- *1.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.0*	+|- *0.3*
Water-Related Operations	19.4	34.8	53.9	87.0	82.9	76.1	69.3	73.8	48.6
Confidence Interval	+|- *12.0*	+|- *11.5*	+|- *11.8*	+|- *6.8*	+|- *7.0*	+|- *9.5*	+|- *14.2*	+|- *7.0*	+|- *5.9*
General Fund	0.1	2.9	5.9	5.4	12.6	7.7	10.4	15.2	4.5
Confidence Interval	+|- *0.1*	+|- *3.5*	+|- *5.9*	+|- *4.1*	+|- *6.3*	+|- *4.4*	+|- *3.6*	+|- *5.6*	+|- *2.3*
Other Revenue Sources	10.8	41.0	68.5	71.9	82.0	78.9	73.5	80.3	52.1
Confidence Interval	+|- *8.4*	+|- *14.2*	+|- *9.2*	+|- *11.1*	+|- *7.0*	+|- *9.9*	+|- *14.8*	+|- *6.1*	+|- *6.0*

Data: Q.26

Notes: Systems have more than one type of revenue; therefore column totals may not sum to 100.

Table includes systems with positive revenue from water sales and water related operations only.

Table 51
Revenue Breakdown
By Ownership
(Percentage of Revenue By Type of Revenue Source)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Water Sales	85.0	89.7	90.9	89.1	88.5	87.7	88.9	86.1	89.9
Confidence Interval	*+|- 21.5*	*+|- 4.8*	*+|- 2.4*	*+|- 2.6*	*+|- 2.1*	*+|- 2.5*	*+|- 2.9*	*+|- 2.1*	*+|- 1.7*
Water-Related Operations	8.0	3.2	2.0	5.3	5.6	5.6	4.6	4.5	3.4
Confidence Interval	*+|- 13.5*	*+|- 2.8*	*+|- 0.9*	*+|- 2.0*	*+|- 1.9*	*+|- 2.1*	*+|- 1.3*	*+|- 1.2*	*+|- 0.9*
General Fund	0.3	0.9	1.4	1.5	0.6	0.9	0.9	1.0	1.2
Confidence Interval	*+|- 0.7*	*+|- 1.1*	*+|- 1.6*	*+|- 1.6*	*+|- 0.4*	*+|- 0.8*	*+|- 0.5*	*+|- 0.5*	*+|- 0.8*
Other Revenue Sources	6.6	6.2	6.0	4.2	5.4	5.9	5.7	8.4	5.7
Confidence Interval	*+|- 9.5*	*+|- 4.7*	*+|- 1.5*	*+|- 1.4*	*+|- 1.2*	*+|- 1.7*	*+|- 1.8*	*+|- 1.8*	*+|- 1.3*
Private Systems									
Water Sales	96.6	95.4	92.6	92.5	90.4	98.3	97.8	96.1	95.3
Confidence Interval	*+|- 3.3*	*+|- 2.8*	*+|- 6.2*	*+|- 3.5*	*+|- 5.4*	*+|- 1.2*	*+|- 1.2*	*+|- 2.1*	*+|- 2.0*
Water-Related Operations	2.8	2.0	4.0	4.9	4.7	0.8	0.9	3.8	2.8
Confidence Interval	*+|- 3.2*	*+|- 1.7*	*+|- 5.6*	*+|- 2.6*	*+|- 2.8*	*+|- 1.1*	*+|- 0.7*	*+|- 2.5*	*+|- 1.7*
Other Revenue Sources	0.6	2.5	3.5	3.0	4.7	1.1	1.4	0.6	1.9
Confidence Interval	*+|- 0.6*	*+|- 2.2*	*+|- 3.3*	*+|- 2.2*	*+|- 4.6*	*+|- 0.8*	*+|- 1.0*	*+|- 0.5*	*+|- 1.0*
All Systems									
Water Sales	95.9	92.7	91.2	89.5	88.7	88.7	89.6	87.0	92.0
Confidence Interval	*+|- 3.4*	*+|- 3.1*	*+|- 2.3*	*+|- 2.4*	*+|- 2.0*	*+|- 2.4*	*+|- 2.6*	*+|- 2.0*	*+|- 1.3*
Water-Related Operations	3.2	2.6	2.4	5.2	5.5	5.2	4.3	4.4	3.2
Confidence Interval	*+|- 3.1*	*+|- 1.6*	*+|- 1.2*	*+|- 1.8*	*+|- 1.7*	*+|- 2.0*	*+|- 1.2*	*+|- 1.1*	*+|- 0.9*
General Fund	0.0	0.3	1.1	1.2	0.5	0.8	0.8	0.9	0.5
Confidence Interval	*+|- 0.0*	*+|- 0.4*	*+|- 1.2*	*+|- 1.4*	*+|- 0.3*	*+|- 0.7*	*+|- 0.5*	*+|- 0.4*	*+|- 0.4*
Other Revenue Sources	1.0	4.3	5.5	4.1	5.4	5.5	5.3	7.9	4.2
Confidence Interval	*+|- 0.9*	*+|- 2.8*	*+|- 1.4*	*+|- 1.3*	*+|- 1.2*	*+|- 1.5*	*+|- 1.7*	*+|- 1.7*	*+|- 1.0*

Data: Q.26

Table 52
Water Sales Revenue Profile
By Ownership
(Percentage of Revenue from Each Customer Category)

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Residential	91.3	85.8	85.9	72.3	64.3	57.5	51.5	39.4	80.3
Confidence Interval	+|- *14.7*	+|- *9.0*	+|- *4.6*	+|- *5.5*	+|- *5.1*	+|- *7.7*	+|- *3.8*	+|- *4.1*	+|- *3.3*
Non-Residential	8.7	14.8	11.6	21.9	26.9	25.5	25.9	28.0	16.0
Confidence Interval	+|- *14.7*	+|- *10.0*	+|- *3.6*	+|- *5.5*	+|- *4.2*	+|- *4.2*	+|- *2.8*	+|- *3.1*	+|- *3.2*
Wholesale	0.0	1.4	1.8	4.7	8.2	14.8	18.7	32.2	3.3
Confidence Interval	+|- *0.0*	+|- *2.5*	+|- *1.7*	+|- *2.8*	+|- *3.3*	+|- *9.0*	+|- *6.6*	+|- *6.1*	+|- *1.1*
Observations	12	51	128	102	111	80	154	45	701
Private Systems									
Residential	99.0	98.2	91.2	85.9	79.6	74.3	59.6	71.5	96.7
Confidence Interval	+|- *1.2*	+|- *2.5*	+|- *10.2*	+|- *7.4*	+|- *11.0*	+|- *10.8*	+|- *10.1*	+|- *6.2*	+|- *1.9*
Non-Residential	1.0	0.6	8.2	9.0	13.0	17.3	32.3	21.6	2.4
Confidence Interval	+|- *1.1*	+|- *0.6*	+|- *9.7*	+|- *5.7*	+|- *7.7*	+|- *6.0*	+|- *7.8*	+|- *7.6*	+|- *1.6*
Wholesale	0.2	1.2	0.1	3.6	6.0	13.4	8.2	1.4	0.9
Confidence Interval	+|- *0.4*	+|- *2.4*	+|- *0.2*	+|- *4.5*	+|- *7.9*	+|- *13.9*	+|- *6.7*	+|- *1.0*	+|- *0.9*
Observations	67	47	23	16	13	9	14	4	200
All Systems									
Residential	98.5	93.0	86.9	74.2	66.0	59.0	52.2	42.1	87.4
Confidence Interval	+|- *1.3*	+|- *5.1*	+|- *4.0*	+|- *5.1*	+|- *4.6*	+|- *7.2*	+|- *3.6*	+|- *4.2*	+|- *2.2*
Non-Residential	1.4	7.0	10.9	20.0	25.4	24.7	26.5	27.3	10.2
Confidence Interval	+|- *1.3*	+|- *5.0*	+|- *3.2*	+|- *4.8*	+|- *3.9*	+|- *3.8*	+|- *2.7*	+|- *2.9*	+|- *2.0*
Wholesale	0.2	1.3	1.5	4.5	7.9	14.7	18.0	29.2	2.3
Confidence Interval	+|- *0.4*	+|- *2.4*	+|- *1.5*	+|- *2.5*	+|- *3.0*	+|- *8.3*	+|- *6.1*	+|- *5.7*	+|- *0.9*
Observations	79	98	151	118	124	89	168	49	901

Data: Q.26A

Notes: Column totals may not sum to 100 due to rounding.

Table 53
Total Revenue
By Ownership
(Dollars per 1,000 Gallons Sold)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Mean	4.47	3.28	3.51	2.46	2.57	2.19	1.72	1.91	3.13
Confidence Interval	*+|- 1.42*	*+|- 0.75*	*+|- 0.52*	*+|- 0.32*	*+|- 0.48*	*+|- 0.23*	*+|- 0.36*	*+|- 0.12*	*+|- 0.30*
Median	5.10	2.32	2.88	2.14	2.23	1.78	1.81	1.86	2.57
Observations	9	66	167	139	130	95	174	51	831
Private Systems									
Mean	4.39	3.76	4.50	3.90	2.88	2.84	2.50	3.07	4.08
Confidence Interval	*+|- 1.22*	*+|- 0.77*	*+|- 1.03*	*+|- 0.94*	*+|- 0.54*	*+|- 0.57*	*+|- 0.32*	*+|- 0.51*	*+|- 0.58*
Median	1.80	2.02	3.84	3.41	2.70	3.10	2.48	2.96	2.41
Observations	58	48	25	17	16	11	15	5	195
All Systems									
Mean	4.39	3.53	3.67	2.62	2.61	2.25	1.78	2.01	3.48
Confidence Interval	*+|- 1.17*	*+|- 0.54*	*+|- 0.48*	*+|- 0.32*	*+|- 0.42*	*+|- 0.22*	*+|- 0.34*	*+|- 0.12*	*+|- 0.29*
Median	1.99	2.17	3.08	2.19	2.32	1.84	1.82	1.87	2.53
Observations	67	114	192	156	146	106	189	56	1,026

Data: Q.26C, Q.5

Notes: Includes wholesale deliveries and unaccounted for water.

Outliers were dropped from public systems serving 25-100 and 501-3,300 and private systems serving 25-100 and 500-3,301. If included in the estimate, these cells are 6.46, 3.59, 4.04, and 5.43, respectively.

Table 54
Water Sales Revenue
By Ownership
(Dollars per 1,000 Gallons Sold)

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Mean	3.89	3.09	3.13	2.10	2.23	1.84	1.46	1.61	2.81
Confidence Interval	*+|- 1.74*	*+|- 0.74*	*+|- 0.43*	*+|- 0.25*	*+|- 0.44*	*+|- 0.17*	*+|- 0.30*	*+|- 0.10*	*+|- 0.27*
Median	5.10	2.32	2.62	1.85	1.85	1.61	1.59	1.56	2.38
Observations	9	68	169	137	128	94	174	51	830
Private Systems									
Mean	4.31	3.88	3.99	3.39	2.59	2.78	2.46	2.97	4.00
Confidence Interval	*+|- 1.19*	*+|- 0.94*	*+|- 0.73*	*+|- 0.84*	*+|- 0.50*	*+|- 0.56*	*+|- 0.32*	*+|- 0.52*	*+|- 0.60*
Median	1.99	2.01	3.84	3.12	2.38	2.31	2.47	2.66	2.37
Observations	59	48	25	18	16	11	15	5	197
All Systems									
Mean	4.30	3.50	3.27	2.26	2.27	1.92	1.53	1.73	3.25
Confidence Interval	*+|- 1.15*	*+|- 0.64*	*+|- 0.39*	*+|- 0.27*	*+|- 0.39*	*+|- 0.18*	*+|- 0.30*	*+|- 0.11*	*+|- 0.29*
Median	1.99	2.24	2.84	2.04	1.95	1.65	1.64	1.62	2.37
Observations	68	116	194	155	144	105	189	56	1,027

Data: Q.26A, Q.5

Notes: Outliers were dropped from public systems serving 25-100 and 501-3,300 and private systems serving 25-100 and 500-3,301. If included in the estimate, these cells are 6.06, 3.25, 5.54, and 4.93, respectively.

Table 55
Water Sales Revenue--Customer Breakdown
By Ownership
(Dollars per 1,000 Gallons Sold)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Residential									
Mean	3.25	3.39	3.66	2.78	2.83	2.48	2.08	2.01	3.31
Confidence Interval	+|- *2.70*	+|- *0.96*	+|- *0.69*	+|- *0.45*	+|- *0.58*	+|- *0.23*	+|- *0.10*	+|- *0.12*	+|- *0.39*
Median	5.10	3.43	3.03	2.46	2.72	2.49	2.02	1.85	2.95
Observations	8	48	110	95	94	70	122	35	582
Non-Residential									
Mean	1.82	3.03	4.23	3.05	2.86	2.43	3.06	1.81	3.52
Confidence Interval	+|- *0.58*	+|- *1.56*	+|- *1.48*	+|- *1.12*	+|- *0.84*	+|- *0.46*	+|- *1.03*	+|- *0.17*	+|- *0.74*
Median	2.08	2.84	2.79	1.92	2.05	1.90	1.86	1.66	2.55
Observations	2	9	70	78	90	69	121	37	476
Wholesale									
Mean	*	*	1.93	1.67	1.70	1.89	1.54	1.45	1.77
Confidence Interval	*	*	+|- *0.86*	+|- *0.50*	+|- *0.59*	+|- *0.40*	+|- *0.24*	+|- *0.24*	0.36
Median	*	*	1.96	1.65	1.24	1.56	1.45	1.24	1.56
Observations	0	0	18	32	58	48	107	42	305
Private Systems									
Residential									
Mean	2.86	2.64	4.29	3.97	2.78	3.72	3.12	3.02	2.93
Confidence Interval	+|- *1.12*	+|- *1.03*	+|- *0.79*	+|- *1.84*	+|- *1.09*	+|- *0.95*	+|- *0.58*	+|- *0.77*	+|- *0.66*
Median	2.00	2.14	4.82	3.19	2.75	3.44	3.26	2.60	2.39
Observations	84	68	20	15	12	10	12	4	225
Non-Residential									
Mean	0.00	2.93	6.28	2.05	3.01	3.38	2.36	3.18	3.52
Confidence Interval	+|- *0.00*	+|- *0.39*	+|- *4.63*	+|- *1.34*	+|- *2.49*	+|- *2.03*	+|- *0.56*	+|- *0.25*	+|- *2.09*
Median	0.00	2.81	5.02	1.61	1.83	2.57	2.35	3.06	1.61
Observations	4	3	8	10	10	12	12	3	62
Wholesale									
Mean	1.09	*	1.16	1.77	2.15	2.47	1.64	1.94	1.87
Confidence Interval	+|- *1.35*	*	+|- *1.54*	+|- *0.36*	+|- *1.18*	+|- *0.76*	+|- *0.36*	+|- *1.03*	+|- *0.50*
Median	1.59	*	2.22	1.67	2.26	2.00	1.28	1.16	1.67
Observations	2	0	2	3	6	7	9	3	32

(Continued)

Table 55 (Cont.)
Water Sales Revenue--Customer Breakdown
By Ownership
(Dollars per 1,000 Gallons Sold)

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
All Systems									
Residential									
Mean	2.87	2.89	3.78	2.95	2.83	2.63	2.18	2.12	3.11
Confidence Interval	+|- *1.09*	+|- *0.76*	+|- *0.58*	+|- *0.54*	+|- *0.52*	+|- *0.24*	+|- *0.11*	+|- *0.14*	+|- *0.39*
Median	2.34	2.79	3.27	2.47	2.72	2.60	2.05	1.89	2.72
Observations	92	116	130	110	106	80	134	39	807
Non-Residential									
Mean	0.04	3.01	4.53	2.93	2.88	2.56	2.99	1.91	3.52
Confidence Interval	+|- *0.09*	+|- *1.28*	+|- *1.45*	+|- *0.99*	+|- *0.79*	+|- *0.49*	+|- *0.93*	+|- *0.16*	+|- *0.70*
Median	0.00	2.81	2.79	1.91	2.05	1.93	1.86	1.71	2.51
Observations	6	12	78	88	100	81	133	40	538
Wholesale									
Mean	1.09	*	1.92	1.68	1.74	1.95	1.55	1.48	1.78
Confidence Interval	+|- *1.35*	*	+|- *0.84*	+|- *0.46*	+|- *0.55*	+|- *0.37*	+|- *0.23*	+|- *0.24*	+|- *0.33*
Median	1.59	*	1.96	1.67	1.32	1.67	1.43	1.20	1.58
Observations	92	116	130	110	106	80	134	39	337

Q 26 Q.26

Notes: *No data collected for these systems.

Wholesale revenue for public systems serving 101-500 people contained only 1 county cluster of systems. In order to calculate the design-based 95% confidence interval, this cluster was moved to the 501-3,301 stratum for this table only.

Outliers were dropped from residential revenue for public systems serving 25-100 and 501-3,300, residential revenue for private systems serving 25-100 and 500-3,301, non-residential revenue for public systems serving 3,301-10,000 and 50,001-100,000, and wholesale systems serving 50,001-100,000 and 100,001-500,000. If included in the estimate, these cells are 5.75, 3.75, 3.77, 5.36, 4.90, 3.02, 2.86, and 32.47 respectively.

Table 56
Residential Revenue per Connection
By Ownership
(Dollars)

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Mean Residential Revenues per Connection	363	258	272	238	255	276	286	261	264
Confidence interval	+|- *239*	+|- *60*	+|- *35*	+|- *33*	+|- *32*	+|- *34*	+|- *23*	+|- *23*	+|- *23*
Median Residential Revenues per Connection	329	220	237	217	227	261	260	219	228
Observations	13	54	128	101	103	72	130	35	636
Private Systems									
Mean Residential Revenues per Connection	230	218	358	341	320	439	333	364	243
Confidence interval	+|- *101*	+|- *76*	+|- *142*	+|- *111*	+|- *85*	+|- *145*	+|- *75*	+|- *46*	+|- *58*
Median Residential Revenues per Connection	172	250	333	318	287	439	314	385	237
Observations	113	72	24	16	12	10	14	4	265
All Systems									
Mean Residential Revenues per Connection	235	232	289	253	262	295	290	272	253
Confidence interval	+|- *98*	+|- *54*	+|- *42*	+|- *34*	+|- *30*	+|- *36*	+|- *23*	+|- *22*	+|- *33*
Median Residential Revenues per Connection	175	235	258	228	237	273	263	240	231
Observations	126	126	152	117	115	82	144	39	901

Data: Q.26A2, Q.20Ab

Notes: One public system serving 25-100 people was dropped from the estimate. If included, residential revenues per connection are $431.

Two private systems serving 25-100 people were dropped from the estimate. If included, residential revenues per connection connection are $423.

Table 57
Residential Revenue per Connection
Private Systems, by Type
(Dollars)

Ownership Type	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	Small Systems
Private Systems				
Mean Residential Revenues per Connection	382	319	383	356
Confidence interval	+|- *124*	+|- *70*	+|- *128*	+|- *64*
Median Residential Revenues per Connection	277	291	336	291
Observations	67	47	23	137
Ancillary Systems				
Mean Residential Revenues per Connection	20	12	0	17
Confidence interval	+|- *33*	+|- *17*	+|- *0*	+|- *21*
Median Residential Revenues per Connection	0	0	0	0
Observations	46	25	1	72
All Systems				
Mean Residential Revenues per Connection	230	218	358	239
Confidence interval	+|- *94*	+|- *71*	+|- *132*	+|- *56*
Median Residential Revenues per Connection	149	250	333	222
Observations	113	72	24	209

Data: Q.28

Notes: Two private systems serving 25-100 people were dropped from the estimate. If included, mean residential revenues per connection are $706 for this category.

Table 58
Residential Rate Structure and Billing Profile
By Ownership
(Percentage of Systems with Each Structure)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Metered Charges									
Uniform Rate	11.6	52.2	52.9	55.1	55.1	45.4	51.1	39.4	52.0
Declining Block Rate	0.0	14.1	29.0	31.4	32.1	21.7	21.0	18.4	25.2
Increasing Block Rate	2.6	10.2	14.3	12.4	16.7	29.3	24.1	34.1	13.4
Seasonal Rate	0.0	0.0	0.4	2.3	0.6	3.6	8.9	9.7	0.8
Unmetered Charges									
Separate Flat Fee for Water	41.0	21.9	6.3	21.7	23.8	24.5	25.7	11.3	15.8
Combined Flat Fee for Water and Other Services	31.5	0.0	0.1	3.3	3.7	7.9	2.3	0.0	2.0
Other billing methods	3.0	0.1	1.4	4.5	2.0	2.7	3.3	5.5	1.8
Observations	18	76	179	148	138	101	183	52	895
Private Systems									
Metered Charges									
Uniform Rate	25.3	28.2	47.8	39.2	44.8	70.4	48.6	80.5	29.4
Declining Block Rate	0.0	4.7	19.6	42.6	44.7	29.6	33.3	39.0	5.8
Increasing Block Rate	3.4	3.6	17.5	14.5	9.7	0.0	13.9	0.0	5.2
Seasonal Rate	0.0	0.1	0.0	0.0	2.9	0.0	0.0	19.5	0.1
Unmetered Charges									
Separate Flat Fee for Water	16.5	17.0	16.4	2.5	33.8	22.3	9.0	41.4	16.6
Combined Flat Fee for Water and Other Services	17.1	10.9	0.1	1.5	9.7	0.0	0.0	0.0	12.4
Other billing methods	1.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Observations	138	95	32	22	23	16	19	6	351

(Continued)

Table 58 (Cont.)
Residential Rate Structure and Billing Profile
By Ownership
(Percentage of Systems with Each Structure)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
All Systems									
Metered Charges									
Uniform Rate	24.5	36.6	52.0	52.7	53.7	48.4	50.9	42.9	40.5
Declining Block Rate	0.0	8.0	27.3	33.0	33.8	22.6	22.1	20.2	15.3
Increasing Block Rate	3.4	5.9	14.9	12.7	15.7	25.8	23.2	31.2	9.2
Seasonal Rate	0.0	0.0	0.3	1.9	0.9	3.2	8.2	10.5	0.4
Unmetered Charges									
Separate Flat Fee for Water	17.9	18.7	8.1	18.9	25.2	24.3	24.2	13.9	16.2
Combined Flat Fee for Water and Other Services	17.9	7.1	0.1	3.0	4.5	7.0	2.1	0.0	7.3
Other billing methods	1.8	0.4	1.1	3.9	1.7	2.4	3.0	5.0	1.4
Observations	156	171	211	170	161	117	202	58	1,246

Data: Q.29

Notes: These rate structures only apply to residential customers.

