

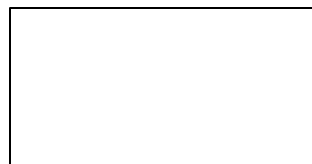
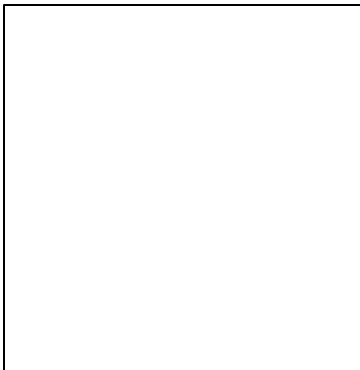
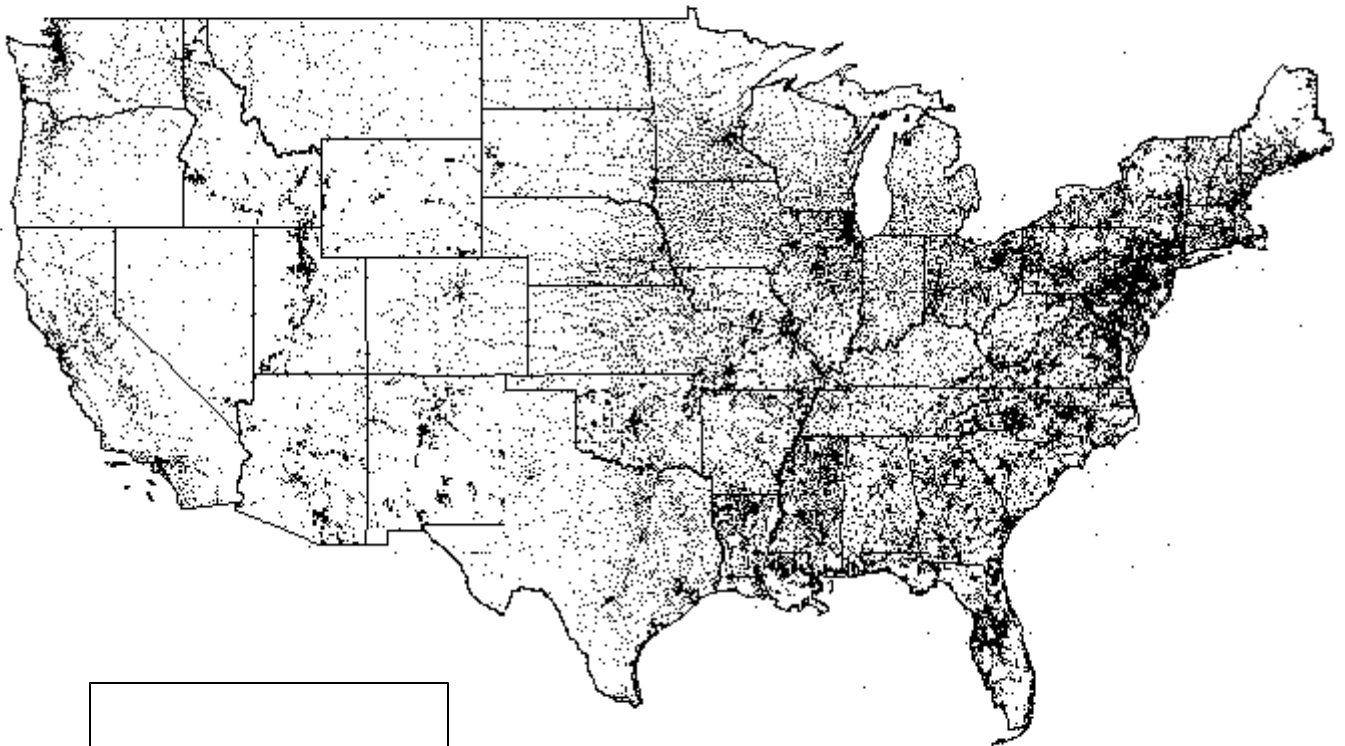
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Office of Water (4606)

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# National Characteristics of Drinking Water Systems Serving Populations Under 10,000



# **National Characteristics of Drinking Water Systems Serving Populations Under 10,000**

This document was prepared to support the deliberations of  
the National Drinking Water Advisory Council's  
Small Systems Implementation Working Group  
(members listed on page vi)

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## EXECUTIVE SUMMARY

This report addresses questions raised by the National Drinking Water Advisory Council's Small Systems Working Group concerning the characteristics of small drinking water systems in the United States. The report is a national characterization based on existing data and therefore may not discuss issues particular to any one State or environment. The data in the report were drawn primarily from three sources: the 1995 *Community Water System Survey*, the 1995 *Drinking Water Infrastructure Needs Survey*, and FY98 data from the *Safe Drinking Water Information System* (SDWIS).