Column totals may not sum to 100.

Table 59
Total Expenses
By Primary Source of Water
(Thousands of Dollars)

Primary Source of Water	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Mean	7	25	133	568	2,147	6,779	18,175	62,201	253
Confidence interval	*+|- 3*	*+|- 5*	*+|- 30*	*+|- 110*	*+|- 479*	*+|- 751*	*+|- 2,899*	*+|- 15,786*	*+|- 40*
Median	3	18	99	501	1,705	6,969	13,412	80,727	22
Observations	91	82	86	60	43	26	36	6	430
Primarily Surface Water Systems									
Mean	19	72	313	980	2,714	6,548	18,604	139,308	2,856
Confidence interval	*+|- 8*	*+|- 21*	*+|- 62*	*+|- 311*	*+|- 434*	*+|- 1,297*	*+|- 1,657*	*+|- 32,605*	*+|- 516*
Median	21	54	279	720	2,356	5,747	15,048	75,567	340
Observations	37	45	68	69	73	52	104	32	480
Primarily Purchased Water Systems									
Mean	7	28	208	816	3,704	10,535	18,932	137,757	1,258
Confidence interval	*+|- 7*	*+|- 10*	*+|- 49*	*+|- 300*	*+|- 1,260*	*+|- 2,769*	*+|- 2,233*	*+|- 39,154*	*+|- 407*
Median	2	18	170	603	2,426	8,721	17,992	87,158	148
Observations	6	20	47	22	24	25	43	12	199
All Systems									
Mean	7	28	169	699	2,673	7,617	18,561	129,320	684
Confidence interval	*+|- 3*	*+|- 5*	*+|- 25*	*+|- 115*	*+|- 385*	*+|- 1,020*	*+|- 1,278*	*+|- 22,377*	*+|- 75*
Median	3	19	128	588	2,299	6,969	14,969	82,283	44
Observations	134	147	201	151	140	103	183	50	1,109

Data: Q.7, Q.31

Notes: One system ground water system serving 25-100 with expenses of $406,808 was dropped from the estimate. If included, the category is $8,900.

Table 60
Total Expenses
By Ownership
(Thousands of Dollars)

Ownership Type	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Public Systems									
Mean	15	36	167	704	2,675	7,630	18,408	131,490	1,212
Confidence interval	*+|- 10*	*+|- 9*	*+|- 29*	*+|- 126*	*+|- 406*	*+|- 1,101*	*+|- 1,309*	*+|- 23,714*	*+|- 186*
Median	13	30	110	603	2,299	6,469	14,031	80,727	135
Observations	13	69	173	133	125	94	170	47	824
Private Systems									
Mean	7	23	180	667	2,664	7,470	20,466	94,419	135
Confidence interval	*+|- 3*	*+|- 6*	*+|- 50*	*+|- 246*	*+|- 1,216*	*+|- 1,393*	*+|- 5,319*	*+|- 6,018*	*+|- 34*
Median	3	14	173	495	1,855	7,366	15,572	90,830	10
Observations	121	78	28	18	15	9	13	3	285
All Systems									
Mean	7	28	169	699	2,673	7,617	18,561	129,320	684
Confidence interval	*+|- 3*	*+|- 5*	*+|- 25*	*+|- 115*	*+|- 385*	*+|- 1,020*	*+|- 1,278*	*+|- 22,377*	*+|- 75*
Median	3	19	128	588	2,299	6,969	14,969	82,283	44
Observations	134	147	201	151	140	103	183	50	1,109

Data: Q.31

Notes: A public system serving 100 or less that has expenses of over $400,000 due to large commercial sales is excluded. If included, expenses for this category are $66,000.

Table 61
Total Expenses for Systems Reporting Positive Revenues and Expenses
By Ownership
(Thousands of Dollars)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Mean	15	36	168	706	2,695	7,685	18,497	131,490	1,241
Confidence interval	+|- *11*	+|- *10*	+|- *29*	+|- *127*	+|- *409*	+|- *1,121*	+|- *1,317*	+|- *23,716*	+|- *190*
Median	13	30	110	603	2,299	6,469	14,031	80,727	136
Observations	11	64	169	132	124	91	169	47	807
Private Systems									
Mean	10	32	180	736	3,034	7,470	20,466	94,419	221
Confidence interval	+|- *5*	+|- *8*	+|- *51*	+|- *273*	+|- *1,190*	+|- *1,394*	+|- *5,320*	+|- *6,019*	+|- *60*
Median	3	14	173	495	1,855	7,366	15,572	90,830	10
Observations	66	43	26	16	14	9	13	3	190
All Systems									
Mean	10	34	170	709	2,731	7,668	18,644	129,320	867
Confidence interval	+|- *5*	+|- *6*	+|- *26*	+|- *118*	+|- *388*	+|- *1,036*	+|- *1,285*	+|- *22,379*	+|- *102*
Median	3	19	128	588	2,299	6,969	14,969	82,283	44
Observations	77	107	195	148	138	100	182	50	997

Data: Q.31

Notes: Table reports systems who reported both positive revenues and positive expenses only.

A public system serving 100 or less that has expenses of over $400,000 due to large commercial sales is excluded. If included, expenses for this category are $76,000.

A private system serving 100 or less that has expenses of $400 has been dropped from the estimate. If included, expenses for this category are $9,000.

Table 62
Expense Breakdown By Major Categories
By Ownership
(As Percentage of Total Expenses)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Employee Expenses	34.2	31.6	32.4	33.0	30.1	27.7	34.1	27.9	32.1
Confidence interval	*+|- 13.2*	*+|- 7.7*	*+|- 4.8*	*+|- 2.8*	*+|- 3.2*	*+|- 2.3*	*+|- 10.9*	*+|- 2.0*	*+|- 2.9*
Routine Operating Expenses	44.9	52.5	52.2	46.4	44.0	45.8	38.5	40.4	50.1
Confidence interval	*+|- 15.7*	*+|- 7.6*	*+|- 4.4*	*+|- 4.6*	*+|- 5.0*	*+|- 3.8*	*+|- 5.8*	*+|- 3.1*	*+|- 3.0*
Debt Service Expenses:	16.2	10.7	12.2	15.8	20.5	20.7	16.8	21.7	13.5
Confidence interval	*+|- 17.6*	*+|- 3.4*	*+|- 3.1*	*+|- 4.4*	*+|- 5.2*	*+|- 3.4*	*+|- 3.9*	*+|- 1.9*	*+|- 1.9*
Other Expenses:	4.7	5.7	3.4	5.3	5.8	5.7	10.8	8.8	4.6
Confidence interval	*+|- 7.4*	*+|- 4.9*	*+|- 2.8*	*+|- 2.9*	*+|- 2.4*	*+|- 2.6*	*+|- 4.9*	*+|- 2.6*	*+|- 1.8*
Private Systems									
Employee Expenses	27.7	28.6	31.8	39.9	34.1	27.2	22.7	35.1	28.8
Confidence interval	*+|- 8.0*	*+|- 9.3*	*+|- 10.5*	*+|- 19.4*	*+|- 11.7*	*+|- 6.7*	*+|- 3.8*	*+|- 2.4*	*+|- 5.4*
Routine Operating Expenses	71.7	68.6	52.6	56.1	50.8	62.0	63.2	43.2	68.0
Confidence interval	*+|- 8.0*	*+|- 8.9*	*+|- 9.3*	*+|- 18.8*	*+|- 12.6*	*+|- 12.5*	*+|- 10.6*	*+|- 10.5*	*+|- 5.4*
Debt Service Expenses:	1.5	2.6	9.9	3.8	8.8	8.2	8.4	21.7	2.8
Confidence interval	*+|- 2.0*	*+|- 1.7*	*+|- 6.4*	*+|- 3.4*	*+|- 5.3*	*+|- 6.3*	*+|- 3.0*	*+|- 8.1*	*+|- 1.4*
Other Expenses:	1.1	0.9	6.0	3.0	7.8	4.1	6.5	0.0	1.6
Confidence interval	*+|- 1.4*	*+|- 1.6*	*+|- 9.6*	*+|- 4.1*	*+|- 9.6*	*+|- 6.6*	*+|- 5.6*	*+|- 0.0*	*+|- 1.3*
All Systems									
Employee Expenses	28.0	29.8	32.3	33.8	30.6	27.6	33.5	28.2	30.5
Confidence interval	*+|- 7.7*	*+|- 6.6*	*+|- 4.1*	*+|- 3.4*	*+|- 3.2*	*+|- 2.2*	*+|- 10.4*	*+|- 2.0*	*+|- 3.0*
Routine Operating Expenses	70.5	62.1	52.3	47.6	44.8	47.1	39.8	40.5	58.7
Confidence interval	*+|- 8.0*	*+|- 6.8*	*+|- 4.2*	*+|- 4.5*	*+|- 4.7*	*+|- 3.7*	*+|- 5.8*	*+|- 3.0*	*+|- 3.3*
Debt Service Expenses:	2.1	5.8	11.8	14.3	19.2	19.8	16.3	21.7	8.4
Confidence interval	*+|- 2.2*	*+|- 2.0*	*+|- 2.8*	*+|- 4.0*	*+|- 4.8*	*+|- 3.3*	*+|- 3.6*	*+|- 1.9*	*+|- 1.3*
Other Expenses:	1.3	2.8	3.7	5.0	6.1	5.6	10.6	8.5	3.2
Confidence interval	*+|- 1.4*	*+|- 2.4*	*+|- 2.7*	*+|- 2.6*	*+|- 2.4*	*+|- 2.4*	*+|- 4.7*	*+|- 2.5*	*+|- 1.2*

Data: Q.31

Notes: Column totals may not sum to 100 due to rounding.

Employee expenses includes contract employees.

Table 63
Total Expenses
By Primary Source of Water
(Dollars per Thousand Gallons Produced)

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Ground Water Systems									
Mean	4.16	2.53	2.97	1.95	2.01	1.70	2.02	1.36	3.01
Confidence interval	*+|- 1.93*	*+|- 0.50*	*+|- 0.59*	*+|- 0.42*	*+|- 0.30*	*+|- 0.23*	*+|- 0.30*	*+|- 0.26*	*+|- 0.56*
Median	2.24	1.91	2.41	1.59	1.90	1.67	1.95	1.49	2.00
Observations	72	79	86	60	43	26	36	6	408
Primarily Surface Water Systems									
Mean	2.72	3.84	4.19	3.22	2.01	1.67	1.55	1.61	3.17
Confidence interval	*+|- 1.06*	*+|- 1.14*	*+|- 1.32*	*+|- 0.88*	*+|- 0.25*	*+|- 0.23*	*+|- 0.10*	*+|- 0.14*	*+|- 0.47*
Median	8.15	3.72	2.95	2.34	1.90	1.54	1.41	1.59	2.42
Observations	30	44	66	69	72	51	103	32	467
Primarily Purchased Water Systems									
Mean	2.49	4.48	5.05	2.52	3.90	2.63	2.02	2.05	4.41
Confidence interval	*+|- 0.13*	*+|- 1.17*	*+|- 1.15*	*+|- 0.35*	*+|- 1.42*	*+|- 0.51*	*+|- 0.23*	*+|- 0.18*	*+|- 0.68*
Median	2.47	3.37	4.24	2.38	3.24	2.52	2.08	2.06	3.48
Observations	6	20	47	22	24	24	43	12	198
All Systems									
Mean	4.08	2.90	3.63	2.32	2.43	1.91	1.82	1.70	3.26
Confidence interval	*+|- 1.84*	*+|- 0.46*	*+|- 0.54*	*+|- 0.34*	*+|- 0.46*	*+|- 0.20*	*+|- 0.16*	*+|- 0.11*	*+|- 0.44*
Median	2.25	2.25	2.90	2.00	2.11	1.67	1.93	1.71	2.41
Observations	108	143	199	151	139	101	182	50	1,073

Data: Q.31

Notes: Two surface water systems serving 25-100 people with expenses greater than $20 per thousand gallons produced were dropped from the estimate. If included, the mean expenses are $12.59.

Table 64
Total Expenses
By Ownership
(Dollars per Thousand Gallons Produced)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Mean	3.83	3.53	3.35	2.22	2.44	1.88	1.80	1.69	3.08
Confidence interval	*+|- 1.86*	*+|- 0.86*	*+|- 0.61*	*+|- 0.37*	*+|- 0.51*	*+|- 0.21*	*+|- 0.17*	*+|- 0.12*	*+|- 0.35*
Median	2.86	3.19	2.76	1.97	2.05	1.67	1.93	1.70	2.41
Observations	13	66	171	133	124	93	169	47	816
Private Systems									
Mean	4.10	2.50	4.98	2.92	2.31	2.27	2.08	1.89	3.46
Confidence interval	*+|- 1.94*	*+|- 0.51*	*+|- 1.23*	*+|- 0.69*	*+|- 0.67*	*+|- 0.54*	*+|- 0.35*	*+|- 0.21*	*+|- 0.87*
Median	2.24	2.00	3.25	2.72	2.30	2.11	2.09	2.05	2.35
Observations	95	77	28	18	15	8	13	3	257
All Systems									
Mean	4.08	2.90	3.63	2.32	2.43	1.91	1.82	1.70	3.26
Confidence interval	*+|- 1.84*	*+|- 0.46*	*+|- 0.54*	*+|- 0.34*	*+|- 0.46*	*+|- 0.20*	*+|- 0.16*	*+|- 0.11*	*+|- 0.44*
Median	2.24	2.25	2.90	2.00	2.11	1.67	1.93	1.71	2.39
Observations	108	143	199	151	139	101	182	50	1,073

Data: Q.7, Q.31

Notes: Two private systems serving 25-100 people with expenses greater than $20 per thousand gallons produced were dropped from the estimate. If included, the mean expenses are $4.84 per thousand gallons.

Table 65
Ratio of Total Revenue to Total Expenses
By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Average Ratio	2.1	1.1	1.3	1.2	1.1	1.3	1.2	1.2	1.2
Confidence interval	+|- *1.0*	+|- *0.2*	+|- *0.2*	+|- *0.1*	+|- *0.0*	+|- *0.2*	+|- *0.0*	+|- *0.0*	+|- *0.1*
10th Percentile	0.8	0.6	0.8	0.9	0.8	0.9	0.9	0.9	0.8
25th Percentile	1.2	0.9	0.9	1.0	1.0	1.0	1.0	1.0	0.9
50th Percentile	1.7	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
75th Percentile	3.4	1.4	1.4	1.3	1.2	1.2	1.3	1.2	1.4
90th Percentile	3.4	1.6	2.3	1.7	1.4	1.6	1.5	1.6	1.9
Observations	11	64	169	132	124	91	169	47	807
Private Systems									
Average Ratio	1.5	1.5	1.1	1.3	1.2	1.3	1.2	1.2	1.4
Confidence interval	+|- *0.3*	+|- *0.3*	+|- *0.1*	+|- *0.3*	+|- *0.2*	+|- *0.2*	+|- *0.2*	+|- *0.1*	+|- *0.2*
10th Percentile	0.5	0.8	0.9	0.8	1.0	1.0	1.0	1.1	0.7
25th Percentile	1.0	0.8	1.0	1.1	1.0	1.1	1.0	1.1	0.9
50th Percentile	1.2	1.1	1.1	1.2	1.2	1.2	1.1	1.2	1.1
75th Percentile	1.8	1.8	1.2	1.3	1.3	1.4	1.2	1.4	1.6
90th Percentile	2.8	2.5	1.3	2.2	1.6	2.1	1.8	1.4	2.5
Observations	66	43	26	16	14	9	13	3	190
All Systems									
Average Ratio	1.5	1.3	1.3	1.2	1.1	1.3	1.2	1.2	1.3
Confidence interval	+|- *0.3*	+|- *0.1*	+|- *0.1*	+|- *0.1*	+|- *0.0*	+|- *0.1*	+|- *0.0*	+|- *0.0*	+|- *0.1*
10th Percentile	0.5	0.7	0.8	0.9	0.8	0.9	0.9	0.9	0.8
25th Percentile	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9
50th Percentile	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
75th Percentile	1.8	1.5	1.3	1.3	1.2	1.2	1.3	1.2	1.4
90th Percentile	3.0	2.0	2.0	1.8	1.4	1.6	1.6	1.6	2.2
Observations	77	107	195	148	138	100	182	50	997

Data: Q.26C, Q.31E

Notes: Refer to next table for additional detail on private systems.

One public system in Colorado serving less than 100 people with a large ratio of revenue to expenses of 4.54 was dropped. If included the ratio for public systems serving less than 100 people is 2.5.

One private system serving 25-100 with a revenue to expense ratio of 15 was dropped. If included, the average ratio is 1.8.

Table 66
Ratio of Total Revenue to Total Expenses
By Type

Ownership Type	System Service Population Category: 100 or Less	101 - 500	501 - 3,300	All Sizes
Private Systems				
Average Ratio	1.5	1.5	1.1	1.4
Confidence interval	+|- *0.4*	+|- *0.3*	+|- *0.1*	+|- *0.2*
10th Percentile	0.5	0.8	0.9	0.6
25th Percentile	0.9	0.8	1.0	0.9
50th Percentile	1.2	1.1	1.1	1.1
75th Percentile	2.0	1.8	1.2	1.6
90th Percentile	3.0	2.5	1.3	2.5
Observations	62	41	25	128
Ancillary Systems				
Average Ratio	1.3	0.6	0.6	1.2
Confidence interval	+|- *0.4*	+|- *0.1*	+|- *0.0*	+|- *0.3*
10th Percentile	1.0	0.6	0.6	0.7
25th Percentile	1.0	0.6	0.6	1.0
50th Percentile	1.4	0.6	0.6	1.0
75th Percentile	1.8	0.7	0.6	1.8
90th Percentile	15.0	0.7	0.6	15.0
Observations	4	2	1	7
All Private Systems				
Average Ratio	1.5	1.5	1.1	1.4
Confidence interval	+|- *0.3*	+|- *0.3*	+|- *0.1*	+|- *0.2*
10th Percentile	0.5	0.8	0.9	0.6
25th Percentile	1.0	0.8	1.0	0.9
50th Percentile	1.2	1.1	1.1	1.1
75th Percentile	1.8	1.8	1.2	1.7
90th Percentile	3.0	2.5	1.3	2.5
Observations	66	43	26	135

Data: Q.7, Q.26, Q.31

Notes: One ancillary system serving 25-100 with a revenue to expense ratio of 15 has been dropped from the mean estimate but included in the median. If included in the mean, the mean ratio is 3.7.

Table 67
Number of Employees and Annual Labor Costs
By Primary Source of Water
(Labor Costs in Thousands of Dollars)

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Ground Water Systems									
Mean Number of Employees	1.3	1.6	2.8	5.7	15.2	42.1	64.6	374.7	4.6
Confidence interval	*+|- 0.3*	*+|- 0.4*	*+|- 0.6*	*+|- 1.1*	*+|- 2.6*	*+|- 13.7*	*+|- 34.7*	*+|- 115.5*	*+|- 0.6*
Mean Annual Labor Costs	5	12	38	190	636	1,755	2,616	17,669	115
Confidence interval	*+|- 3*	*+|- 4*	*+|- 9*	*+|- 40*	*+|- 137*	*+|- 231*	*+|- 1,495*	*+|- 5,151*	*+|- 19*
Primarily Surface Water Systems									
Mean Number of Employees	1.2	8.3	3.6	8.2	23.8	45.6	117.6	680.8	23.5
Confidence interval	*+|- 0.3*	*+|- 9.0*	*+|- 0.8*	*+|- 1.5*	*+|- 8.3*	*+|- 8.4*	*+|- 11.2*	*+|- 104.2*	*+|- 3.0*
Mean Annual Labor Costs	6	25	117	270	798	1,865	5,312	37,356	874
Confidence interval	*+|- 6*	*+|- 9*	*+|- 28*	*+|- 39*	*+|- 114*	*+|- 415*	*+|- 507*	*+|- 6,236*	*+|- 147*
Primarily Purchased Water Systems									
Mean Number of Employees	*	1.4	2.7	6.7	25.4	35.3	75.0	394.6	8.2
Confidence interval	*	*+|- 0.4*	*+|- 0.5*	*+|- 1.4*	*+|- 19.4*	*+|- 8.6*	*+|- 11.2*	*+|- 146.3*	*+|- 2.9*
Mean Annual Labor Costs	*	4	39	188	618	1,853	3,714	21,438	267
Confidence interval	*	*+|- 3*	*+|- 10*	*+|- 50*	*+|- 265*	*+|- 436*	*+|- 576*	*+|- 7,234*	*+|- 88*
All Systems									
Mean Number of Employees	1.3	2.5	2.9	6.4	20.4	42.0	88.3	586.9	8.3
Confidence interval	*+|- 0.3*	*+|- 1.5*	*+|- 0.4*	*+|- 0.8*	*+|- 5.3*	*+|- 5.9*	*+|- 18.4*	*+|- 78.1*	*+|- 0.9*
Mean Annual Labor Costs	5	12	46	206	686	1,829	3,983	30,731	256
Confidence interval	*+|- 2*	*+|- 3*	*+|- 8*	*+|- 28*	*+|- 95*	*+|- 223*	*+|- 854*	*+|- 4,406*	*+|- 30*

Data: Q.31A

Notes: *No data collected for purchased water systems with a population of less than 100 people.

Labor costs includes wages, salaries, fringe benefits, and contractors.

Two ground water sytems serving 25-100 people were dropped from the calculations because they are outliers. This had little effect on the calculations.

Table 68
Number of Employees and Annual Labor Costs
By Ownership
(Labor Costs in Thousands of Dollars)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Mean Number of Employees	1.6	1.6	2.8	6.4	21.7	43.1	89.5	608.8	10.1
Confidence interval	*+|- 0.7*	*+|- 0.3*	*+|- 0.4*	*+|- 0.9*	*+|- 6.2*	*+|- 6.5*	*+|- 19.8*	*+|- 83.9*	*+|- 1.4*
Annual Labor Costs	13	12	46	201	703	1,843	3,922	30,066	326
Confidence interval	*+|- 5*	*+|- 5*	*+|- 8*	*+|- 27*	*+|- 104*	*+|- 242*	*+|- 896*	*+|- 4,509*	*+|- 48*
Private Systems									
Mean Number of Employees	1.3	3.5	3.3	6.7	12.6	31.8	72.4	358.4	4.1
Confidence interval	*+|- 0.3*	*+|- 3.2*	*+|- 1.4*	*+|- 1.7*	*+|- 3.5*	*+|- 6.7*	*+|- 25.3*	*+|- 94.6*	*+|- 1.2*
Annual Labor Costs	5	12	44	244	568	1,677	4,864	41,208	89
Confidence interval	*+|- 2*	*+|- 5*	*+|- 17*	*+|- 112*	*+|- 228*	*+|- 369*	*+|- 1,743*	*+|- 10,486*	*+|- 26*
All Systems									
Mean Number of Employees	1.3	2.5	2.9	6.4	20.4	42.0	88.3	586.9	8.3
Confidence interval	*+|- 0.3*	*+|- 1.5*	*+|- 0.4*	*+|- 0.8*	*+|- 5.3*	*+|- 5.9*	*+|- 18.4*	*+|- 78.1*	*+|- 0.9*
Annual Labor Costs	5	12	46	206	686	1,829	3,983	30,731	256
Confidence interval	*+|- 2*	*+|- 3*	*+|- 8*	*+|- 28*	*+|- 95*	*+|- 223*	*+|- 854*	*+|- 4,406*	*+|- 30*

Data: Q.31

Notes: Labor costs includes wages, salaries, fringe benefits, and contractors.

Two public systems serving 25-100 people were dropped from the calculations do to high labor costs. If included, the mean number of employees are 2.0 and annual labor costs are $37,000 for this category.

Table 69
Percentage of Systems Making Major Capital Improvements in the Past 5 Years
By Primary Source of Water

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Ground Water Systems									
Percentage of Systems	43.2	49.9	51.4	69.6	80.3	89.6	73.6	86.9	51.1
Confidence interval	*+|- 12.0*	*+|- 12.4*	*+|- 11.7*	*+|- 11.8*	*+|- 10.8*	*+|- 9.4*	*+|- 24.2*	*+|- 15.7*	*+|- 6.4*
Observations	104	93	92	67	50	29	44	7	486
Primarily Surface Water Systems									
Percentage of Systems	21.0	74.5	77.9	76.4	87.0	79.7	91.3	86.9	70.7
Confidence interval	*+|- 16.6*	*+|- 20.6*	*+|- 12.2*	*+|- 9.4*	*+|- 7.0*	*+|- 13.8*	*+|- 3.2*	*+|- 5.7*	*+|- 8.7*
Observations	46	55	69	76	83	58	110	38	535
Primarily Purchased Water Systems									
Percentage of Systems	15.8	57.8	47.9	57.3	86.4	86.8	83.2	93.6	55.9
Confidence interval	*+|- 27.1*	*+|- 26.2*	*+|- 18.4*	*+|- 18.4*	*+|- 13.2*	*+|- 10.7*	*+|- 8.8*	*+|- 8.0*	*+|- 11.7*
Observations	6	23	50	27	28	30	48	13	225
All Systems									
Percentage of Systems	41.6	52.7	52.8	68.6	83.9	84.4	82.9	88.6	53.9
Confidence interval	*+|- 11.2*	*+|- 10.5*	*+|- 8.6*	*+|- 8.3*	*+|- 6.1*	*+|- 7.6*	*+|- 9.4*	*+|- 4.6*	*+|- 5.0*
Observations	156	171	211	170	161	117	202	58	1,246

Data: Q.32A7

Table 70
Percentage of Systems Making Major Capital Improvements in the Past 5 Years
By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Mean	65.1	58.7	52.0	69.1	84.3	84.8	83.7	92.8	40.2
Confidence interval	+|- *35.4*	+|- *15.0*	+|- *9.0*	+|- *9.2*	+|- *6.7*	+|- *8.3*	+|- *10.2*	+|- *3.9*	+|- *11.0*
Observations	18	76	179	148	138	101	183	52	138
Private Systems									
Mean	49.4	55.9	65.4	81.7	81.5	74.3	51.0	41.6	52.7
Confidence interval	+|- *13.7*	+|- *21.0*	+|- *22.1*	+|- *14.6*	+|- *16.8*	+|- *15.6*	+|- *23.2*	+|- *11.2*	+|- *10.5*
Observations	95	32	22	23	16	19	6	156	171
All Systems									
Mean	52.8	68.6	83.9	84.4	82.9	88.6	61.2	47.1	53.9
Confidence interval	+|- *8.6*	+|- *8.3*	+|- *6.1*	+|- *7.6*	+|- *9.4*	+|- *4.6*	+|- *5.7*	+|- *7.9*	+|- *5.0*
Observations	211	170	161	117	202	58	895	351	1,246

Data: Q.32A

Table 71
Total Capital Investment in the Past 5 Years
By Primary Source of Water
(Thousands of Dollars)

Primary Source of Water	System Service Population Category								
	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Mean	35	97	309	923	3,392	7,001	17,656	160,507	624
Confidence interval	*+|- 17*	*+|- 59*	*+|- 93*	*+|- 287*	*+|- 1,056*	*+|- 1,393*	*+|- 12,506*	*+|- 40,079*	*+|- 124*
Median	9	21	156	550	2,700	6,782	4,896	182,990	55
Observations	49	51	49	46	38	23	35	6	297
Primarily Surface Water Systems									
Mean	111	387	892	1,763	3,514	14,277	33,868	304,107	6,942
Confidence interval	*+|- 91*	*+|- 280*	*+|- 393*	*+|- 774*	*+|- 878*	*+|- 3,844*	*+|- 3,824*	*+|- 69,944*	*+|- 1,356*
Median	17	140	370	919	2,194	8,675	24,986	165,500	609
Observations	23	38	50	55	71	49	99	33	418
Primarily Purchased Water Systems									
Mean	16	229	346	962	8,743	13,410	20,656	202,524	3,063
Confidence interval	*+|- 12*	*+|- 290*	*+|- 184*	*+|- 677*	*+|- 6,855*	*+|- 5,771*	*+|- 4,696*	*+|- 82,573*	*+|- 1,588*
Median	23	12	100	325	2,127	6,466	15,077	86,936	250
Observations	2	12	27	16	23	25	39	12	156
All Systems									
Mean	38	144	392	1,119	4,648	11,895	25,649	259,328	1,903
Confidence interval	*+|- 17*	*+|- 68*	*+|- 91*	*+|- 275*	*+|- 1,861*	*+|- 2,398*	*+|- 6,062*	*+|- 48,594*	*+|- 312*
Median	9	23	189	512	2,232	7,468	17,069	157,151	96
Observations	74	101	126	117	132	97	173	51	871

Data: Q.32A

Table 72
Total Capital Investment in the Past 5 Years
By Ownership
(Thousands of Dollars)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Mean	204	291	385	1,128	4,940	11,591	24,732	266,778	3,124
Confidence interval	*+|- 128*	*+|- 164*	*+|- 94*	*+|- 302*	*+|- 2,165*	*+|- 2,581*	*+|- 6,360*	*+|- 51,256*	*+|- 614*
Median	110	105	189	512	2,232	6,778	15,954	157,151	350
Observations	11	44	109	102	115	85	159	48	673
Private Systems									
Mean	21	49	418	1,056	3,053	14,446	36,474	137,160	390
Confidence interval	*+|- 11*	*+|- 26*	*+|- 239*	*+|- 639*	*+|- 1,388*	*+|- 6,360*	*+|- 10,478*	*+|- 53,571*	*+|- 112*
Median	8	14	373	500	2,700	9,620	27,422	100,963	18
Observations	63	57	17	15	17	12	14	3	198
All Systems									
Mean	38	144	392	1,119	4,648	11,895	25,649	259,328	1,903
Confidence interval	*+|- 17*	*+|- 68*	*+|- 91*	*+|- 275*	*+|- 1,861*	*+|- 2,398*	*+|- 6,062*	*+|- 48,594*	*+|- 312*
Median	9	23	189	512	2,232	7,468	17,069	157,151	96
Observations	74	101	126	117	132	97	173	51	871

Data: Q.32A

Table 73
Type of Capital Expenses in the Past 5 Years
By Primary Source of Water
(Percentage of Systems Reporting Each Type of Expense)

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Ground Water Systems									
Land	1.1	2.5	5.0	26.5	27.7	13.6	28.9	34.0	7.0
Water Source	30.6	48.7	31.0	49.6	47.8	64.6	47.6	83.0	40.0
Distribution and Transmission System	40.7	61.7	73.2	70.6	84.9	96.4	100.0	100.0	61.5
Treatment	27.6	32.3	34.0	39.5	59.7	61.9	42.0	66.0	34.0
Storage	30.4	35.1	40.0	43.1	47.9	60.1	80.2	49.1	37.0
Other	11.9	19.8	17.5	28.7	41.7	65.6	45.9	83.0	19.8
Observations	49	51	49	46	38	23	35	6	297
Primarily Surface Water Systems									
Land	0.0	3.6	3.8	21.4	18.8	24.0	38.7	61.7	13.0
Water Source	25.2	12.3	22.7	30.2	21.8	42.5	52.8	76.6	24.3
Distribution and Transmission System	39.7	53.2	62.2	82.3	82.7	98.1	89.0	100.0	70.5
Treatment	55.0	71.5	38.5	63.7	65.4	90.3	89.1	100.0	61.8
Storage	25.1	38.7	28.5	33.3	48.6	52.9	64.8	76.0	38.6
Other	23.7	13.2	9.8	27.3	40.6	49.0	63.8	96.2	25.8
Observations	23	38	50	55	71	49	99	33	418
Primarily Purchased Water Systems									
Land	0.0	0.0	0.0	27.4	36.3	26.7	33.3	78.6	9.9
Water Source	0.0	0.0	5.8	4.3	8.6	30.3	39.6	34.2	5.8
Distribution and Transmission System	0.0	71.2	84.3	68.8	100.0	85.1	97.8	100.0	81.2
Treatment	0.0	0.8	1.2	4.3	22.2	17.2	41.5	69.2	5.6
Storage	100.0	39.9	20.9	54.9	42.4	27.5	65.6	77.8	34.3
Other	0.0	1.1	2.9	27.4	12.2	43.4	57.0	70.1	9.0
Observations	2	12	27	16	23	25	39	12	156
All Systems									
Land	1.1	2.3	3.6	25.5	26.6	21.6	34.1	63.0	8.3
Water Source	30.4	38.7	23.5	37.9	30.4	46.0	48.1	64.4	32.6
Distribution and Transmission System	40.5	62.1	74.6	73.0	87.6	94.1	94.7	100.0	65.8
Treatment	28.4	32.2	26.2	39.4	53.4	61.9	62.5	85.8	33.6
Storage	30.3	36.1	33.7	42.8	46.9	48.3	70.2	72.7	36.8
Other	12.3	16.7	12.8	28.2	34.8	52.6	56.2	86.3	19.0
Observations	74	101	126	117	132	97	173	51	871

Data: Q.32A

Table 74
Type of Capital Expenses in the Past 5 Years
By Primary Source of Water
(Thousands of Dollars)

	System Service Population Category								
Primary Source of Water	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Primarily Ground Water Systems									
Land	1	277	350	102	147	282	841	3,231	197
Water Source	8	11	71	307	823	2,475	4,337	31,796	201
Distribution and Transmission System	41	97	176	490	1,772	3,285	6,488	58,732	424
Treatment	29	57	191	401	1,261	1,301	12,276	40,408	383
Storage	26	17	162	431	979	795	1,897	11,326	216
Other	3	7	54	278	560	1,392	4,360	50,630	313
Observations	49	51	49	46	38	23	35	6	297
Primarily Surface Water Systems									
Land	0	35	39	164	117	139	1,185	17,897	1,041
Water Source	2	17	285	442	1,194	1,254	9,778	26,170	2,067
Distribution and Transmission System	174	155	610	842	2,057	5,347	14,339	158,182	3,891
Treatment	63	327	943	1,169	1,189	7,604	12,595	74,103	3,004
Storage	12	111	253	411	773	1,677	2,998	79,483	2,054
Other	11	34	282	153	515	1,847	5,086	27,833	1,835
Observations	23	38	50	55	71	49	99	33	418
Primarily Purchased Water Systems									
Land	0	0	0	65	452	4,871	1,399	4,542	818
Water Source	0	0	49	3,863	343	10,699	6,389	21,423	3,190
Distribution and Transmission System	0	107	303	605	7,681	5,938	10,247	90,905	2,413
Treatment	0	18	30	3,367	619	7,264	9,612	68,509	6,527
Storage	16	78	420	376	1,713	2,599	3,905	35,230	1,054
Other	0	6	82	128	482	4,993	2,671	36,940	2,413
Observations	2	12	27	16	23	25	39	12	156
All Systems									
Land	1	239	309	108	232	1,746	1,130	11,658	498
Water Source	8	11	96	396	883	3,456	7,320	26,405	479
Distribution and Transmission System	45	104	258	599	3,407	4,846	10,566	122,691	1,328
Treatment	31	117	329	739	1,172	5,652	12,092	69,084	1,223
Storage	26	36	213	416	1,055	1,483	2,747	57,944	607
Other	4	9	78	227	536	2,374	4,350	33,180	758
Observations	74	101	126	117	132	97	173	51	871

Data: Q.32A

Table 75
Type of Capital Expenses in the Past 5 Years
By Primary Source of Water
(Percentage of Funds Allocated for Each Type of Expense)

	System Service Population Category								
Primary Source of Water	100 or Less	101 - 500	501 - 3,300	3,301 - 10,000	10,001 - 50,000	50,001 - 100,000	100,001- 500,000	Over 500,000	All Sizes
Primarily Ground Water Systems									
Land	0.0	7.1	5.7	2.9	1.2	0.5	1.4	0.7	2.2
Water Source	7.3	5.5	7.2	16.0	11.6	22.8	11.8	16.4	12.8
Distribution and Transmission System	46.9	61.2	41.8	36.3	44.3	45.2	37.1	36.6	41.6
Treatment	22.4	18.7	21.1	16.6	22.2	11.5	29.5	16.6	20.8
Storage	22.2	6.1	21.1	19.9	13.8	6.8	8.7	3.5	12.8
Other	1.2	1.4	3.1	8.4	6.9	13.0	11.5	26.2	9.9
Observations	49	51	49	46	38	23	35	6	297
Primarily Surface Water Systems									
Land	0.0	0.3	0.2	2.0	0.7	0.2	1.3	3.2	2.1
Water Source	0.4	0.6	7.1	7.5	7.8	3.7	14.8	5.9	7.7
Distribution and Transmission System	62.9	22.5	41.8	38.8	50.9	36.2	36.7	44.4	42.2
Treatment	31.6	63.7	40.0	41.7	23.3	47.4	32.3	21.7	28.6
Storage	2.7	11.7	7.9	7.7	11.1	6.1	5.5	16.9	12.1
Other	2.4	1.2	3.1	2.3	6.3	6.3	9.3	7.8	7.3
Observations	23	38	50	55	71	49	99	33	418
Primarily Purchased Water Systems									
Land	0.0	0.0	0.0	1.8	1.8	9.5	2.2	1.8	2.5
Water Source	0.0	0.0	0.8	16.8	0.3	23.6	12.0	3.6	5.8
Distribution and Transmission System	0.0	70.9	73.2	42.3	87.8	36.8	47.5	44.9	62.0
Treatment	0.0	0.1	0.1	14.6	1.5	9.1	18.9	23.4	11.5
Storage	100.0	28.9	25.2	20.9	7.9	5.2	12.1	13.5	11.4
Other	0.0	0.1	0.7	3.6	0.6	15.8	7.2	12.8	6.9
Observations	2	12	27	16	23	25	39	12	156
All Systems									
Land	0.0	4.4	2.8	2.4	1.3	3.1	1.5	2.7	2.2
Water Source	6.6	3.4	5.7	13.1	5.8	13.3	13.6	6.2	8.4
Distribution and Transmission System	48.4	50.9	48.9	38.0	64.9	38.0	38.7	43.9	47.3
Treatment	23.2	29.9	21.9	25.3	13.4	29.2	29.3	21.7	22.2
Storage	20.5	10.3	18.2	15.7	10.6	6.0	7.4	15.1	12.1
Other	1.3	1.2	2.5	5.5	4.0	10.4	9.5	10.5	7.8
Observations	74	101	126	117	132	97	173	51	871

Data: Q.32A

Notes: Column totals may not sum to 100 due to rounding.

Table 76
Major Capital Expense Categories in the Past 5 Years
By Ownership
(Percentage of Systems Investing Capital Funds in Each Category)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Water Quality Improvements	91.9	26.9	18.1	38.5	58.3	54.7	79.1	78.0	33.9
Replacement or Major Repair	33.4	74.9	65.6	87.5	77.9	87.9	78.3	92.7	73.3
System Expansion	1.8	23.6	49.0	65.4	64.4	74.7	83.9	79.1	48.2
Observations	11	42	106	90	109	82	139	41	620
Private Systems									
Water Quality Improvements	29.7	50.1	63.2	77.6	54.6	81.1	87.1	100.0	45.1
Replacement or Major Repair	74.5	75.7	53.9	65.4	71.8	100.0	94.1	100.0	72.1
System Expansion	17.6	22.2	76.9	89.9	86.8	81.1	87.1	100.0	32.2
Observations	61	53	17	13	17	11	13	3	188
All Systems									
Water Quality Improvements	35.6	40.6	27.9	43.3	57.7	57.4	79.8	79.4	38.9
Replacement or Major Repair	70.7	75.4	63.1	84.7	76.9	89.2	79.6	93.1	72.7
System Expansion	16.1	22.8	55.1	68.4	68.1	75.4	84.2	80.5	41.1
Observations	72	95	123	103	126	93	152	44	808

Data: Q.32A, Q.32B

Notes: Includes systems with positive capital expenses only.

Table 77
Major Capital Expense Categories in the Past 5 Years
By Ownership
(Capital Funds Invested Per System in Each Category, in Thousands of Dollars)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Water Quality Improvements	90	84	72	340	774	1,768	3,816	43,573	511
Replacement or Major Repair	87	124	178	506	1,231	4,753	8,759	92,941	1,021
System Expansion	27	81	141	293	3,041	5,364	11,851	128,082	1,419
Observations	11	42	106	90	109	82	139	41	620
Private Systems									
Water Quality Improvements	2	8	44	345	600	5,088	8,837	15,659	83
Replacement or Major Repair	7	20	86	340	985	6,852	17,517	40,396	141
System Expansion	12	22	287	477	1,469	2,897	10,630	81,105	177
Observations	61	53	17	13	17	11	13	3	188
All Systems									
Water Quality Improvements	10	39	66	340	746	2,109	4,226	41,732	322
Replacement or Major Repair	15	62	158	486	1,191	4,969	9,473	89,475	630
System Expansion	13	46	172	315	2,786	5,111	11,751	124,983	867
Observations	72	95	123	103	126	93	152	44	808

Data: Q.32A, Q.32B

Notes: Includes systems with positive capital expenses only.