The report is divided into 8 sections:

1. Introduction
2. Ownership Characteristics
3. Operating Characteristics
4. Financial Characteristics
5. Infrastructure Needs
6. Compliance and Violations
7. Noncommunity Water Systems
8. Missing Data

## Findings

Principle conclusions are summarized below:

### Inventory

- There are 54,367 community water systems (CWSs), serving about 253 million people. Approximately 93 percent of CWSs are small systems serving fewer than 10,000 persons. Although these small systems comprise the significant majority of CWSs, they serve just 20 percent of the population served by CWSs.
- There are 20,255 nontransient, noncommunity water systems (NTNCWSs), serving about 6 million people.
- There are 95,754 transient, noncommunity water systems (TNCWSs), serving approximately 17 million people.
- For the purposes of this report, small systems are defined as CWSs, NTNCWSs, and TNCWSs that serve fewer than 10,000 persons.

### Ownership Characteristics

- Ownership type and system size are related. Most systems serving 500 or fewer people are ancillary or privately owned systems, while most larger systems are publicly owned.

### Operating Characteristics

- The smallest systems (systems serving under 501 persons) appear to have experienced little growth in service population between 1990 and 1994. The only evident growth was found in the number of systems serving 101 to 500 persons, which increased by only 2.5 percent in median connections for this period.
- The largest growth in service population among small systems was found in those serving 3,301-10,000 persons. Between 1990 and 1994, systems in this size category experienced a 10 percent increase in the number of connections and an 11.1 percent increase in customers.
- A system's water source is a key factor in determining operating characteristics, and source corresponds closely to system size. Larger systems are more likely to use surface water or purchased water as their primary source, whereas most small systems use ground water.
- Production per connection increases steadily as system size increases. This increase in production per connection is likely indicative of the differences between the customer bases of larger and smaller systems. Large systems tend to have a higher percentage of industrial, commercial, and agricultural customers, whereas small systems serve primarily residential customers, who, as a group, generally use less water.
- Publicly owned systems serving less than 500 persons generally receive more technical assistance than privately owned or ancillary systems of the same size.
- Through source water protection and wellhead protection programs, water systems can improve the quality of their water, decrease the likelihood of waterborne disease outbreaks, and reduce the need for future capital expenditures for treatment facilities and equipment. The importance of source water protection is highlighted by the finding that 93 percent of groundwater systems serving 1,001-3,300 persons and 83 percent of those serving less than 1,001 persons have a potential source of contamination within 2 miles of their well(s).

### Financial Characteristics

- More than 50 percent of systems serving 25 to 100 persons do not keep separate income and expense statements. This may be attributed to the large number of systems in this size category that are ancillary systems and, therefore, do not provide water as their primary business. Ancillary systems typically do not record water-related expenses separately.

- Water systems' total water revenues are generated from water sales, fees, fines, and general fund revenues. Systems can also generate revenues from other non-consumption based charges such as interest earnings. Ancillary systems usually do not generate water sales or water-related revenue. Rather, revenue is generated by the principal business of the system of which the provision of water is merely an ancillary function. Water rates are the primary mechanism through which customers are charged for service and the main vehicle through which non-ancillary systems generate revenue.

- Median total water revenue per connection for the smallest CWSs (serving 25-100 persons) is \$0, indicating that at least half of the smallest systems do not charge for water through rates or fees.

- Revenues per connection across all revenue categories are higher for surface water systems, perhaps reflecting the greater technical complexity generally associated with surface water sources.

- Unmetered systems tend to be very small systems; only 37% percent of all connections served by systems serving 25-100 persons are metered.

- For systems serving fewer than 10,001 persons, median expenditures per connection increase as system size increases for all ownership types.

### Infrastructure

- Small systems have more than 3 times the per-household need of large systems. The small systems need is \$3,300 per household until the year 2015. Transmission and distribution is the largest category of need cited by small systems.

- Over 60 percent of small systems also report need in source development, often because their sources are threatened by contamination or supply problems.

### Compliance and Violations

- Systems serving 25-500 persons have many more violations per 1,000 people than do any other size category of systems. This is true for CWSs, NTNCWSs, and TNCWSs. Of particular note are MCL violations which, like other types of violations, decrease in frequency with system size. For every one million customers of CWSs serving 500 or fewer people (of which 39% are ancillary systems), there are approximately 800 MCL violations and 7,164 total violations. In contrast, for systems serving over 10,000 persons, there is approximately 2 MCL violations and 10 total violations per one million customers.

## Noncommunity Water Systems

- NOTE: The Community Water System Survey (CWSS) provided a unique opportunity to review data for a variety of system sizes and ownership types. No similar survey exists for non-community water systems (NCWS). Therefore, because SDWIS is the primary source of information on these systems, analysis is limited to information contained in that database, which is largely inventory and compliance data available from SDWIS.

- Over 97 percent of NTNCWSs serve fewer than 3,301 people and most NTNCWSs have large service populations per connection.

- TNCWSs serving 3,300 or fewer persons account for over 99 percent of violations committed by TNCWSs. Of these violations, almost 97 percent were committed by systems serving fewer than 501 persons. Most of these violations were monitoring and reporting.

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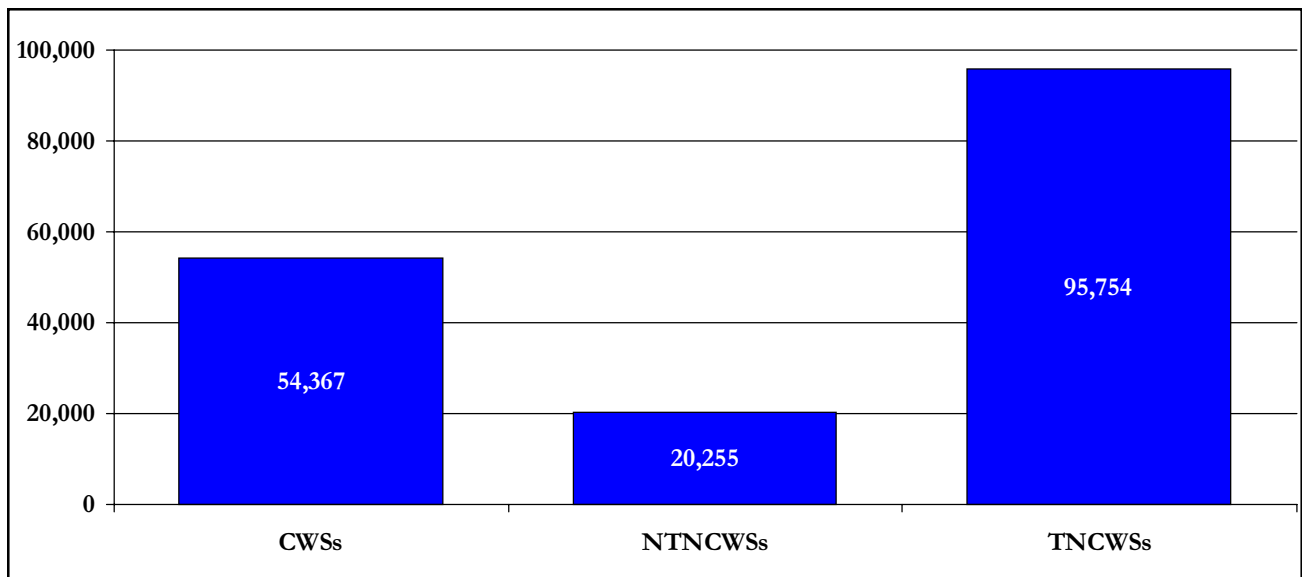
\* Due to other professional obligations, Ms. Kiesling withdrew from NDWAC and the working group during its early deliberations.



# Section 1: INTRODUCTION

According to FY98 data obtained from the Safe Drinking Water Information System (SDWIS) database, there are 170,376 public water systems (PWSs) in operation in the United States. **A PWS is a “system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. A public water system is either a community water system or a noncommunity water system.” (40 CFR §141.2)**