Table 78
Major Capital Expense Categories in the Past 5 Years
By Ownership
(Percentage of Capital Funds Invested in Each Category)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Water Quality Improvements	44.0	29.2	18.4	29.8	15.3	14.9	15.6	16.5	17.3
Replacement or Major Repair	42.8	42.9	45.6	44.5	24.4	40.0	35.9	35.1	34.6
System Expansion	13.2	28.0	36.0	25.7	60.3	45.1	48.5	48.4	48.1
Observations	11	42	106	90	109	82	139	41	620
Private Systems									
Water Quality Improvements	7.8	16.2	10.5	29.7	19.7	34.3	23.9	11.4	20.5
Replacement or Major Repair	35.4	39.8	20.6	29.3	32.3	46.2	47.4	29.5	35.2
System Expansion	56.8	44.0	68.9	41.0	48.1	19.5	28.7	59.1	44.2
Observations	61	53	17	13	17	11	13	3	188
All Systems									
Water Quality Improvements	26.0	26.6	16.6	29.7	15.8	17.3	16.6	16.3	17.6
Replacement or Major Repair	39.1	42.3	39.9	42.6	25.2	40.8	37.2	34.9	34.7
System Expansion	34.8	31.1	43.5	27.7	59.0	41.9	46.2	48.8	47.7
Observations	72	95	123	103	126	93	152	44	808

Data: Q.32A, Q.32B

Notes: Column totals may not sum to 100 due to rounding.

Table reports the percentage of funds invested in each category in the nation and the aggregate. It is *not* the percentage of funds invested on average by each system.

Table 79
Source of Capital Funds in the Past 5 Years
By Ownership
(Percentage of Systems Making Capital Expenditures)

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Current Revenues	6.3	63.8	70.1	73.9	79.9	81.7	90.4	95.9	69.5
DWSRF Loans	24.4	9.4	12.6	3.4	7.7	8.8	9.3	25.7	9.8
DWSRF Principal Repayment Forgiveness	16.3	14.0	6.9	1.5	4.3	3.5	2.9	2.1	7.1
Other Government Loans	0.0	13.1	12.6	14.2	16.4	8.3	7.4	2.1	12.9
Other Government Grants	6.5	28.3	17.9	28.0	21.6	13.8	6.0	6.2	21.8
Borrowing from Private Sector	3.2	10.0	12.6	27.3	36.0	50.5	40.8	75.1	19.5
Other	46.9	0.0	3.0	3.5	1.1	2.7	3.6	2.0	3.6
Observations	11	43	111	94	113	85	157	45	659
Private Systems									
Current Revenues	79.2	86.5	71.6	67.5	85.9	73.6	92.9	64.0	81.2
DWSRF Loans	0.0	0.0	0.0	0.0	3.2	0.0	14.1	36.0	0.1
DWSRF Principal Repayment Forgiveness	0.1	0.0	0.0	11.6	0.0	0.0	0.0	0.0	0.5
Other Government Loans	3.3	0.3	8.6	2.4	22.6	17.6	15.3	0.0	3.3
Other Government Grants	0.0	4.9	14.8	11.6	18.3	8.8	0.0	0.0	4.8
Borrowing from Private Sector	12.4	6.1	24.1	51.1	36.6	55.8	70.6	68.0	13.4
Other	7.5	3.9	6.9	9.3	10.4	0.0	0.0	0.0	6.0
Observations	64	59	16	14	15	10	12	3	193
All Systems									
Current Revenues	72.6	77.6	70.4	73.0	80.8	81.0	90.5	93.9	74.8
DWSRF Loans	2.2	3.5	10.0	2.9	7.0	8.0	9.6	26.3	5.4
DWSRF Principal Repayment Forgiveness	1.6	5.3	5.5	2.9	3.6	3.2	2.7	1.9	4.1
Other Government Loans	3.0	5.2	11.8	12.6	17.3	9.1	7.9	1.9	8.5
Other Government Grants	0.6	14.2	17.3	25.7	21.1	13.3	5.6	5.8	14.3
Borrowing from Private Sector	11.5	7.6	15.0	30.6	36.1	51.0	42.7	74.7	16.8
Other	11.0	2.4	3.8	4.3	2.6	2.4	3.4	1.9	4.7
Observations	75	102	127	108	128	95	169	48	852

Data: Q.32C

Notes: Systems can receive funds by more than one source; therefore column totals may not sum to 100.

This table reports sources of capital funds only for those systems making capital expenditures in the past 5 years.

The DWSRF program may forgive all or a portion of the loan principal repayment by disadvantaged systems.The questionnaire refers to principal payment forgiveness as grants. This was done to distinguish principal that must be repaid from principal whose repayment is forgiven.

Table 80
Source of Capital Funds in the Past 5 Years
Percentage Distribution of the Sources of Funds for Investment for the Average System
By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Current Revenues	6.1	50.3	52.8	50.1	56.8	50.8	67.3	52.6	51.1
DWSRF Loans	24.4	4.6	10.8	3.0	3.2	3.7	3.9	1.4	7.0
DWSRF Principal Repayment Forgiveness	16.3	9.3	4.2	0.1	1.3	1.3	0.6	0.0	4.3
Other Government Loans	0.0	4.7	8.2	11.4	10.0	4.6	1.9	1.4	7.8
Other Government Grants	4.7	22.7	10.8	15.6	5.1	1.9	1.2	0.7	12.9
Borrowing from Private Sector	2.1	9.9	10.9	17.1	23.3	35.9	23.6	45.0	14.3
Other	46.3	0.0	2.5	2.0	0.2	1.6	1.3	0.1	2.9
Observations	11	43	111	94	113	85	157	45	659
Private Systems									
Current Revenues	78.0	84.8	65.1	52.1	56.2	54.9	67.8	56.0	77.7
DWSRF Loans	0.0	0.0	0.0	0.0	3.0	0.0	0.6	4.3	0.1
DWSRF Principal Repayment Forgiveness	0.1	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.2
Other Government Loans	3.3	0.3	4.7	1.8	5.0	5.3	5.4	0.0	2.2
Other Government Grants	0.0	4.8	10.0	4.1	10.9	1.6	0.0	0.0	3.7
Borrowing from Private Sector	12.2	3.3	13.3	28.3	24.9	38.2	26.2	39.7	9.6
Other	6.3	3.9	6.9	9.3	3.1	0.0	0.0	0.0	5.4
Observations	64	59	16	14	15	10	12	3	193
All Systems									
Current Revenues	71.5	71.4	55.3	50.4	56.7	51.2	67.3	52.8	63.1
DWSRF Loans	2.2	1.7	8.6	2.6	3.1	3.3	3.7	1.5	3.9
DWSRF Principal Repayment Forgiveness	1.6	3.5	3.4	0.7	1.1	1.2	0.6	0.0	2.5
Other Government Loans	3.0	2.0	7.5	10.1	9.3	4.7	2.1	1.3	5.3
Other Government Grants	0.4	11.9	10.6	13.9	6.0	1.9	1.1	0.6	8.8
Borrowing from Private Sector	11.3	5.8	11.4	18.6	23.5	36.1	23.8	44.6	12.2
Other	9.9	2.4	3.4	3.0	0.7	1.4	1.2	0.1	4.0
Observations	75	102	127	108	128	95	169	48	852

Data: Q.32C

Notes: This table reports sources of capital funds only for those systems making capital expenditures in the past 5 years.

The DWSRF program may forgive all or a portion of the loan principal repayment by disadvantaged systems.The questionnaire refers to principal payment forgiveness as grants. This was done to distinguish principal that must be repaid from principal whose repayment is forgiven.

This table shows how much of each (average) system's total capital expenditures came from each funding source. It is not the percentage of funds acquired from each funding source for the nation in the aggregate. That is reported in table 81.

Table 81
Source of Capital Funds in the Past 5 Years
Percentage Distribution of the Sources of Funds for Investment for the Nation
By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
Current Revenues	2.3	14.5	27.2	34.0	49.9	38.9	54.5	29.0	38.8
DWSRF Loans	38.5	12.4	23.4	4.4	3.0	5.6	3.8	1.2	4.1
DWSRF Principal Repayment Forgiveness	8.3	13.3	11.1	0.5	0.9	0.8	0.3	0.0	1.2
Other Government Loans	0.0	13.4	14.6	17.3	20.7	6.2	2.2	0.3	7.9
Other Government Grants	9.4	42.6	10.6	13.7	7.0	1.3	3.0	0.5	4.8
Borrowing from Private Sector	16.7	3.9	10.9	26.3	18.5	43.1	34.1	68.7	42.0
Other	24.9	0.0	2.2	3.8	0.0	4.1	2.0	0.1	1.2
Observations	11	43	111	94	113	85	157	45	659
Private Systems									
Current Revenues	64.1	51.8	62.8	35.6	30.7	21.5	62.5	31.3	42.3
DWSRF Loans	0.0	0.0	0.0	0.0	4.7	0.0	0.9	7.5	2.4
DWSRF Principal Repayment Forgiveness	0.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Other Government Loans	2.9	0.7	8.2	2.2	6.3	8.6	5.6	0.0	4.9
Other Government Grants	0.0	12.0	14.9	11.7	10.1	2.2	0.0	0.0	6.4
Borrowing from Private Sector	20.2	7.7	12.1	46.5	46.3	67.7	31.0	61.1	41.0
Other	11.9	27.8	1.9	3.9	2.0	0.0	0.0	0.0	2.9
Observations	64	59	16	14	15	10	12	3	193
All Systems									
Current Revenues	33.5	21.5	33.5	34.2	48.1	37.2	55.3	29.1	39.1
DWSRF Loans	19.1	10.0	19.3	3.8	3.2	5.1	3.5	1.5	3.9
DWSRF Principal Repayment Forgiveness	4.5	10.8	9.1	0.5	0.8	0.7	0.3	0.0	1.1
Other Government Loans	1.5	11.0	13.5	15.4	19.3	6.4	2.5	0.3	7.7
Other Government Grants	4.6	36.8	11.4	13.5	7.3	1.4	2.7	0.5	5.0
Borrowing from Private Sector	18.5	4.6	11.1	28.8	21.2	45.5	33.8	68.4	41.9
Other	18.3	5.2	2.1	3.9	0.2	3.7	1.8	0.1	1.3
Observations	75	102	127	108	128	95	169	48	852

Data: Q.32A, Q.32C

Notes: This table reports sources of capital funds only for those systems making capital expenditures in the past 5 years.

The DWSRF program may forgive all or a portion of the loan principal repayment by disadvantaged systems.The questionnaire refers to principal payment forgiveness as grants. This was done to distinguish principal that must be repaid from principal whose repayment is forgiven.

Of all capital expenditures spent nationally, this table reports how much that came from each funding source. It does not report how much came from each source for each system on average. That is reported in table 80.

Table 82
Average Interest Rate for Capital Funds Lending Sources
By Ownership

	System Service Population Category								
Ownership Type	**100 or Less**	**101 - 500**	**501 - 3,300**	**3,301 - 10,000**	**10,001 - 50,000**	**50,001 - 100,000**	**100,001- 500,000**	**Over 500,000**	**All Sizes**
Public Systems									
DWSRF Loans	*	0.3	4.3	1.6	3.9	3.0	3.1	3.3	3.1
Other Government Loans	*	1.2	2.0	3.5	3.4	4.2	3.8	5.3	2.5
Borrowing from Private Sector	6.0	6.8	4.6	4.8	4.3	5.1	5.4	5.2	4.9
Other	*	*	0.9	1.5	*	*	5.5	*	1.3
Observations	1	8	32	30	42	41	71	30	255
Private Systems									
DWSRF Loans	*	*	*	*	2.5	*	1.9	4.3	2.6
Other Government Loans	*	4.5	5.3	*	6.2	3.3	5.4	*	5.4
Borrowing from Private Sector	4.8	1.4	0.5	9.5	3.3	5.6	7.6	5.0	2.2
Other	*	*	*	*	*	*	*	*	*
Observations	2	7	3	1	6	5	5	2	31
All Systems									
DWSRF Loans	*	0.3	4.3	1.6	3.8	3.0	3.0	3.4	3.1
Other Government Loans	*	1.3	2.6	3.5	3.9	3.9	3.9	5.3	2.8
Borrowing from Private Sector	4.8	3.8	3.2	5.0	4.2	5.2	5.6	5.2	4.1
Other	*	*	0.9	1.5	*	*	5.5	*	1.1
Observations	3	15	35	31	48	46	76	32	286

Data: Q.32C

Notes: *No data available for these systems

This table reports systems making capital expenditures in the past 5 years and reporting their interest rates.

Part 2

Methodology Report

1. INTRODUCTION

1.1 Study Background

In compliance with Executive Order 12866, the Regulatory Flexibility Act, and the Safe Drinking Water Act (SDWA), the U.S. Environmental Protection Agency's Office of Ground Water and Drinking Water (OGWDW), Standards and Risk Management Division (SRMD) conducts periodic surveys of the financial and operating characteristics of community water systems. These Community Water System Suveys (CWSSs) supply information that is essential to support economic analyses of the costs and benefits of new regulations and changes to existing regulations on consumers, the water supply industry, and the nation. The information also will be used to measure the financial burden of EPA's regulations on consumers and the industry. Furthermore, data from the survey will help EPA identify, evaluate and develop guidance on Best Management Practices used in water treatment and distribution systems. Previous surveys of Community Water Systems were conducted in 1976, 1982, 1986, and 1995.

1.2 Survey Overview

This section is intended to provide the reader with an overview of the design and conduct of the CWSS. The topics presented in this section will then be discussed at greater length in the following chapters.

The CWSS was designed to collect operating and financial information from a representative sample of community water systems. In order to reduce the burden of the survey on small systems, the data were collected from systems serving 3,300 or fewer people through site visits by water system professionals. Systems serving over 3,300 people received the questionnaire in the mail. Water system professionals were assigned to each system that received the mailed questionnaire to help the systems respond to the survey's questions. A toll-free telephone number and an e-mail address also were provided to the systems to provide technical support.

The Community Water System survey was based on a nationally representative sample of community water systems. The sample was drawn from a list of approximately 53,000 systems in the Safe Drinking Water Information System (SDWIS). The survey used a stratified random sample design to ensure the sample is representative. The sample was stratified by several characteristics of water systems to increase the efficiency of estimates based on the sample. To limit the travel costs involved in visiting each small system in the sample, they were selected in geographic clusters in a two-stage design. A sample of 1,806 systems was selected, including a census of all systems serving populations of 100,000 or more.

A separate version of the questionnaire was developed for systems serving more than 500,000 people. Additional questions were asked of these very large systems regarding concentrations of several contaminants in raw and finished water and average well depth. Questions that would not apply to very large systems were excluded from their version of the questionnaire.

Water system professionals contacted the small systems in the sample to schedule appointments for the site visits. Upon mailout, each system receiving the questionnaire was notified by telephone that they would receive the questionnaire in the mail. Phone calls were made throughout the data collection period to encourage non-respondents to participate and to provide technical support when needed. Requests to re-mail the questionnaire were received through the toll-free support line and during the phone calls to the system; the questionnaires were re-mailed as the requests were received.

As completed questionnaires were returned, they were logged into a receipt control system using an on-line data tracking system. The completed questionnaires went through an extensive data quality review. Water system analysts reviewed each mailout questionnaire and contacted the systems to clarify answers, correct anomalous items, or collect missing responses. The questionnaires were then reviewed by senior engineering staff. The senior staff also reviewed the site visits reports for each small system. The questionnaires were then key-entered using independent double-key entry. Finally, the electronic form of the data were run through automated cleaning and editing programs.

A series of sample weights, non-response adjustments, and other statistical techniques were created and applied to the final set of sampled respondents. These weights allow for extrapolation from the sampled systems to the universe of Community Water Systems in the nation. The sample design and weights also allow for the calculation of confidence intervals for each estimate.

Planning and design of the survey began in August of 1999. A pre-test of the questionnaire was conducted in July 2000. The pilot test was conducted from April to May, 2001, and the final design was developed in May 2001. Data collection took place from June through October, 2001. Data processing and analysis continued through February 2002.

EPA secured the services of several contractors who performed a variety of tasks in support of the survey design, survey administration, data processing, and analysis. The Cadmus Group, Inc., was the prime contractor. Abt Associates, Inc. served as a subcontractor, as did Norfolk Data, Inc. The site visits were conducted through subcontracts with several experienced water system professionals. The Cadmus Group has been supporting EPA and other clients in the assessment and analysis of the water industry for over 20 years. Cadmus' primary responsibilities were for overall project management; design of the questionnaire; sample design; selection of the medium, large, and very large system sample; design, administration, and management of the data collection; technical support to water systems in the sample; expert quality assurance review of the survey data; data tabulations; and report preparation. Abt Associates assisted with the development of the survey instrument, selected the small system sample, developed and maintained the on-line data tracking system, edited and

prepared the data into final form for data entry, managed the data entry, calculated the sample weights, assisted in the data tabulations, and developed the final data with documentation. Norfolk Data keyed the data into the electronic data base.

EPA also requested comments on the survey from several independent reviewers. EPA consulted with Jeanne Bailey in the office of Regulatory Affairs at the American Water Works Association in Washington, DC. Drafts of the questionnaire were reviewed by Diane Moles, from the Iowa Department of Natural Resources, in Des Moines, IA, and James K. Cleland of the Drinking Water and Radiological Protection Division of the Michigan DEQ in Lansing, MI. EPA also consulted with Robert W. Mann of the Water Supply Engineering Bureau of the State of New Hampshire's Department of Environmental Services.

2. SAMPLE DESIGN AND WEIGHTING

2.1 Sample Design and Selection

This section describes the sample design for the 2000 Community Water System Survey (CWSS). It includes a description of the sampling frame, target sample size, stratification variables, and sampling methods.

The survey relied on a probability sample of Community Water Systems. For small systems (those serving populations of 3,300 or less), a two-stage cluster sample was used. A stratified random sample was used for systems serving populations of between 3,301 and 100,000. Systems serving populations of over 100,000 were selected with certainty. The strata were defined by the combinations of the size of the residential population served by the water systems and the source of water (ground or surface).

2.1.1 SDWIS Sampling Frame and Coverage

The sampling frame is developed from the federal Safe Drinking Water Information System (SDWIS/Fed). SDWIS is a centralized database of information on public water systems, including their compliance with monitoring requirements, maximum contaminant levels (MCLs), and other requirements of the Safe Drinking Water Act (SDWA) Amendments of 1996. The following information was extracted from SDWIS for the statistical survey:

- Name of system
- Address of system
- Population served
- Primary source (surface water or ground water)
- Public water system identification number (PWSID)
- Ownership type
- Consecutive system (i.e., does system purchase or sell water)

From these data, EPA developed a sample list from which it (1) calculated summary statistics for use in calculating sample size, and (2) randomly chose systems within the design strata which will take part in the survey.

SDWIS is the appropriate sampling frame because:

- It fully covers the target population.
- It contains no duplication.
- It contains no foreign elements (i.e., elements that are not members of the population).
- It contains information for identifying and contacting the units selected in the sample.
- It contains other information that will improve the efficiency of the sample design.

SDWIS is the best choice for a sample frame because of its inclusive coverage of all units of observation for this survey. In addition, SDWIS has two other advantages: it contains information that will facilitate contacting the respondents, and it contains other information that is useful in stratifying the sample, thereby improving the efficiency of the sample design. However, SDWIS is not designed to be such a sample frame; many properties of SDWIS, and some lingering problems of system classification in SDWIS, can result in many inaccuracies for such sample frame applications and sample selection.

For EPA's 1999 Drinking Water Infrastructure Needs Survey (Needs Survey), EPA and Cadmus made a considerable effort to improve the SDWIS information and create an inventory list more suitable as a sample frame. The Needs Survey took several steps to prepare SDWIS for use as a sample frame. Problematic data were first identified based on the experience of the 1995 Needs Survey. EPA then provided the confirmed inventory data to the States (including the Virgin Islands and Puerto Rico) for review and asked the States to provide any necessary changes.

EPA also worked with the States to identify the total "consecutive" population served (including the population of retail buyers) by many prominent large systems, to group systems into size and type categories that more accurately reflect actual populations served by a particular water system. For instance, the reported population served by the Metropolitan Water District of Southern California (MWD) is categorized as a small system serving less than 3,300 people in SDWIS; in fact, MWD serves nearly 16 million consumers. Therefore, the system was reclassified as a large system, which accurately reflects the way this system is regulated under the Safe Drinking Water Act.

Criteria used to determine the accuracy of SDWIS data include: (1) 1995 inventory verification showing a discrepancy rate greater than 1 percent; or (2) the number of community water systems in a State in SDWIS as of March 1998 being at least 3 percent greater than in the sampling frame used for the 1995 Needs Survey. On site inventory verifications were also conducted for States that contributed to at least 0.8 percent of total national need in the 1995 Needs Survey, and if EPA determined that SDWIS inventory may not accurately reflect a State's inventory, based on experience with the 1995 Needs Survey. Inventory verifications were conducted in Arizona, Arkansas, California,

Colorado, New York, North Carolina, Ohio, Oklahoma, and Tennessee. SDWIS-Fed inventory information for Virginia was replaced with SDWIS/State inventory information, since SDWIS/Fed was known to be an inaccurate source of current inventory.

The process of State corrections included a variety of inventory review procedures and data verification:

- A stratified random sample of systems was used to select systems within each State to verify the inventory. (A two-staged cluster sampling approach was used to select systems in New York, since data in this State are managed by numerous district offices.)

- Sanitary survey information, bacteriological results, or other chemical records in State files and/or databases were reviewed on site to ensure that inventory data were accurate. If inventory information was different between SDWIS and the State files and/or database, a discrepancy was issued. Each State so identified was then given an opportunity to provide monitoring results or other documentation of a system's characteristics, and in some cases, a system's actual existence. Systems that were inactive were removed from the Needs Survey sampling frame, while other systems were re-categorized if necessary.