**Figure 1.1: Number of Systems by System Type**  
Source: SDWIS FY98Q4 Frozen Inventory Table (Data from Table 1)

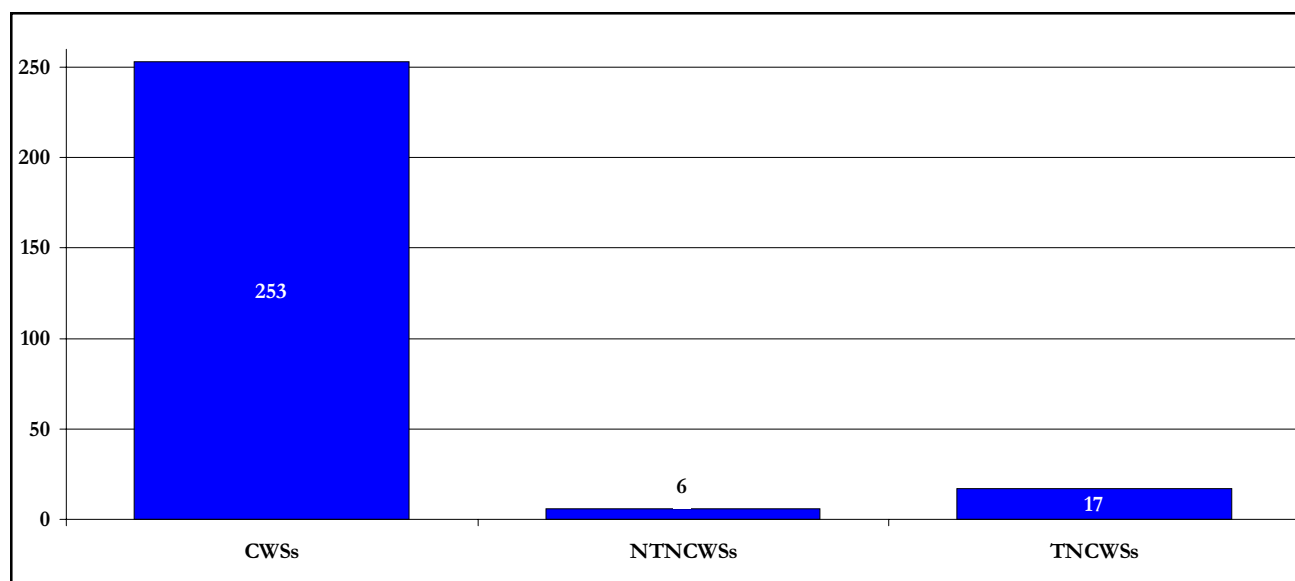


**A community water system (CWS) is “a public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.” (40 CFR §141.2)** There are 54,367 CWSs (Figure 1.1) serving about 253 million people (Figure 1.2). CWSs can be privately owned or publicly owned. A substantial number of privately owned systems are ‘ancillary’ systems that provide water as an ancillary function of their principal business. Mobile home parks are common examples of ancillary systems.

A noncommunity water system (NCWS) is a PWS that is not a CWS. Noncommunity water systems are divided into nontransient (NTNCWSs) and transient (TNCWSs) systems. **A NTNCWS is a PWS that “regularly serves at least 25 of the same persons over 6 months per year.” (40 CFR §141.2)** Examples of NTNCWSs are schools, factories, office and industrial parks, and major shopping centers. The 20,255 NTNCWSs (Figure 1.1) across the nation serve about 6 million people (Figure 1.2). Many of these systems are privately owned.

**Figure 1.2: Number of People Served by System Type (in millions)**

Source: SDWIS FY98Q4 Frozen Inventory Table (Data from Table 1)