- Based on results of the inventory verification, the total inventory for each State was further refined. The inventory verification results were extrapolated to all systems in each State to estimate the number of active systems in each size and type category.

In addition to these changes, the inventory of systems serving Alaskan native populations in SDWIS was replaced with data developed by EPA Region 10 and the State of Alaska.

The Needs Survey sample frame was further refined during the course of the data collection period. System status as of January 1, 1999 was used to determine inclusion and placement within the sample frame.

The sample frame used for the Needs Survey is based on the SDWIS from 1998; to account for changes in SDWIS, we compared the SDWIS available from the first quarter of 2000 to the Needs Survey list. New systems were verified and added. This revised list of systems will be used as the sample frame for the CWSS.

2.1.2 Sample Design and Selection

Sample Eligibility

To be eligible for the CWSS, a water system must meet several criteria. First, it must meet the CFR definition of a community water system; principally, a water system providing drinking water to 25 or more permanent residents or to 15 permanent connections. (See 40 CFR 141.2 for the complete definition.) In addition, the CWSS excluded federal- and state-owned or operated systems; because these are not affected by regulatory and economic forces in the same way as other systems. To the extent possible, all ineligible systems were identified in SDWIS and removed from the frame; however, many ineligible systems could not be identified and were therefore left in the frame. If systems were clearly identified as ineligible during data collection (e.g., they are no longer an active water system, they no longer meet the CFR definition of a Community Water System, or they are owned by the federal or a state government), the data were excluded from analyses based on the sample.

After it drew the initial sample, EPA decided to exclude systems in the trust territories. The original sample included 64 systems in Puerto Rico, the U.S. Virgin Islands, and the Pacific territories. EPA decided not to select a new sample because this would affect the site visit schedule. Instead, EPA dropped the systems in the trust territories, and classified these systems as non-respondents when calculating the sample weights.

Sample Design

The CWSS analytical plan specified precision level targets for subpopulations of systems, which required minimum sample sizes be achieved for each subpopulation. The precision targets for each subpopulation were 95 percent confidence intervals of ± 10 percentage points for estimated proportions. The domains of the population of interest for EPA are based on two characteristics of the systems:

1. **The source of water**. Systems that rely on ground water are distinguished from surface water systems.

2. **The size of the population served by the system**. Eight size categories will be used: systems that serve less than 100 people; systems that serve 101 to 500 people; systems that serve from 501 to 3,300 people; systems that serve from 3,301 to 10,000 people, systems that serve from 10,001 to 50,000 people; systems that serve 50,001 to 100,000 people; systems that serve from 100,001 to 500,000 people; and systems serving more than 500,000 people.

The two water sources and the eight system sizes produce sixteen strata.

A system is classified as a surface water system in SDWIS if any of its water is surface water. Ground water under the direct influence of surface water is classified as surface water. Systems that rely on purchased water systems are included in the ground water strata because we assume the characteristics of the water and the treatment requirements will be more similar to ground water than to surface water. (While some untreated surface water is purchased, the majority is treated and therefore more similar to ground water than surface water.)

The sample is stratified to achieve two goals. First, stratifying the data allows us to draw inferences about specific population domains. For example, EPA may wish to draw conclusions about systems serving populations of less than 10,000 or 3,300. We can ensure that estimates of the sub-populations will meet the required levels of precision by drawing the necessary number of observations for each stratum.

The second goal achieved by stratifying the data is that we can increase the efficiency of our estimates by grouping systems into relatively homogeneous strata. The strata were chosen to minimize the differences among systems within strata, and to maximize the differences among strata. The results of previous surveys indicate there are important differences in the way systems are operated and in their finances across the strata selected. The operating characteristics and treatment requirements of ground water systems tend to be different from surface water systems. The operating and financial characteristics of large systems tend to be more complex than small systems. System management, and the resources available to it, also may vary by system size. The regulatory impact models require reasonably precise parameter estimates from each of these domains. The sample size in each domain should be large enough to provide a sufficient number of completed questionnaires to obtain estimates with reasonable precision.

Table 2-1 shows the number of systems in the sample frame and the minimum sample size required to obtain an estimate for a proportion of 50 percent with an error not exceeding ± 10 percentage points (except for a 1 in 20 chance) in each domain. (A 50 percent statistic was used because the standard error is largest when the population percentage is 50 percent. The error will be smaller for other population percentages.) Systems with populations served of over 100,000 were selected with certainty.

Sample Selection

For Community Water Systems serving 3,300 or fewer people (small CWSs), a two-stage sampling design was used to reduce field data collection costs. Field data collectors were sent to the clusters of six systems at a time to collect data. The primary sampling unit (PSU) was a county or a group of counties. (Each county with fewer than six small systems was combined with geographically adjacent counties to form the primary sampling units.) At the first stage of sampling, a sample of 100 PSUs were selected with probabilities proportional to size. The measure of size was the number of small systems in the PSU. A large PSU could be selected ("hit") more than one time. PSUs were re-

sampled to account for potential non-response. The over-sampling rate was determined based on EPA's experience with the 1999 EPA DWINS and the 1995 CWS Survey. States were provided with a list of small CWSs in the counties selected, and EPA asked States to verify that the systems on the list are active and serve populations of 3,300 or fewer.

To select the second stage sample of small systems, the overall selection rate for each small system stratum was calculated as the target initial sample size in the stratum divided by number of systems in the stratum. The expected frequency of selection was calculated for each PSU in the first stage sample. For each PSU selected, the second stage selection rate for a stratum equaled the overall selection rate for the stratum divided by the first-stage expected frequency of selection. That second stage selection rate for a stratum was applied to the count of systems in that county to determine the fractional sample size. The fractional sample sizes was converted to integer sample sizes using stochastic rounding and with the constraint that the total integer sample size for a county hit equals six systems. To measure composite sample size in selecting counties or PSUs, an "overall stratum selection rate" was multiplied by the number of systems in the stratum in that PSU, and summed over all strata in each primary sampling unit (county or group of counties).

Table 2-1. Frame and Sample Sizes by Strata

Source of Water	Population Served	Frame Size	Required Sample
Ground	100 or less	14,972	95
	101-500	16,025	95
	501 - 3,300	12,341	95
	3,301 - 10,000	3,300	92
	10,001-50,000	1,921	89
	50,001 - 100,000	260	60
	100,001 - 500,000	126	126
	More than 500,000	17	17
Surface	100 or less	538	88
	101-500	789	91
	501 - 3,300	1,551	93
	3,301 - 10,000	988	91
	10,001-50,000	970	91
	50,001 - 100,000	215	74
	100,001 - 500,000	189	189
	More than 500,000	66	66
All		54,268	1,452

For systems serving populations of 3,301 – 100,000, the sample was obtained by drawing a random sample of systems from the cleaned SDWIS frame, within each sampling stratum serving populations of this size. Systems in these strata were oversampled to account for non-response. As with the small systems, the over-sampling rate was based on EPA's experience with the 1999 DWINS and the 1995 CWSS. Systems serving populations of more than 100,000 were selected with certainty. The resulting increase in sample size is warranted for the following reasons:

- Each of the larger systems has a more significant impact on the total costs and benefits of regulations.

- Because of the small numbers of systems in many of the larger strata, precision can be increased at comparatively lower cost than it can be for smaller systems. Other things being equal, doubling precision will quadruple sample size in strata with 5,000 systems or more. Many of the larger strata, however, have only hundreds of systems. In a stratum of 750 systems, one could double precision by only tripling sample size. In a stratum of 200 systems, one could double precision by doubling sample size.

A total of 1,870 systems were selected into the sample. The sample size by strata and the and sampling rate are shown in table 2-2.

2.1.3 Stratum Migration

Errors in the SDWIS frame classification of the water systems by population served and water source introduces inefficiency in the sample design through a loss of sample size and/or by introducing unequal sampling rates. Among the respondents, 87 percent reported the same population served category as indicated by the frame. Just over 91 percent reported the same source as the frame.

Population Served by the System

Table 2-3 compares the classification of systems by their population served using the population data from the frame and from the systems' responses to the survey. In all size categories, more than 80 percent of systems confirmed their original size category. Within each size category, over 96 percent of systems were either in their original size category or in the adjacent class. While migration across size categories is small, several systems reported to serve 3,300 or fewer people in the frame moved into larger categories; 20 moved into the 3,301-10,000 category, and 4 moved into larger population categories. Also, 19 systems moved into small system categories from the larger categories.

Table 2-2. Sample Size and Sampling Rate by Strata

Source of Water	Population Served	Sample Size	Sampling Rate (%)
Ground	100 or less	128	0.9
	101-500	124	0.8
	501 - 3,300	124	1.0
	3,301 - 10,000	155	4.7
	10,001-50,000	152	7.9
	50,001 - 100,000	116	44.6
	100,001 - 500,000	126	100.0
	More than 500,000	17	100.0
Surface	100 or less	94	17.5
	101-500	85	10.8
	501 - 3,300	90	5.8
	3,301 - 10,000	145	14.7
	10,001-50,000	144	14.8
	50,001 - 100,000	110	51.2
	100,001 - 500,000	194	102.6
	More than 500,000	66	100.0
All		1,870	3.4

Table 2-3. Survey Respondents by the Frame-Based and Sample-Based Size Categories

Sample-Based Population Served Categories		Frame-Based Population Served Category							
		25-100	101-500	501-3,300	3,301-10,000	10,001-50,000	50,001-100,000	100,001-500,000	Over 500,000
25-100	Count	142	13	0	0	0	0	1	0
	Percent	91	8	0	0	0	0	1	0
101-500	Count	16	144	10	1	0	0	0	0
	Percent	9	84	6	1	0	0	0	0
0501-3,300	Count	6	11	177	15	1	0	1	0
	Percent	3	5	84	7	0	0	0	0
3,301-10,000	Count	1	0	19	139	10	0	1	0
	Percent	1	0	11	82	6	0	1	0
10,001-50,000	Count	1	0	1	13	136	9	1	0
	Percent	1	0	1	8	84	6	1	0
50,001-100,000	Count	1	0	0	0	4	108	4	0
	Percent	1	0	0	0	4	92	3	0
100,001-500,000	Count	1	0	0	0	1	14	182	4
	Percent	1	0	0	0	1	7	90	2
Over 500,000	Count	0	0	0	0	0	1	2	55
	Percent	0	0	0	0	0	2	3	95

Source of Water

Table 2-4 shows the cross-tabulation of the frame-based and response-based water source classifications. Approximately 86 percent of the systems classified as ground water systems in the frame confirmed that status in the sample. Ninety-four percent of surface water systems in the frame were also classified as surface water systems in the sample.

Table 2-4. Survey Respondents by the Frame-Based and the Sample-Based Source Categories

Sample-Based Water Source		Frame-Based Water Source							
		Small		Medium		Large		All	
		Ground	Surface	Ground	Surface	Ground	Surface	Ground	Surface
Ground	Count	323	42	146	12	123	19	592	73
	Percent	88	12	92	8	87	13	89	11
Surface	Count	9	164	10	163	15	220	34	547
	Percent	5	95	6	94	6	94	6	94

Impact of Strata Migration on the Accuracy of Domain Estimates

The sample was designed to estimate a 50 percent statistic with a 95 percent confidence interval of ± percentage points. One measure of the impact of the strata migration on the efficiency estimates is to calculate the size of the confidence interval given number of observations in each stratum for the sample collected. Table 2-5 shows the minimum sample required to estimate a 50 percent statistic with a 95 percent confidence interval of ± 10 percentage points. The planned sample size is the sample that would be needed if the frame had correctly identified all subdomain members. The required sample size is the sample needed, given the inaccuracies in the frame. The table also shows the half-width of the 95 percent confidence interval that results from the actual sample selected, given the sample's estimate of the number of systems in each subdomain. The increase in the half-width for mid-sized ground water systems is modest. Because the sample was designed to collect data on all systems with populations of more than 100,000, the width of the confidence interval for these systems would have been zero. The width increased substantially for ground water systems in these strata and slightly for surface water systems serving greater than 500,000 people categories due to the strata migration, as the number of systems in these strata is larger than expected. It also increased for surface water systems serving populations of more than 500,000.

Table 2.5. Sample Sizes and the Impact on Precision of Estimates of Strata Migration

Source	Population Served	Required	Planned	Half width of 95% Confidence Interval
Ground	100 or less	95	95	0.100
	101 - 500	95	95	0.100
	501 - 3,300	95	95	0.100
	3,301 - 10,000	93	92	0.101
	10,001 - 50,000	91	89	0.101
	50,001-100,000	70	60	0.111
	100,001-500,000	125	73	0.074
	Over 500,000	17	8	0.260
Surface	100 or less	79	88	0.094
	101 - 500	85	91	0.096
	501 - 3,300	90	93	0.099
	3,301 - 10,000	88	91	0.098
	10,001 - 50,000	87	91	0.098
	50,001-100,000	66	74	0.092
	100,001-500,000	191	257	0.000
	Over 500,000	66	50	0.069

2.2 Weighting and Estimation

A sampling weight is attached to each responding water system record to (1) account for differential selection probabilities, and (2) reduce the potential bias resulting from nonresponse. The sampling weights are necessary for estimation of the population characteristics of interest. The sample variance is then used to calculate 95 percent confidence intervals for the estimates.

2.2.1 Derivation of Base Weight and Nonresponse Adjustment

The calculation of the sample weight reflects the complex nature of the sampling design. The community water system sample consists of a stratified element sample of medium and large water systems. Systems were stratified by water source and their population served. For small water systems a two-stage cluster sample design was used.

1. At the first stage geographic clusters (counties or county groupings) were sampled using probability proportional to size sampling. The measure of size was a function of the number of small systems in the cluster.

2. Within clusters a stratified element sample of small systems was drawn.

After the initial sample was drawn, it was decided to go back to some of the clusters and draw additional small systems from specific strata to make up for a short fall in sample size due to a larger than expected number of ineligible small systems. Also, sample clusters located in U.S. territories were not included in the actual data collection for cost reasons and are treated as nonrespondents.

The EPA SDWIS data file was used as the sampling frame for sample selection. Sixteen sampling strata were defined based on systems' population served and source of water; all weight calculations use this sample stratum variable.

Base weights

The first step was the calculation of a base sampling weight for each sample system. For the medium and large systems the base sampling weight equals the number of systems in the stratum divided by the number sampled from that stratum. In other words the base weight for the h^{th} stratum, B_h, is:

$$B_h = \frac{N_h}{n_h}$$

where N_h represents the number of systems in the stratum in SDWIS, and n_h represents the number of systems sampled from the stratum.

For the small systems the base sampling weight equals the product of the reciprocal of the probability of selection of the cluster times the reciprocal of the within cluster probability of selection of the small system. For large clusters selected with certainty the cluster base sampling weight component equals one. The reciprocal of the within cluster selection probability equals the number of small systems in a stratum divided by the number selected from that stratum. The base weight for a sample system in the h^{th} stratum in the m^{th} cluster is given by B_{mh}:

$$B_{mh} = \left(\frac{1}{P_m}\right)\left(\frac{N_{mh}}{n_{mh}}\right)$$

where P_m is the probability of selection of the m^{th} cluster.

Nonresponse adjustment

The second step in the weighting methodology was to make a unit nonresponse adjustment to

the base sampling weights. For each medium and large system stratum, the nonresponse adjustment factor is equal to the ratio of the number of systems that completed the survey plus the number of nonrespondents to the number of systems that completed the survey (i.e., the reciprocal of the stratum response rate). Ineligible systems are not incorporated into the unit nonresponse adjustment. The adjustment factor for the h^{th} stratum is given by $*_h$:

$$d_h = \frac{n_h + r_h}{n_h}$$

Where r_h is the number of refusals and other nonrespondents in the h^{th} stratum.

For the small system sample the unit nonresponse adjustment was not implemented within each cluster because the sample sizes were too small. Rather the adjustment was carried out within each small system stratum at the total sample (i.e., national) level.

Final weights

The nonresponse adjustment factor $*_h$ was multiplied by the base sampling weight, B_h, to obtain the nonresponse adjusted base sampling weight. The nonresponse adjusted base sampling weight for the medium and large systems that completed the survey is the final weight for use in analysis. The nonresponse adjusted weights can be written as:

$$W_h^f = B_h d_h$$

for medium and large systems, and

$$W_{mh} = B_{mh} d_h$$

for small systems.

The final step in the weight calculations for small systems was a ratio adjustment to the SDWIS data file count of small systems in each small stratum at the national level. This step was carried out because the two-stage sample of small systems, drawn from 104 sample clusters, may not have the same stratum distribution as the entire EPA data file of small systems. For each small system stratum, the sum of the nonresponse adjusted base sampling weights for systems with a completed survey was added to the sum of the base sampling weights for the ineligible systems. The count of small systems in SDWIS was then divided by this sum. This yielded a ratio adjustment factor for each small system

$$r_h = \frac{N_h}{\sum_{j \in R_h} W_{mhj} + \sum_{j \in I_h} B_{mhj}}$$

stratum, D_h:

Where: R_h is the set of systems that responded to the survey, and

I_h is the set of systems sampled that were ineligible.

j designates the j^{th} sample system.

For the small systems with a completed survey their nonresponse adjusted base sampling weight was multiplied by the ratio adjustment factor to yield a final weight for use in analysis:

$$W_{mh}^{f} = W_{mh} r_h$$

2.2.2 Variance Estimation

The estimate of the variance must account for the sampling design. Weights are used to produce estimates for the population as a whole – for example, the proportion of treatment facilities that use a particular treatment practice, or the mean water-sales revenue of a system. Weights also affect the standard error of the estimates, and therefore the confidence intervals.

The 2000 CWSS sampling design was relatively complex; medium and large systems were selected by strata; small systems were selected in clusters of counties (or, in some cases, groups of counties) using a probability proportional to size sampling. This sampling design also affects the estimate of the standard error. The stratification of the systems by water source and population served will tend to reduce the overall sample variance, as systems within a stratum tend to be similar to each other and different from systems in other strata. The clustering will likely increase the sampling variance, as systems within a cluster may be similar to each other . This effect of clustering may not be large; while systems within a county share some characteristics, the often are a diverse group in terms of population served and water source, as well as revenue, expenses, and operating characteristics. But ignoring the clustering may lead to an underestimate of the sampling variance, so it must be taken into account.

The treatment facilities in the sample were not selected independently; rather, they were selected in clusters in a two-stage process. For medium and large systems, the stratified random sample of systems were selected in the first stage; every treatment facility in each system was selected in the second stage. Facilities in small systems were selected in a three-stage process: counties (or groups of counties) were selected in the first stage; a sample of systems within each county was selected in the second stage; every facility within each system was selected in the third stage. The calculation of the sample variance of estimates regarding treatment facilities also must take into account

this sampling design.

Variance Estimator

The variance is estimated using a first-order Taylor expansion. The variance is calculated in Stata. The variance estimator is given by:

$$\hat{V}\left(\hat{R}\right) = \frac{1}{\hat{X}^2}\left\{\hat{V}\left(\hat{Y}\right) - 2\hat{R}C\hat{o}v\left(\hat{Y},\hat{X}\right) + \hat{R}^2\hat{V}\left(\hat{X}\right)\right\}$$

where $\hat{R} = \hat{Y}/\hat{X}$, the ratio of estimates of two population totals. $\hat{Y}$ is equal to $\sum_{h=1}^{L}\sum_{i=1}^{m_h}\sum_{j=1}^{n_{hi}} w_{hij}y_{hij}$, and $\hat{X}$ is equal to $\sum_{h=1}^{L}\sum_{i=1}^{m_h}\sum_{j=1}^{n_{hi}} w_{hij}x_{hij}$. L is the number of strata, m_h is the number of primary sampling units in strata h, and n_{hi} is the number of elements in the i^{th} primary sampling unit in the h^{th} strata.

Most of the estimates produced in this volume are either means or proportions. A mean is simply a ratio in which x_{hij} is equal 1. A proportion is simply a mean in which y_{hij} is equal to a 0/1 variable.[1]

Finite Population Correction

A finite population correction factor was derived for medium and large systems in the sample. The factor is the ratio of systems in the sample to the number of systems in each stratum. Because the primary sampling units for small systems were selected with replacement, the finite population correction factor is set equal to zero for small systems.

To estimate the variance, we first define the following ratio residual:

$$d_{hij} = \frac{1}{\hat{X}}\left(y_{hij} - \hat{R}x_{hij}\right)$$

We then define the weighted total of the ratio residual as

[1]See Cochran, W.G. 1977, *Sampling Techniques*, New York: John Wiley & Sons for amore information about variance estimates..

$$z_{dhi} = \sum_{j=1}^{n_{hij}} w_{hij} d_{hij}$$

and the weighted average of the residual as:

$$\bar{z}_{dh} = \frac{1}{m_h} \sum_{i=1}^{m_h} z_{dhi}$$

We can then define the variance estimate as:

$$\hat{V}\left(\hat{R}\right) = \sum_{h=1}^{L} \left(1 - f_h\right) \frac{m_h}{m_h - 1} \sum_{i=1}^{n_h} \left(z_{dhi} - \bar{z}_{dh}\right)^2$$

where f_h is the finite population correction.

The estimate of the variance is used to estimate 95 percent confidence intervals in the detailed tables of this report. An implicit assumption is that the average values presented in each table are normally distributed. When the estimate is based on a large number of systems, this will generally be true; in cases where the estimate is based on a small number of systems, the assumption may not hold. The confidence interval in these cases may be larger than the mean itself. The confidence interval is not adjusted in these cases; to compute the correct confidence interval requires examination of the empirical distributions for each variable in the calculation and is beyond the scope of this study.

3. SURVEY DESIGN AND RESPONSE

The survey was administered through site visits to small systems (those serving populations of 3,300 or less), and through a mail survey to medium and large systems (those serving more than 3,300 people). This chapter discusses the survey instrument, the processes for conducting the site visits and distributing the questionnaires, as well as the process to assure sufficient response rates and the handling of returned questionnaires.

3.1 Questionnaire Design

The Cadmus Group, working closely with EPA staff responsible for regulatory development, developed the questionnaire. The process began with a meeting of EPA staff to discuss their data needs, distinguishing core needs required for regulatory development from other data needs. Based on these discussions, some of the questions that were in the 1995 CWSS were eliminated from the 2000 questionnaire. Other questions – especially those focusing on treatment – were further developed. A slightly modified version of the questionnaire was developed for systems that serve populations of over 500,000; this version of the questionnaire included additional questions on source and finished water contaminant concentrations, and excluded questions that only would apply to small systems. The survey instrument is in Appendix A. The questionnaire in Appendix A is a composite of the two questionnaires used; the questions that are asked only of systems serving over 500,000 people or only systems serving up to 500,000 people are noted.

Cadmus worked with EPA on the wording and organization of the questionnaire. It was responsible for the design and layout of the questionnaire form, and for documenting and incorporating all revisions to the several design and test versions of the questionnaire. Throughout the design process, the EPA project officer consulted with the full range of EPA regulatory and analytical staff, representing expert advisors and future users fo the data, to identify and correctly present the broad survey topics and specific survey questions to be included in the survey instrument. These covered such areas as water production, storage, distribution, treatment, and cross connection control, as well as financial information regarding water sales revenue, customer data, operating expenses, and capital investment.

EPA went to great lengths to attempt to reduce the burden to respondents while collecting complete, accurate, detailed data. EPA decided to conduct site visits to small systems because of the difficulties they faced in responding to past Community Water System Surveys. EPA also established a process to provide extensive technical assistance and guidance to recipients of the mailed questionnaire. As discussed in chapter 4, EPA conducted a pre-test of the questionnaire to identify questions that posed potential problems for respondents. EPA also conducted a pilot test of the data collection methods. As a response to both tests, EPA made several changes to the questionnaire, reducing the scope of several questions. For example, as a result of the pre-test, the number of age and diameter categories was reduced in the question regarding the length of the distribution system. was simplified.

3.2 Data Verification

EPA forwarded the list of water systems selected in the sample to the states. For small systems, the states were asked to verify that the systems were active systems serving up to 3,300 people, as well as the address, telephone, and the contact information. The states identified 27 systems that were not active Community Water Systems. To replace the systems that were inactive, 22 additional systems were selected from each of the clusters that contained inactive systems. Not every inactive system could be replaced because each cluster did not have enough systems in the sample frame to replace all the inactive systems.

3.3 The Pilot Test

Approximately 50 systems were selected from the sample for a pilot test. Two clusters of small systems were selected for site visits by senior Cadmus water system professionals. Ten systems participated in the pilot test. (One system was inactive, and one refused to participate.) Approximately 40 systems serving more than 3,300 people received the questionnaire by mail. The pilot tested the site visit and mail-out process, and the technical support system. The pilot systems were included in the full sample.

3.4 Site Visit Operations.

Three contractors were selected to conduct the site visits. The contractors were:

- International Studies and Training Institute, Inc.,
- Southwest Environmental Engineering, and
- McNenny Environmental Engineering and Consulting.

Cadmus also conducted several site visits.

Cadmus trained the site visit staff. The training covered the survey, the information required from the systems, and the data collection protocol. The training included on-site inspections with Cadmus staff of a cluster of systems in the sample, as well as detailed instructions on the conduct of the visit.

The states were contacted ahead of time to confirm the systems in the sample and to review information on the system contacts. Site visitors were told to let state contacts know they were in their area and what they were doing, as a courtesy. The surveyor extended the opportunity to the states to attend the survey. Otherwise, the surveyors were told to not burden the states with requests for assistance.

As part of the training, site visitors were instructed as follows:

- The survey is voluntary and not to be misrepresented as mandatory. It is an opportunity to provide information to be used by EPA to make sound, informed decisions and regulations.

- Obtain the operating and financial information for the same time period of time, if at all possible

- If information is not available for the separate classes of system (for example, water deliveries by customer class), then collect the totals (e.g., total deliveries).

- Indicate the system has a treatment objectives only if the facility was "designed" for that purpose. For example, if the facility was designed for particulate removal and removed arsenic in the process, the surveyors were to only check particulate removal.

- Complete the sequence of treatment after a walk-through of the treatment plant. If available, collect a schematic.

- Operators on-call are not the same as on-site; therefore, if a system only has an operator on-call, it should not be classified as having an operator on-site 24 hours a day.

- SCADA for process monitoring was defined as information on values (i.e. elevations, pressures, pH, cl2, etc.). It was classified as process control if it had the capability to automatically control equipment (i.e. pump controls, feed equipment controls, pacing control, etc)

- Related questions should be checked for consistency. For example, questions on water produced should be consistent with deliveries and unaccounted for water. Water delivered should be consistent with the number of customers and connections.

- Collect a service area map or draw the service area on a map (USGS, MapBlast, Microsoft, etc) for each system.

- The cross connection control program must be more than the plumbing code. The program should be specifically designed as a backflow prevention/cross connection control program.

- Financial data. If there is no other information, get the average annual bill (question26). Again, if the information was not available in a manner that it could be

broken down into components, get totals.

- Collect financial reports if they are available and if the system will not break down the costs as requested.

Several issues arose during the site visits that required consistent responses. They included:

- If the system indicated that it merged with another system, the site survey was conducted.

- If a system decreased in size so it was no longer a community water system, the site visit was conducted to confirm the status.

- If the system grew so it was no longer a small system, the site visit was conducted and data collected.

Each site visitor was given a list of systems to visit. The site visitors contacted the systems to schedule the on-site inspections; the site visitors were required at times to contact the state to confirm contact information. Once on-site or in some cases prior to the site visit, the systems were provided with an letter introducing the site visitor and explaining the survey. The site visitor inspected the system, interviewed the staff, photographed the system (from source to delivery), and filled out the questionnaire. The completed questionnaire, inclusive of the pictures, site map, and collected information and reports, was then submitted to Cadmus. Senior staff at Cadmus reviewed all surveys submitted by the site visitors to ensure the site visitors were filling out the questionnaire correctly and to insure consistent responses from the 6 site surveyors. The questionnaires were then logged into the tracking system as received and completed.

During the site visits, Cadmus senior staff communicated with the site visitors via telephone and e-mail to insure consistent and complete results. Group email was used to provide answers and clarification to the site visitors questions. All site visitors received the same information.

Site visits were not done in Alaska or Hawaii. For Alaska, two clusters of small systems were surveyed using a combination of telephone interviews with system, state regulatory, and EPA personnel. The remoteness and reluctance of some of the systems in Alaska made on-site visits infeasible. The information that was collected from these system was abbreviated to promote response. The data reflect the Alaska systems, but may not be easily compared to the remaining small system surveys.

3.5 Mail Survey Operations

Cadmus produced camera-ready versions of the two questionnaires, which EPA printed at its facility. Cadmus produced three mailing information and control labels for each system's questionnaire. Information for the mailing label was extracted from the sample frame and attached to the envelope for mailing. A second label that included contact information, the mailing address, and a telephone number was produced and attached to the questionnaire itself. This label explicitly instructed the respondent to respond only to the sampled system when answering the questions. Both labels included a public water system identification number (PWSID), in both alpha-numeric and bar-code. The third label contained the toll-free telephone support line and e-mail information. Included in the envelope, along with the questionnaire, was an introductory letter from the president of the Cadmus Group, a brief list of instructions, and a pre-addressed pre-paid FedEx envelope for systems to return the completed questionnaire.

The questionnaires were mailed to approximately 1,200 community water systems over a 2 day period. Each system then received a telephone call from the analyst at Cadmus responsible for that system. The call informed the system of the survey, told them they would receive the questionnaire, and gave the systems a name and telephone number to call with any questions. If a system did not receive the questionnaire, the analyst responsible for that system sent them another copy of the questionnaire via FedEx. The analyst continued to follow-up with each system until the system either responded to the survey or refused to participate. The analysts provided technical assistance as necessary, and in some cases filled-out the questionnaire through a telephone interview.

As questionnaires were received from the water systems, Cadmus logged them into the on-line tracking system. The analyst responsible for the questionnaire reviewed it for data quality and to identify potential problems. When necessary, senior engineering or financial staff were consulted regarding potential problems. If a problem or question could not be resolved by Cadmus staff, the analyst contacted the Community Water System. When this initial review was completed, the questionnaire was forwarded to senior staff for additional review. All changes to the questionnaires were recorded in a permanent log. After the senior review was completed, the completed questionnaire was forwarded to data entry.

3.6 Data Entry

Upon review by the senior staff, all questionnaires were logged as completed, and sent to Abt for data review and editing, and preparation for data processing. The questionnaires were then key-entered using 100 percent verified double-key entry. After entry, the data were run through automated cleaning and editing programs that checked each variable for proper values and ranges, and checked skip patterns. Items failing these checks were examined and either confirmed or corrected. Questionnaires that reached this stage were considered to be entered and cleaned. (The data were subject to further intensive checks as part of the quality assurance process, discussed in chapter 4.)

Status reports were sent to the EPA project managers every two weeks during the data collection effort. The report showed the number of questionnaires with each of the following status codes:

- Site visit appointments scheduled or questionnaires mailed
- Questionnaires re-mailed
- Inactive systems
- Questionnaires undeliverable
- Refusals
- Site visits completed/questionnaire returned
- Questionnaires reviewed and ready to enter into database
- Completed questionnaires entered into database

Table 3-1 presents an example of the information provided to EPA.

Table 3-1. Example of Data from Status Report

Ground Water Systems											
Population Served	**25-100**	**101-500**	**501-3,300**	**Subtotal, 25-3,300**	**3,301-10,000**	**10,001-50,000**	**50,001-100,000**	**100,001-500,000**	**>500,00**	**Subtotal, >3,300**	**Total**
Sample selected	128	124	124	376	155	152	116	127	17	567	943
Sample needed to meet precision requirements*	95	95	95	285	93	91	70	127	17	398	683
Appointments scheduled or questionnaires mailed	113	110	121	344	153	151	115	126	17	562	906
Questionnaires re-mailed	0	0	0	0	26	28	22	30	4	110	110
System found to be inactive	10	6	0	16	1	1	0	1	0	3	19
Questionnaires undeliverable	2	0	0	2	2	1	0	2	0	5	7
Water systems that refused to participate	1	1	0	2	30	15	22	25	1	93	95
Site visits complete/ questionnaires received	96	95	121	312	73	67	61	68	11	280	592
Questionnaires reviewed for quality assurance and ready to enter into database	91	94	121	306	49	44	36	40	3	172	478
Completed questionnaires entered into database	0	0	0	0	0	0	0	0	0	0	0

Table 3-1. Example of Data from Status Report

Surface Water Systems											
Population Served	**25-100**	**101-500**	**501-3,300**	**Subtotal, 25-3,300**	**3,301-10,000**	**10,001-50,000**	**50,001-100,000**	**100,001-500,000**	**>500,00**	**Subtotal, >3,300**	**Total**
Sample selected	94	85	90	269	145	144	110	193	66	658	927
Sample needed to meet precision requirements*	77	84	90	251	87	87	66	198	66	504	755
Appointments scheduled or questionnaires mailed	65	63	85	213	143	138	106	189	66	642	855
Questionnaires re-mailed	0	0	0	0	14	21	14	24	11	84	84
System found to be inactive	7	4	0	11	0	0	0	1	0	1	12
Questionnaires undeliverable	0	0	2	2	0	2	0	2	0	4	6
Water systems that refused to participate	0	1	0	1	15	20	14	20	4	73	74
Site visits complete/ questionnaires received	61	59	77	197	86	82	67	120	47	402	599
Questionnaires reviewed for quality assurance and ready to enter into database	59	57	77	193	59	63	41	82	27	272	465
Completed questionnaires entered into database	0	0	0	0	0	0	0	0	0	0	0

Table 3-1. Example of Data from Status Report

Total, Ground and Surface Water Systems											
Population Served	**25-100**	**101-500**	**501-3,300**	**Subtotal, 25-3,300**	**3,301-10,000**	**10,001-50,000**	**50,001-100,000**	**100,001-500,000**	**>500,00**	**Subtotal, >3,300**	**Total**
Sample selected	222	209	214	645	300	296	226	320	83	1,225	1,870
Sample needed to meet precision requirements*	172	179	185	536	180	178	136	325	83	902	1,438
Appointments scheduled or questionnaires mailed	178	173	206	557	296	289	221	315	83	1,204	1,761
Questionnaires re-mailed	0	0	0	0	40	49	36	54	15	194	194
System found to be inactive	17	10	0	27	1	1	0	2	0	4	31
Questionnaires undeliverable	2	0	2	4	2	3	0	4	0	9	13
Water systems that refused to participate	1	2	0	3	45	35	36	45	5	166	169
Site visits complete/ questionnaires received	157	154	198	509	159	149	128	188	58	682	1,191
Questionnaires reviewed for quality assurance and ready to enter into database	150	151	198	499	108	107	77	122	30	444	943
Completed questionnaires entered into database	0	0	0	0	0	0	0	0	0	0	0

Note: includes systems that were in the pilot test.

* Systems serving populations of over 100,000 are sampled with certainty.

3.7 Survey Response

The data collection effort was closed out October 31, 2001. Of the 1,807 systems included in the sample, 1,246 responded to the survey. The overall response rate was 67 percent. Table 3.2 shows the response rate by strata. Excluding the trust territories, the overall response rate was 69 percent.

Table 3-2. CWSS Responses and Response Rate by Strata

Source of Water	Population Served	Completed Question-naires	Response Rate (%)
Ground	100 or less	107	83.6
	101-500	106	85.5
	501 - 3,300	124	100.0
	3,301 - 10,000	77	49.7
	10,001-50,000	70	46.1
	50,001 - 100,000	62	53.4
	100,001 - 500,000	69	54.8
	More than 500,000	11	64.7
Surface	100 or less	61	64.9
	101-500	62	72.9
	501 - 3,300	83	92.2
	3,301 - 10,000	91	62.8
	10,001-50,000	82	56.9
	50,001 - 100,000	70	63.6
	100,001 - 500,000	123	63.4
	More than 500,000	48	72.7
All		1,246	66.6

4. QUALITY ASSURANCE AND PEER REVIEW

The quality assurance plan for the CWSS encompassed specific measures to check and ensure the validity of the survey data from data collection through data processing and analysis, as well as measures to assure the quality of other survey components. A Quality Assurance Project Plan (QAPP) was developed for the survey and was approved prior to the start of data collection. The Office for Environmental Information reviewed the methodology and the data presented in the body of the report. The report results and statistical methods also were peer reviewed by subject matter experts. Drafts of the questionnaire were reviewed by Diane Moles, from the Iowa Department of Natural Resources, in Des Moines, IA, and James K. Cleland of the Drinking Water and Radiological Protection Division of the Michigan DEQ in Lansing, MI. OGWDW also consulted with Robert W. Mann of the Water Supply Engineering Bureau of the State of New Hampshire's Department of Environmental Services. Finally, the sampling design was reviewed by senior statisticians at as part of the external QAPP review, as well as by Cadmus, Abt , and within EPA; it is the same basic design used for the 1999 DWINS.

Section 4.1 discusses the questionnaire pre-test and the survey pilot test. Section 4.2 presents the measures taken to assure the quality of the statistical sample. Section 4.3 discusses the quality assurance procedures used during the data collection effort. Section 4.4 describes the data processing quality assurance procedures. The last section describes the quality assurance steps taken during the preparation of this report.

4.1 Draft Questionnaire Pre-test and Survey Pilot Test

A significant component of the survey quality assurance plan was to thoroughly test the questionnaire design, the survey design, and data collection procedures prior to implementing the full study. Confirming the validity and effectiveness of these designs, or revising them when the tests revealed problems, errors, or difficulties, led to design and process improvements that would have a positive effect on the quality of the survey in such areas as data reliability, data completeness, accuracy of the sample frame, and response rates.

4.1.1 Pre-test

When the initial data collection objectives had been identified and the questionnaire shaped into a working draft instrument, EPA conducted a pre-test of this draft with 7 water systems in New England of various sizes, including ground and surface water systems. The pre-test participants were recruited with the assistance of Ray Raposa of the New England Water Works Association. The main objective of the pre-test was to gauge the respondents' reactions to the questionnaire itself. The test did not address any of the actual survey operations and response rate issues that would later be tested in the full-scale pilot test.

The recruited systems received the questionnaire in July, 2000. EPA then convened a focus group meeting of the 7 water systems, facilitated by survey research staff from Abt Associates and Cadmus. The focus group explored questions regarding comprehensibility, use of clear and appropriate terminology, provision of suitable response categories, and questionnaire layout. The focus group also discussed respondents' ease or difficulty in providing answers, their immediate knowledge of or access to information requested by the questionnaire, and their overall reaction to the survey.

Overall, the focus group felt the questionnaire was clear and relatively easy to follow. As a result of the pre-test, some questions were re-worded, and others were shortened. Otherwise, the pre-test found no systematic problems in the respondents' ability to provide answers to the questions.

4.1.2 Pilot Test

A full scale pilot test was conducted in April and May, 2001. The pilot tested the questionnaire and the major operational components of the survey design. The results of the pilot, along with the final version of the questionnaires were delivered to EPA in May, 2001. The full on-line tracking system was developed during the pilot, and the mail-out and receipt logging procedures were finalized.

Twelve small systems and 42 medium, large, and very large systems were selected from the full sample for use in the pilot. Of these, 10 of the small systems and 26 of the medium, large, and very large systems responded. The response rate was consistent with the target rate for the survey as a whole.

As a result of the pilot, modest changes were made to the mail-out process and the instructions for systems. The pilot also resulted in changes to several questions in the questionnaires. Questions 19 (length of distribution mains) and 32 (capital improvements) were simplified. Modest changes were made to several other questions to clarify the question. The pilot also finalized the site visit protocols, and identified issues that needed to be addressed when training the site visitors.

4.2 Sampling Quality Assurance

Quality assurance of the sampling process for the CWSS involved three principal areas:

- Development of the sample frame
- Sampling specifications, and
- Use of software designed to draw complex samples.

Development of the Sample Frame. EPA conducted an extensive review of the data used for the sample frame. By starting with the data used for the 1999 DWINS frame, the 2000 CWSS was able to take advantage of the extensive data verification effort undertaken the 1999 DWINS. The 1999 DWINS frame was updated with data collected through the survey. This updated frame was

then compared to the data in SDWIS in the first quarter of 2000 to identify systems that were either added or removed from SDWIS since the DWINS was completed. The development of the frame is discussed in detail in section 2.1.

Sampling Specifications. In order to carry out the sampling processes, the survey statisticians prepared detailed specifications that served as directions for performing the sampling and as a permanent documentation of the process. The sampling plan was documented in both the supporting materials for the Information Collection Request submitted to the Office of Management and Budget, and in the Quality Assurance Project Plan. The specifications ensured the sample was drawn in conformity with the sample design and in a statistically valid manner.

Sampling Software. The CWSS sample of systems serving up to 3,300 people was drawn using SAS-based program designed to draw two-stage cluster samples of this type. The same program was used to draw the 1999 DWINS. The sample of systems serving population s of 3,301 to 100,000 was a stratified random sample and was drawn using Stata-based program to select random samples.

4.3 Data Collection Quality Assurance

Each component of the CWS survey was implemented pursuant to detailed written specifications that clearly stipulated how the design was to be implemented.

Questionnaire Design

- The various drafts of the questionnaires were the product of close review and comments by EPA, Cadmus, and outside reviewers. Improvements also were made as a result of the pre-test and pilot test.

- Questionnaire version control was maintained through the various drafts by hand-writing all changes onto the hard copy master of the current version. After the changes were made to the master word processing file, the previous hard copy version was filed. Each version was dated and serially numbered.

- The questionnaire form was designed to clarify and simplify for respondents the provision of the highly detailed and complex data required for the survey. Graphic devices were used to make the form clearer and simpler to use. The devices included type fonts and sizes, borders, and text boxes.

- Because of the difficulties small systems have with filling out complex questionnaires like the CWSS, site visitors were sent to small systems to ensure the questionnaires were filled out correctly.

Mail Data Collection

- Workers preparing the questionnaire for mailing were provided with detailed written specifications for the job and were supervised by a mail operations manager.

- Mail clerks worked in tandem to produce the packages to be mailed to each respondent. One clerk applied identification labels and assembled the packet; the second applied the corresponding address label to the mail out envelope. This procedure effectively provided a 100% check that the mailing and questionnaire labels were for the same water system.

- A survey manager conducted spot checks of the questionnaires before they were sealed to ensure the respondent was receiving the appropriate form and that the address label and CWS information label matched.

- The prepared questionnaires were counted prior to mailing to verify that the correct number of questionnaires were mailed.

- Each recipient of the mailed questionnaire was assigned an analyst who maintained contact with the water system throughout the survey. The analysts provided reminder calls and technical support to the systems. They also reviewed the data as it was received, following up with the system if there were any questions.

- Senior survey managers reviewed at least the first 25 surveys received to ensure analysts were using consistent procedures for each survey.

- The on-line tracking system ensured proper tracking and control of all questionnaires from the point of sampling until the data were entered and cleaned. In addition to supporting overall management of the project, the periodic status reports identified response rate problem areas which enabled Cadmus to take appropriate follow-up measures.

Site Visits

- Extensive training was provided to the site visitors, including on-site training at a cluster of small systems.

- Detailed instructions were provided to each site visitor regarding the conduct of the on-site surveys.

- Regular contact was maintained with all site visitors. Site visitor questions and Cadmus

responses were sent to all site visitors to ensure each received complete and consistent information.

- Each completed survey was reviewed by Cadmus staff as it was received. Follow-up instructions were provided as needed.

4.4 Expert Review of Responses

Each questionnaire was subjected to a multi-level, detailed review by Cadmus staff as it was returned by the systems. Cadmus reviewed the questionnaire for completeness and internal consistency. Systems were called if key questions were not answered or if answers were inconsistent or unclear.

Upon receipt of the completed questionnaire, the Cadmus analyst responsible for the system reviewed the survey. They identified missing information and questions or potential problems with responses. The analysts were provided training on how to evaluate a completed questionnaire, as well as written guidance for reviewing the responses. The written guidance included rules-of-thumb for internal consistency checks; these guidelines helped the analyst compare questions and identify inconsistent answers. For example, guidelines were provided on average annual water consumption per household, which were used to compare annual water production with the number of connections reported.

Guidelines were provided regarding follow-up questions for the system. If essential data on system finance, treatment, and production were missing, or if inconsistencies could not be resolved, analysts contacted the system. If detailed information was not available (e.g., revenue by customer class), analysts attempted to collect more aggregate-level data (e.g., total water sales revenue.) Analysts worked with the systems to resolve inconsistencies. Senior staff contacted systems when difficult issues arose. Changes to the questionnaire were documented and logged.

The analysts review of the surveys was itself reviewed by senior survey staff. Senior survey evaluated the analysts' reviews at the beginning of the review process, and and provided feedback to the analysts. Senior staff and water system experts provided information and answered questions throughout the data collection period.

Upon the completion of the analyst's review of a questionnaire, the completed questionnaire was then reviewed by Cadmus water system experts. Each question in the survey was subject to review. The expert review focused on the validity of the responses to each question (e.g., checking that the treatment sequence is logical), consistency across quesitons (e.g., the treatment practice is consistent with the treatment objectives), and that questions were answered and reviewed consistently across by water systems. Any further changes were documented and logged.

4.5 Data Processing Quality Assurance

The completed surveys were edited and entered into an electronic database.. The electronic data were then imported into a hierarchical database for distribution, and a statistical package for detailed analysis. Procedures were in place at every step to maintain the integrity and quality of the data.

4.5.1 Manual Editing, Coding, and Data Entry

Following the expert review, the questionnaires were subjected to a 100 percent editing review in preparation for entering the data. This editing process examined every response field on every form, to check skip patterns, clarify handwriting that would be difficult for the data entry staff to read, standardize the recording of quantitative data, and identify any potential problems, such as marginal notes or potential order-of-magnitude reporting errors in the volumetric questions. General protocols were developed to guide the data preparation staff in reviewing the forms and in handling generic problems. Data Preparation supervisors performed a 100% quality control review of edited forms before they were data entered. During the editing process any questions, including the creation of open-ended codes, that could not be answered by the general protocols were passed on to Cadmus by staff at Abt Associates for final decisions. The editing protocol was updated to reflect coding decisions.

After the initial edit, the questionnaires moved to the data entry process. Each form was entered with 100 percent verification, that is, using independent double key entry. The automated data entry program was customized to each form.

As the data were entered, the batches of entered records passed through a data cleaning process, consisting of standard computer edits that examined each variable for conformity to appropriate values or data ranges and also checked the small number of skip patterns that existed in the survey instruments. A report identified each variable for each case that failed any of these tests. A data preparation supervisor then examined the original questionnaire forms to determine whether the anomaly occurred in the original data and, if so, whether to confirm it as correct or to refer to Cadmus for resolution as described above. The standard computerized edits were repeated for all the data until no cases failed the edits, except for any that had been specifically confirmed as valid outliers during a previous review.

After all questions were edited, entered, and cleaned to the degree permitted by these processes, the resulting keyed data passed to a process of detailed automated logical edits that enabled expert staff to conduct a highly focused review of data values and relationships.

4.5.2 Automated Data Validation Checks

In preparing the final database, EPA, Cadmus, and Abt designed, produced, and analyzed a series of computer validation checks. These checks were run on the full survey database after the data were entered and passed the standard computer edits for values and ranges on a variable-by-variable basis. The checks included the following:

- Distribution frequencies for all categorical variables;
- Distribution frequencies for all continuous numerical variables formatted into four categories (non-zero responses, zero responses, legitimately skipped, and missing);
- Univariates for each continuous variable;
- Item-specific cross-tabulations of categorical variables;
- Item-specific cross-univariates of continuous data; and
- Item-specific advanced logic edits.

4.5.3 Database Quality Assurance

The final, clean survey database represented the product of the various review, editing, data entry, and data validation steps described above. Once the database was prepared, there were a number of subsequent data processing steps required to create a variety of files suitable for analyses and tabulations for the final delivery of a permanent database to EPA. The principal steps included:

- Appending needed variables from external files, including sample and contact information from SDWIS.
- Analyzing the hard copy questionnaires and the frequency distributions of continuous and categorical variables to devise rules for handling missing data.
- Zero-filling blank responses. A detailed series of rules was developed for assessing blank responses and determining whether to regard these as zeros or missing values. In general, blank quantity fields were treated as zero, except when there was external evidence in a logically related item that the response should not be zero. A detailed set of programming specifications was designed to implement these rules.
- Creating new derived variables from the survey data to categorize systems into strata comparable to the original sampling strata but based on the final survey responses

rather than the SDWIS data.

- Attaching the sample weights to the analytical file.

- For the final delivery of the database to EPA, deriving and attaching the numerous composite variables created for the production of the analytical tables in this report.

Each step was planned in advance. Detailed specifications were written to guide the programming and data processing needed to perform each step. In addition to these specifications, the processing of files and flow of data throughout these steps were planned, controlled, and documented through data flow diagrams. The diagrams are schematic representations of how files, data record, data elements, and individual data point values are handled, combined, extracted, and moved from one stage to the next. These diagrams are crucial quality assurance tools to help ensure that programmers and systems analysts have aclear an common understanding of the entire process of data management, that the processing stages fit together in a logical order and accomplish the intended objectives, and that there is an unambiguous audit trail of the condition of the data at each stage.

Version control was maintained for all computer programs, an interim stages of all data files were permanently archived. This meant that when changes were made to a program or process, it was clear which was the current version and it always was clear of sequential changes that had been made from one version to the next. It was always possible to restore any earlier version in full or to merge selected data from the old version to the new version.

The combination of the processing specifications, data flow diagrams, version control, and data archiving ensured that no process was irreversible, that it was always possible to recover from any deliberate or inadvertent changes to the data, and that the characteristics of the survey data were fully known at each processing stage.

4.5.4 Tabulation Quality Assurance

The tabulations of the results presented in the tables in this report are varied and complex. Rather than being a simple presentation of individual survey variables, each table usually presents the results of multiple calculations involving several survey variables. Many tables present several such results in a single table. There often were several different ways of defining or calculating an item of interest, and sometimes there were different direct or derived sources of data for the calculation available on the survey database. Hence, the following steps were taken to help assure that each table accurately summarized and presented the data contained in the final survey database.

- Identify important, relevant, and useful information that could be developed from analyses of the survey data;

- Design each table to effectively present the results or to juxtapose related results in the same table;

- Clearly describe the contents of each table;

- Define in detail the variables, values, formulas, and derivations that went into each calculation;

- Prepare clear and detailed data processing specifications for carrying out the tabulations according to the calculation definitions;

- Develop computer programs to process the data pursuant to the tabulation specifications;

- Review the initial tabular output for:

  - Consistency with the design of the table of contents;

  - Conformity with the definitional and programming specifications; and

  - Reasonable agreement with expected valuesbased on external measures and expert knowledge of water system operations and finance;

- Review definitions, specifications, programs, and underlying data for tabulations exhibiting data anomalies or outliers;

- Review any definitions, specifications, or programs if the review process identifies errors or the need for modifications to previous decisions; and

- Repeat previous tabulation quality assurance steps and re-run tabulations until no further unacceptable data anomalies are found.

The tabulation process was fully automated, from the underlying source data through all processing stages to the final formatted tables. There were no intermediate stages requiring manual transfer or entry of data from one stage to the next. This eliminated human transcription error. Of equal importance, it also expedited the process of successive iterations of the tabulations during the quality review process, as each time a table was produced the output data automatically were transferred into the same final table form as on the previous iteration. This ensured that any new anomalies identified in later iterations did not result from transcription errors, and allowed the review staff to focus their investigations on the table data, specifications, and programs.

4.6 Quality Assurance During Report Preparation

EPA requested comments on the survey from several independent reviewers. EPA consulted with Jeanne Bailey in the office of Regulatory Affairs at the American Water Works Association in Washington, DC. Drafts of the questionnaire were reviewed by Diane Moles, from the Iowa Department of Natural Resources, in Des Moines, IA, and James K. Cleland of the Drinking Water and Radiological Protection Division of the Michigan DEQ in Lansing, MI. EPA also consulted with Robert W. Mann of the Water Supply Engineering Bureau of the State of New Hampshire's Department of Environmental Services. As noted in the introduction to this part of the report, EPA's Office of Environmental Information reviewed the data presented in this report to ensure the findings were appropriately described and presented. Additional peer review was provided by Jan Beecher of Michigan State University and John Petersen of George Mason University.

Appendix A

Community Water System Survey

Questionnaire

United States
Environmental Protection Agency

SURVEY OF SMALL, MEDIUM, LARGE, AND VERY LARGE COMMUNITY WATER SYSTEMS

(Composite of questionnaire sent to small, medium, and large systems, and to very large systems)

OMB No. 2040-0227
Expiration date: 2/29/04

Please return this questionnaire in the enclosed Federal Express envelope

or mail to:

EPA Community Water System Survey
c/o The Cadmus Group, Inc.
135 Beaver St., Suite 2
Waltham, MA 02452

Participation in the survey is voluntary. However, as a matter of policy, EPA will not disclose the identity of any respondent to this questionnaire, nor the identity of any participating water system. While no respondent has ever claimed that the information asked for in this survey contains confidential business information (CBI), EPA will offer you the opportunity of claiming CBI in the event that we receive a Freedom of Information Act request for any data that would identify you or your system. It should be noted, however, that EPA has never received a Freedom of Information Act request for such information in prior surveys.

The public reporting and record keeping burden for this collection of information is estimated to average 2.27 hours per response or to range from 1 hour to 4 hours per respondent annually. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR Part 9 and 48 CFR Chapter 15.

If you wish, you may send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW, Washington, DC 20503, Attention: Desk Officer for EPA. Include the EPA ICR number and OMB control number in any correspondence. Do not send the completed survey to this address.

Dear Owners and Operators of Community Water Systems:

The United States Environmental Protection Agency (EPA) is conducting a national survey of drinking water systems using the attached questionnaire. About 1,500 water systems have been randomly selected to participate in this survey, and yours was one such system. This survey is conducted approximately every five years, the last one being in 1995. We are sending you this questionnaire because you were identified in your state's database (State Drinking Water Information System) as the most appropriate person to provide information about your water system. Participation in the survey is voluntary.

This survey will accomplish a number of important objectives. First, it will give us current data that will allow us to better consider the costs and benefits to water systems when we develop new national drinking water regulations. It will also allow us to measure the impact of drinking water regulations that have been put in place since the last survey. This, in turn, will help us determine more affordable approaches to drinking water treatment. Furthermore, the answers you provide in this questionnaire will help us in developing more effective programs to safeguard our nation's drinking water, provide guidance to the states and measure the effectiveness of programs already in existence, such as the Drinking Water State Revolving Fund.

As we have done in the past, EPA will only make use of the information you provide when it has been aggregated with the responses of many other water systems in the same size category as yours. We will never disclose your name or the name of your water system in any public documents. Please see the inside cover of the questionnaire if you'd like more details on how your privacy will be protected.

Answers to this questionnaire will help EPA to understand your circumstances better than any other single tool we have. If you have ever wanted to have a larger say in the development of national rules that could directly effect you and your water system, providing answers to this questionnaire is an important contribution. Because only 1,500 of you are being asked to speak for over 50,000 other systems, your voice is that much more important and will carry that much more weight. If you have ever felt that Federal regulators don't understand your situation, then please take this opportunity to tell us, in detail, just what your situation is. It will make a difference.

Sincerely,

Brian C. Rourke
Program Analyst
Standards and Risk Management Division

Please respond about:

Please return you completed questionnaire in the enclosed pre-paid Federal Express envelope by July 13, 2001

2000 Community Water Systems Survey

Small, Medium Large / Very Large Systems Questionnaire

GENERAL INSTRUCTIONS

This questionnaire asks two preliminary questions and then is divided into two parts.

PART I – OPERATING CHARACTERISTICS (Questions 3 – 25); and
PART II – FINANCIAL CHARACTERISTICS (Questions 26 – 32).

Please complete the questionnaire.

Make a copy of the completed questionnaire for your records before sealing it in the enclosed envelope.

Please include a map of your service area or delineate your service area on the enclosed map.

[VERY LARGE SYSTEMS:]
Please enclose a schematic of your system, site plans of your treatment facilities, and the latest available financial report. If the schematics, diagrams, financial or other reports contain the information requested by a question, **you may refer to the documentation rather than fill out the question**.

[SMALL/MEDIUM/LARGE SYSTEMS]:

Your are strongly encouraged to enclose schematics, diagrams, financial reports, or other information that will help provide a complete picture of your water system. If schematics, diagrams, financial or other reports contain the information requested by a question, **you may enclose and refer to the documentation rather than fill out the question**.

If you require more space to answer an question than is provided, please record the information on a photocopy of the question or use a blank sheet of your own.

1. Please provide the name, title, and telephone number of the most knowledgeable person to contact for information on:

(A) Part I – Operating Characteristics

Name: _____ Title: _____

Tel. No. _____ Fax No. _____

e-mail: _____

(B) Part II – Financial Characteristics
(Write "SAME" if same as above)

Name: _____ Title: _____

Tel. No. _____ Fax No. _____

e-mail: _____

2. This survey will ask you to provide operating and financial information for your public water system for the most recent 12-month period for which data are available. Please specify below the end dates for which data are provided.

A. Operating information . . . . . _____/_____/_____
(mm / dd / yy)

B. Financial information . . . . . _____/_____/_____
(mm / dd / yy)

Part I – Operating Characteristics

For Part I of the survey, please use the period indicated in Question 2(a) to report "last year's" operating data.

3. Please classify your water system using the following criteria *(circle one)*.

Owned or operated by a government or public agency (including government-owned systems that hire a private company to operate the system)	1
Owned privately and operated for profit primarily as a water business	2
Owned privately and not operated for profit (e.g., a homeowners association or a non-profit cooperative)	3
Owned privately and operated as a necessary part of another business (e.g., a mobile home park)	4

4. If your system is owned or operated by the government, please select one of following that best describes the form of government *(circle one)*.

A local or municipal government (e.g. towns, townships, cities, counties, boroughs, parishes, and special districts)	1
State government	2
The Federal government	3
Some other government *(Please specify)*_____	4

A. PRODUCTION and TREATMENT

5. What was the amount of water that was produced and delivered to each of the following customer categories during the last year [as defined by your answer to Question 2A]? *(In millions of gallons. Note: if you cannot distinguish among the different types of non-residential customers, enter the total for your non-residential customers in line c.4.)*

Customer Type	**Total**
a. Sold to other public water suppliers:	
1. Treated water	_____ Million Gallons/Yr.
2. Untreated water	_____ Million Gallons/Yr.
b. Residential	_____ Million Gallons/Yr.
c. Non-residential	
1. Commercial/industrial	_____ Million Gallons/Yr.
2. Agricultural	_____ Million Gallons/Yr.
3. Other *(specify)*_____	_____ Million Gallons/Yr
4. Subtotal, non-residential	_____ Million Gallons/Yr
d. Unaccounted for water not included above (including uncompensated usage and system losses)	_____ Million Gallons/Yr
e. Total, all customer types (including unaccounted for water)	_____ Million Gallons/Yr

6. Provide the name of each public water supplier included in the response to Question 5a, above.

a. Treated water _____ _____ _____

b. Untreated water _____ _____ _____

7. How much of the water reported in Question 5 came from each of the following sources during the twelve month period reported in Question 2A ? *(in millions of gallons; answer 'none' if a source does not apply).*

a. Surface water (non-purchased) *(including Ground Water Under the Direct Influence of Surface Water)* . . . . . _____ Million Gallons/Yr.

b. Ground water (non-purchased) . . . . . _____ Million Gallons/Yr.

c. Purchased water

1) Treated water . . . . . _____ Million Gallons/Yr.

2) Untreated water . . . . . _____ Million Gallons/Yr.

d. Other (*specify*)_____ _____ Million Gallons/Yr.

e. Total . . . . . _____ Million Gallons/Yr

8. What was the maximum daily water production from all sources for this utility over a single 24 hour period during the twelve month period reported in Question 2A? . . . . . _____ Million Gallons/day

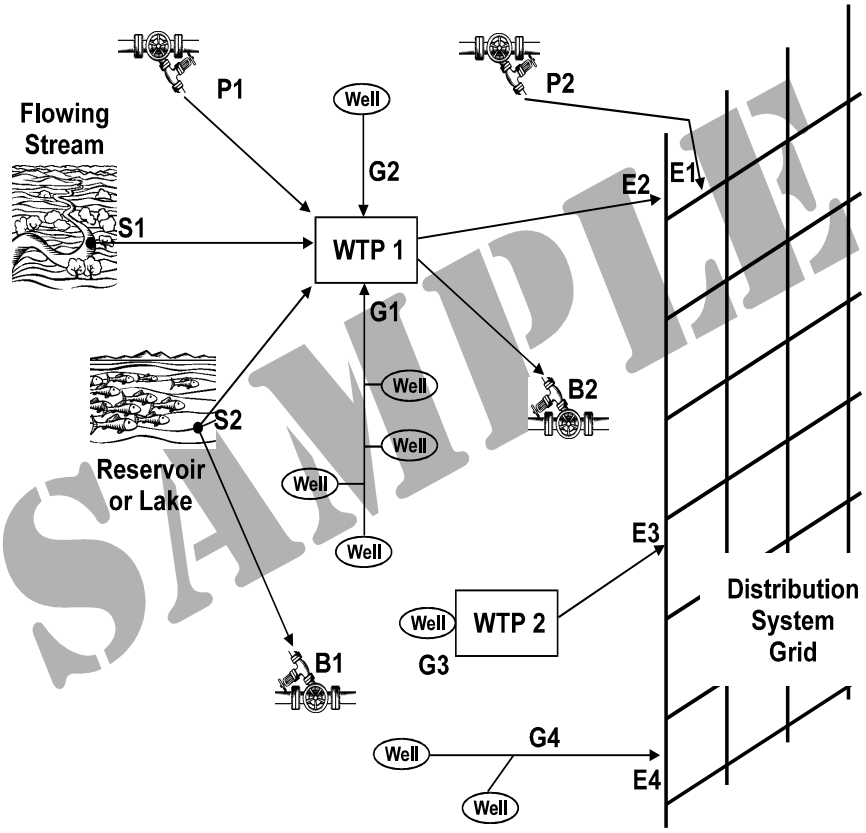
The following definitions of the components of a water system are used in this survey. Figure 1 is an example of a schematic of a water system, showing water sources, treatment plants, transmission lines, and the distribution system.

Please refer to these definitions and the schematic for an explanation of the terms used in questions 10 through 18. **Please submit diagrams or schematics, using figure 1 as a guide**.

Please note that the identifier numbers used in the questions do not refer to specific items in the schematic. For example, use 'S1' to refer to your first surface water source, regardless of whether it is a flowing stream, as depicted in the schematic, or another surface water source.

Term	Definition	Code in the Schematic
Surface water intake	A surface water intake refers to the transmission of untreated water from a surface water source (flowing stream, lake, reservoir, or ground water under the direct influence of surface water) to a water treatment plant at the utility (see accompanying diagram).	S1, S2
Ground water intake	A ground water intake refers to the transmission of untreated water from one or more wells to a water treatment plant or directly into the distribution system. Where the water from multiple wells flows through a common pipe prior to entry into the treatment plant or distribution system, the combined flow is considered one ground water intake (see accompanying diagram).	G1 – G4
Purchased water intake	A purchased water intake refers to the transmission of water from the seller's utility to a water treatment plant or directly into the distribution system of the purchaser's utility.	P1, P2
Water treatment plant	A facility where water is filtered, disinfected, and/or otherwise treated prior to its transmission into the distribution system (or its conveyance to another purchasing water utility). For the purposes of this survey, simple disinfection only or pH adjustment prior to entry into the distribution system are considered to be a water treatment plant.	WTP 1, WTP 2
Entry point	An entry point is where treated or untreated potable water enters into the utility's distribution system.	E1 – E4

Figure 1: Sample Diagram of Intakes, Treatment Plants, and Entry Points



9. Please draw your schematic here or submit a schematic on a separate sheet of paper.

10. Provide the following information for the surface water, ground water, and purchased water intakes for this utility: MGD refers to millions of gallons daily. If the source is used on a seasonal basis, the average daily amount is for the months in which water is drawn from the source.

A. Surface Source.

Surface water intake identifiers	What is the source type for each surface water intake? (circle the appropriate number)			Is this a seasonal source? (Circle 1 for yes and 2 for no)		What was the average daily amount of water drawn from each surface water intake during the reporting period in Question 2A? (MGD)	What is the estimated potential maximum daily amount of water that can be drawn from each surface water intake, given water availability constraints only (e.g. source capacity contractual obligations, permits, or legal constraints)? (MGD)*	What is the estimated potential maximum daily amount of water that can be drawn from each surface water intake, given current pumping and equipment constraints only (e.g. system components and physical constraints)? (MGD)
	Flowing stream	Reservoir or lake	Ground-water under the direct influence of surface water	Yes	No			
S1	1	2	3	1	2			
S2	1	2	3	1	2			
S3	1	2	3	1	2			
S4	1	2	3	1	2			
S5	1	2	3	1	2			
* If not limited enter "no limit" here.				**Q10A Totals**				

B. Ground water source.

Ground water wells	How many individual wells supply each ground water intake?	*[Very Large Systems Only]:* What is the average well depth? (In feet)	*[Very Large Systems Only]:* Is the intake a confined aquifer? (Circle 1 for yes or 2 for no e.g. unconfined)		Is this a seasonal source? (Circle 1 for yes and 2 for no)		What was the average daily amount of water drawn from each groundwater well during the reporting period in Question 2A? (MGD)	What is the estimated potential maximum daily amount of water that can be drawn from each groundwater well, given water availability constraints only (e.g. source capacity contractual obligations, permits, or legal constraints)? (MGD)*	What is the estimated potential maximum daily amount of water that can be drawn from each goundwater well, given current pumping and equipment constraints only (e.g. system components and physical constraints)? (MGD)
			Yes	No	Yes	No			
G1			1	2	1	2			
G2			1	2	1	2			
G3			1	2	1	2			
G4			1	2	1	2			
G5			1	2	1	2			
* If not limited enter "no limit" here.					**Q10B Totals**				

C. Purchased water source.

Purchased water intake identifiers	Provide the names of the sellers for this water	Is this a seasonal source? (Circle 1 for yes and 2 for no) Yes	No	What was the average daily amount of water drawn from each purchased water intake during the reporting period in Question 2A? (MGD)	What is the estimated potential maximum amount drawn from each purchased water intake given water availability constraints only (e.g. source capacity contractual obligations, permits, or legal constraints)? (MGD)*	What is the estimated potential maximum amount drawn from each purchased water intake, given current pumping and equipment constraints only (e.g. system components and physical constraints)? (MGD)
P1		1	2			
P2		1	2			
P3		1	2			
P4		1	2			
P5		1	2			
	Q10C Totals					
	Totals for all intakes Q10A-Q10C (MGD)					

* If not limited enter "no limit" here.

11. Does your system provide treatment? *(Circle one)*

Yes 1

No *(go to Question 18)* 2

12. Provide the following information for each water treatment plant or other facility at this utility. Design Capacity refers to the maximum amount the plant can produce in a single 24 hour period with all treatment trains operating at capacity. Peak daily production refers to the maximum amount produced in a single day over the twelve month reporting period in Question 2A. *Please submit site plans and flow charts of each treatment facility in your water system.*

Water treatment plant identifiers	List all of the surface, ground, and purchased water intake identifiers from Question 10 that feed into each water treatment plant or other facility.	What was the average daily production for each water treatment plant or other facility? (MGD)	What was the peak daily production for each water treatment plant or other facility? (MGD)	What was the design capacity for each water treatment plant or other facility? (MGD)
WTP1				
WTP2				
WTP3				
WTP4				
WTP5				

Note: WTP refers to a treatment plant or any other facility that provides treatment.

13. Using the water treatment plant identifiers from Question 12, indicate which water treatment objectives apply to each plant. *(Circle 1 for Yes and 2 for No).*

	Do you have this treatment objective in the following water treatment plant? (use the plant number from Question 12)									
	WTP1		WTP2		WTP3		WTP4		WTP5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Algae control	1	2	1	2	1	2	1	2	1	2
Corrosion control	1	2	1	2	1	2	1	2	1	2
Disinfection	1	2	1	2	1	2	1	2	1	2
Dechlorination	1	2	1	2	1	2	1	2	1	2
Oxidation	1	2	1	2	1	2	1	2	1	2
Iron removal	1	2	1	2	1	2	1	2	1	2
Manganese removal	1	2	1	2	1	2	1	2	1	2
Fluoridation	1	2	1	2	1	2	1	2	1	2
Taste/odor control	1	2	1	2	1	2	1	2	1	2
TOC removal	1	2	1	2	1	2	1	2	1	2
Particulate/Turbidity Removal	1	2	1	2	1	2	1	2	1	2
Softening (hardness removal)	1	2	1	2	1	2	1	2	1	2
Recarbonation	1	2	1	2	1	2	1	2	1	2
Organic contaminant removal (e.g., VOCs, pesticides)	1	2	1	2	1	2	1	2	1	2
Inorganic contaminant removal (e.g., arsenic)	1	2	1	2	1	2	1	2	1	2
Radionuclides contaminant removal	1	2	1	2	1	2	1	2	1	2
Other (*specify*)_____	1	2	1	2	1	2	1	2	1	2

14 A. Using the Water Treatment plant identifiers from Question 12, characterize the treatment used and the sequence of treatment for each plant by entering a number to identify the order in which each treatment process occurs for each water treatment plant. *(See example. If you have the option of more than one treatment type for a single step – e.g., you can use either chlorine or chlorine dioxide for disinfection – assign the same sequence number to each alternative).*

		Water Treatment Plant Number (from Question 12)				
Treatment Category	**Example**[1]	**WTP1**	**WTP2**	**WTP3**	**WTP4**	**WTP5**
Chlorination only						
Raw water storage/Presedimentation basin						
Predisinfection/oxidation prior to sedimentation						
Chlorine	2					
Chlorine dioxide						
Chloramines						
Ozone						
Potassium permanganate	3					
Other Predisinfection						
Predisinfection/Oxidation prior to filtration						
Chlorine						
Chlorine dioxide						
Chloramines						
Ozone						
Potassium permanganate						
Other Predisinfection						
Rapid mix						
Coagulation/ Flocculation						
Polymers						
Settling/Sedimentation	4					
Softening						
Lime/soda ash						
Recarbonation						
Ion exchange						
Filtration						
Direct filtration						
Micro strainer						
Slow sand						
Bag and Cartridge						
Rapid sand						
Green sand	5					
Diatomaceous earth						
Dual/Multi media						
Pressure filtration						
Other (specify)						
Post-disinfection after filters						
Chlorine	7					
Chlorine dioxide						
Chloramines						
Ozone						
UV						
Other post disinfection						
Clearwell						

		Water Treatment Plant Number (from Question 12)				
Treatment Category	**Example**[1]	**WTP1**	**WTP2**	**WTP3**	**WTP4**	**WTP5**
Membranes						
Reverse osmosis						
Micro filtration						
Ultrafiltration						
Nanofiltration						
Corrosion Control						
Miscellaneous						
Ion exchange						
Granular activated carbon						
Activated Alumina						
Aeration	1					
Other (*please specify*)	6					

1. This is an example of a green sand filter plant for treating ground water for Iron and Manganese removal. In this example ‘other ‘ is contact basin.

B. Using the Water Treatment plant identifiers from Question 12, indicate which filter backwash techniques you use for each treatment plant that uses filtration. (*Check all that apply*).

		Water Treatment Plant Number (from Question 12)				
Filter backwash	**Example**	**WTP1**	**WTP2**	**WTP3**	**WTP4**	**WTP5**
Air scouring						
Surface wash	x					
Recycle filter backwash						
Filter to waste	x					
Other filter backwash	x					
None						

[QUESTION 15 ASKED OF VERY LARGE SYSTEMS ONLY]

15. Using the identifiers from questions 10 and 12, please list the intake or entry point identifier number and concentration for each water quality parameter (contaminant) for the reporting period recorded in Question 2A. If you conducted multiple tests of a source over the reporting period, report the average concentration. If you did not test for a contaminant mark N/A; if you did not detect a contaminant mark ND. If you require additional space for entry points/well identifiers please attach an additional sheet.

A. Using the source identifiers from questions 10, please provide **raw water concentration** in units of parts per million (ppm) for each compound:

Intake Identifier	**Raw Water Concentration (units- ppm, except Radon - pCi/L)**								
	Arsenic	Radon	MTBE	Atrazine	Metolachlor	Boron	2,4-D	Simazine	Glyphosate
Example 1: G-1/W-1	<0.002	N/A	N/A	N/A	N/A	N/A	ND	0.001	0.01
Example 2: G-1/W-2	0.002	100	N/A	0.002	N/A	N/A	ND	ND	ND

B. Using the treatment plant identifiers from question 12, please provide **post-treatment concentration** in units of parts per million (ppm) for each compound:

Entry Point Identifier	**Treated Water Concentration (units- ppm, except Radon - pCi/L)**								
	Arsenic	Radon	MTBE	Atrazine	Metolachlor	Boron	2,4-D	Simazine	Glyphosate
Example 1: WTP-1	<0.002	N/A	N/A	ND	N/A	N/A	ND	0.001	0.01
Example 3: WTP-2	0.002	ND	N/A	ND	N/A	N/A	ND	ND	ND

16 A. Using the water treatment facility identifiers from Question 12, indicate if the specified residuals management practices are used and provide the requested information regarding potential discharge. (*Circle 1 for Yes and 2 for No*).

	Do you use the following residual management process in the following water treatment plants? (use the water treatment plant numbers from Question 12)									
Residual Management	**WTP1**		**WTP2**		**WTP3**		**WTP4**		**WTP5**	
Category	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Mechanical dewatering	1	2	1	2	1	2	1	2	1	2
Non-mechanical dewatering	1	2	1	2	1	2	1	2	1	2
Chemical precipitation	1	2	1	2	1	2	1	2	1	2
Land application	1	2	1	2	1	2	1	2	1	2
Nonhazardous waste landfill	1	2	1	2	1	2	1	2	1	2
Deep well injection	1	2	1	2	1	2	1	2	1	2
Evaporation pond	1	2	1	2	1	2	1	2	1	2
French drain	1	2	1	2	1	2	1	2	1	2
Direct discharge to surface water	1	2	1	2	1	2	1	2	1	2
If no, is direct discharge to surface water an option?	1	2	1	2	1	2	1	2	1	2
Septic system	1	2	1	2	1	2	1	2	1	2
If no, is discharge to a septic system an option?	1	2	1	2	1	2	1	2	1	2
Sanitary sewer	1	2	1	2	1	2	1	2	1	2
If no, is discharge to a sanitary sewer an option?	1	2	1	2	1	2	1	2	1	2

B. Please describe any current limitations on the use of direct discharge to surface water, septic systems, and discharge to sanitary sewer for residuals management at any of the water treatment plants at this utility.

17. Using the water treatment plant identifiers from Question 12, provide the following information regarding operators and SCADA usage at each water treatment plant at this utility. *(SCADA Supervisory Control and Data Acquisition system is an automated system for monitoring, controlling, and /or transmitting information on water treatment plant processes).*

Operator Information	Water Treatment Plant (use the water treatment plant numbers from Question 12)									
	WTP1		**WTP2**		**WTP3**		**WTP4**		**WTP5**	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1. Is there an operator on-site 24 hours per day seven days per week? *(Circle yes or no)*	1	2	1	2	1	2	1	2	1	2
2. If the above answer is no, estimate the total number of hours per week that an operator is on site	_____		_____		_____		_____		_____	
3. Is there a SCADA in use for process monitoring? *(Circle yes or no)*	1	2	1	2	1	2	1	2	1	2
4. Is there a SCADA in use for process control? *(Circle yes or no)*	1	2	1	2	1	2	1	2	1	2

B. STORAGE AND DISTRIBUTION SYSTEM INFORMATION

18. Please indicate whether you have the following types of treated-water storage, and if so, the number of storage facilities and their capacity, in millions of gallons.

		Yes	**No**	**If yes, what is the total capacity of the storage (in millions of gallons)?**
A.	Do you have clearwell storage after treatment?	1	2	_____
B.	Do you have storage after treatment (and after clearwell, if any), but before the distribution system with dedicated entry and exit points?	1	2	_____
C.	Do you have storage after treatment (and after clearwell, if any), but before the distribution system with a common inlet and outlet (i.e., rides the line)	1	2	_____
D.	Do you have storage within the distribution system with dedicated entry and exit points?	1	2	_____
E.	Do you have storage within the distribution system with a common inlet and outlet (i.e., rides the line)?	1	2	_____

19 A. Estimate the length of the distribution mains pipe in your system, and length of pipe replaced in the last five years.

Pipe Diameter	Length of Pipe (In Miles)	Length of Pipe Replaced in the Last 5 Years[1] (In Miles)	Total Cost of Pipe Replaced in the Last 5 Years[1] (In Dollars)
Less than or equal to 6"			
Greater than 6" but less than or equal to 10"			
Greater than 10"			

1.Ending on the date shown in your answer to Question 2A.

B. What percentage of the total length of pipe in the distribution system is less than 40 years old, between 40 and 80 years old, and more than 80 years old? (*The percentages should total 100 percent*.)

1. Less than 40 years old . . . . . _____%
2. Between 40 and 80 years old . . . . . _____%
3. More than 80 years old . . . . . _____%

20. A. How many people and connections does your system currently serve **year round**? Please indicate the number of connections and number of people served by your system for all customer types that apply. *(If you cannot distinguish among the different types of non-residential customers, enter the total for your non-residential customers in line c.4.*)

Customer Type	Connections	Number of People
a. Sold to other public water suppliers		
1. Treated water	[redacted]	
2. Untreated water		
b. Residential		
c. Non-residential		[redacted]
1. Commercial/industrial		
2. Agricultural		
3. Other *(specify)*_____		
4. Subtotal, non-residential		

[QUESTIONS 20 B. AND 20 C. ASKED OF SMALL, MEDIUM, LARGE SYSTEMS ONLY]

B. Does your system serve a residential population that changes on a seasonal basis (for example, is it a winter or summer resort area)? *(Circle one)*

Yes 1

No *(Go to Question 21)* 2

C. If your system serves a population that changes on a seasonal basis, please indicate the highest seasonal number of people (residential only), the highest number of residential connections and the number of months each year during which the seasonal population is the highest.

1. Highest seasonal population . . . . . _____
2. Highest number of seasonal residential connections . . . . . _____
3. Number of months when seasonal population is highest . . . . _____

21. Please enclose a map of your service area

C. CROSS CONNECTION CONTROL

22. Does your system have a cross connection control (CCC) program? *(Circle one)*

Yes 1

No *(Go to Question 26)* 2

Don't Know *(Go to Question 26)* 3

23. Please indicated the type of program your system has. *(Circle one)*

Containment	(A program that is designed to prevent backflow from reaching a publicly owned distribution system, but does not provide protection within the premises. This often is referred to as providing protection up to the meter.)	1
Containment and isolation	(A program that is designed to prevent backflow from reaching a publicly owned distribution system and provides protection within a customer's premises. This often is referred to as providing protection up to the tap.)	2

24. Please indicate which elements are included in the CCC program:
(Circle 1 for "yes" and 2 for "no")

Cross Connection Control Program Elements	Does your program include this element? Yes	 No
a. Right of entry	1	2
b. Surveys/inspections to identify cross connections within the system/facility	1	2
c. Policy specifying which service connections must be equipped with backflow prevention device/assemblies	1	2
d. Enforcement authority to install devices/assemblies.	1	2
e. Enforcement authority to test assemblies	1	2
f. Penalties for non-compliance with ordinance	1	2
g. Public education programs	1	2
h. Training/certification of testers and inspectors	1	2

25. What percentage of backflow prevention assemblies that are tested fail annually during inspection?
(*An assembly is a device that can be tested)* . . . . . _____%

Part II – Financial Characteristics

Reporting period: For Part II of the survey, please use the period indicated in Question 2(B) to report "last year's" financial data.

Providing estimates: Please provide exact information from your system's records. Otherwise, provide your best estimate of financial information that is applicable to your drinking water system.

If your system is a joint drinking water/wastewater facility, please be careful to record only data that are relevant to the drinking water part of the facility. If data for the drinking water part of the facility are not kept separately, please provide your best estimate of the share that is attributed to drinking water.

Rounding: Please record your dollar amounts to the nearest dollar. Do NOT record cents.

26 A. During the last year [as defined in your response to Question 2(B)] what were your drinking water system's revenues from water sales for each of the following customer categories.
(If zero, enter "0". Note: if you cannot distinguish among the different types of non-residential customers, enter the total for your non-residential customers in line d.)

	Water Sales Customer Categories	**Water Sales Revenues**
1.	Sold to other water suppliers	
	a. Treated water	$_____
	b. Untreated water	$_____
2.	Residential	$_____
3.	Non-residential	
	a. Commercial/industrial	$_____
	b. Agricultural	$_____
	c. Other *(please specify)*_____	$_____
	d. Subtotal, nonresidential (a - c)	$_____
4.	Total water sales revenues (1-3)	$_____

B. Please indicate your water system's revenues during the last year from other water-related revenue sources. *(If zero, enter '0')*

		Water-related Revenues
5.	Connection fees	$_____
6.	Development fees	$_____
7.	General fund revenues (e.g., from municipalities)	$_____
8.	Other water revenues not reported in the categories above (e.g., fines, penalties, other fees) (*Please specify)*_____	$_____
9.	Total water-related revenues	$_____

C. Please indicate your total water system revenues from lines 4 and 9 above.

10. Total water system revenues (lines 4 + 9) . . . . . $_____

[QUESTION 27 ASKED OF SMALL, MEDIUM, AND LARGE SYSTEMS ONLY]

27. If your primary business is not water-related and you reported no revenues in Question 26 A or B, please indicate the revenues you receive from your primary, non-water related business, including rental income and the sale of other goods or services . . . . . $_____

Note: Questions 28 - 30 Refer to Residential Customers Only

28. What is the average annual bill for a residential customer? . . . . . $_____

29. Please identify your drinking water system's billing structure for residential customers *(circle all that apply)*.

	Billing structure (Circle all that apply)
Metered charges	
Uniform rates	1
Declining block rate	2
Increasing block rate	3
Peak period rate (e.g., seasonal)	4
Unmetered charges	
Separate flat fee for water	5
Combined flat fee for water and other services (e.g., rental fees, associate feeds, pad fees)	6
Other billing methods (*Please specify*)_____	7

30 A. Does your system use rates that may lower the cost of drinking water for low-income or fixed-income households? (e.g., lifeline rates) *(Circle one)*?

Yes 1

No *(Go to Question 31)* 2

B. If your system uses rates that lower the cost of drinking water for low-income or fixed-income households, please answer the following:

1. How many households receive these rates? . . . . . _____ (Number of households)
2. What is the highest annual income that qualifies for these rates? . . . . . _____ (Dollars per year)
3. How much does it cost your system to provide these rate reductions (i.e., what is the total dollar amount of the reductions)? . . . . . _____ (Dollars per year)

31. Question 31 is intended to account for all of your drinking water expenses related to the revenues referred to in question 26 A and B.

A. Please enter the number of people employed by your drinking water system and your system's total compensation expenses (including direct compensation and fringe benefits) in the last year: If your system is operated by or employs a contractor, enter the number of contract employees and total expenses of the contractor on line 2.

	Last year's employment and compensation	
	1. Number of Employees	**2. Total Expenses, including fringe benefits (in Dollars)**
1. Employment and employee expenses	_____	$_____
2. Contractor expenses	_____	$_____

B. Please enter other routine operating expenses in the last year *(in dollars)* . . . . . $_____

C. Please enter the amount of debt service expenditures in the last year for borrowing to finance capital expenses (i.e., excluding expenditures for borrowing to finance operating expenses, *in dollars)* . . . . . $_____

D. Please enter the amount of other expenses (excluding operating and debt service expenses reported in Parts A, B, and C, but including any debt service expenditures for borrowing to finance operating expenses) in the last year *(in dollars)* (*Please specify*)_____ . . . . . $_____

E. Total expenses, Parts A through D. *(in dollars)* . . . . . $_____

32. A. If you have paid for major capital improvements, repairs, or expansion in the last five years ending on the date reported in Question 2B, allocate those expenditures to the following categories.

	Type of Expense	Total
1.	Land	$
2.	Water source	$
3.	Distribution and transmission system	$
4.	Treatment	$
5.	Storage	$
6	All other not included above	$
7.	Total capital expenses	$

B. What percent of the total capital expenditures from Line 7 of Part A was for water quality improvement, replacement or major repair, or system expansion.? (*The percentages should total to 100 percent.*)

1. Water quality improvements _____ %
2. Replacement or major repair _____ %
3. System expansion _____ %

C. How were the total expenses from Line 7 in Part A funded?

	Source of funds	Percentage of capital expenses funded from each source *(Should sum to 100%)*	Average Interest Rate
1.	Current revenues	%	
2.	Grants from the Drinking Water State Revolving Fund	%	
3.	Other government grants (either Federal or State)	%	
4	Borrowing from the Drinking Water State Revolving Fund	%	%
5.	Borrowing from other public sector sources (e.g., state or regional authorities)	%	%
6.	Borrowing from private sector sources (e.g., banks or the bond market)	%	%
7.	Other *(please specify)*_____	%	%

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