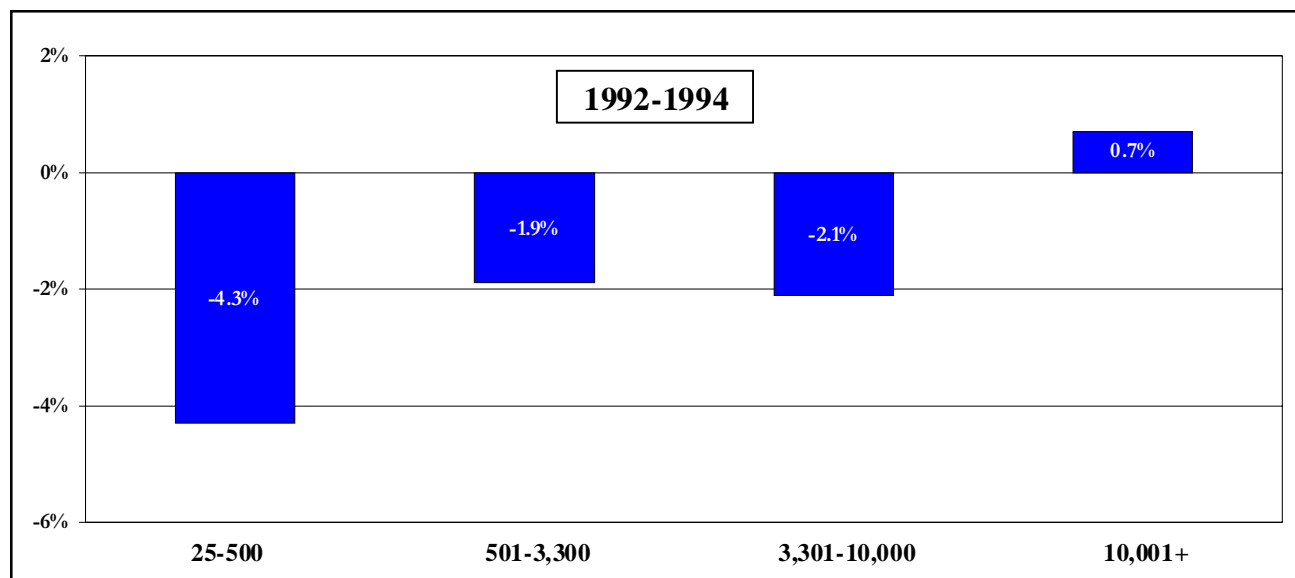


A TNCWS is a PWS that “does not regularly serve at least 25 of the same persons over 6 months per year.” (40 CFR §141.2) Examples of TNCWSs are highway rest stops, small restaurants, and recreation areas. The 95,754 TNCWSs (Figure 1.1) serve approximately 17 million people (Figure 1.2).

Figure 1.3 illustrates the net change in the number of systems from 1992-1994. EPA data from the 1994 National Compliance Report (NCR) show that the largest decrease in the number of CWSs by size category is found in systems serving fewer than 500 persons, a decrease of 4.3%.

**Figure 1.3: Percent Change in the Number of CWSs by System Size**

Source: 1994 National Compliance Report (Data from Table 2)



Three factors contributed to the overall decline in the number of small systems: interconnection of systems; systems terminating operation; and corrections in the inventory of systems. In contrast to small systems, there was modest growth in larger CWSs, with a 0.7 percent increase in the number of systems serving over 10,000 people between 1992 and 1994. There has been a 3.3 percent overall decline in the number of CWSs nationwide.

This report addresses the characteristics of PWSs in general and CWSs in particular. Approximately 93 percent of CWSs serve fewer than 10,000 persons. Although these systems comprise a significant majority of CWSs, they serve only 20 percent of the total population served by CWSs. For the purposes of this report, small systems will be defined as those systems serving fewer than 10,000 people. These small systems differ from their larger counterparts in many important aspects. This report highlights the differences between small and large systems in ownership, operating characteristics, financial characteristics, infrastructure needs, and compliance with National Primary Drinking Water Regulations (NPDWRs). Noncommunity systems, which are not included in many of the national surveys that furnish data on water systems, are dealt with separately at the end of this report. It is important to keep in mind that the small system information in this report is a national characterization based on existing data. Therefore, the report may not reflect characteristics of small systems in specific environments or situations.

Most of the data for this report were drawn from the three sources outlined below:

#### *Community Water System Survey*

EPA conducted the 1995 *Community Water System Survey* to provide data necessary for the development and evaluation of drinking water regulations. The survey was completed in two phases. Phase one involved a preliminary survey and instrument sampling plan, which was followed by a pretest of nine water systems. Computer-assisted telephone interviews were then conducted to determine system eligibility and appropriate respondents for the pilot test and mail questionnaire. The second phase of the survey was a mailing of 3,700 questionnaires. Water systems were asked to respond to questions concerning operating and financial characteristics, including questions regarding source, treatment, distribution, operator certification, revenues, and expenses. Approximately 54 percent of eligible participants completed the questionnaire.

#### *Drinking Water Infrastructure Needs Survey*

EPA's Drinking Water Infrastructure Needs Survey was conducted in 1995 to document the infrastructure needs of the nation's CWSs for the 20-year period from January 1995 through December 2014. Infrastructure needs were grouped into four categories: source, treatment, storage, and transmission and distribution.

Systems were divided into three size classifications: large (serving more than 50,000 people), medium (serving 3,301-50,000 people), and small (serving fewer than 3,300). All large CWSs received mailed questionnaires. Infrastructure needs for medium and small CWSs were estimated using statistical surveys. To identify needs of medium systems, a portion of the medium sized

systems were surveyed by mailed questionnaire. To determine the needs of the small drinking water systems, EPA staff and contractors conducted site visits. Needs of the sampled systems were extrapolated to estimate total need for medium and small systems. The most common documentation of CWS needs was found in capital improvement plans and engineering reports.

*Safe Drinking Water Information System (FY98 data)*

The Safe Drinking Water Information System (SDWIS), maintained by EPA, is a database containing information on public water systems throughout the United States. It contains a variety of historical and current data on compliance, enforcement, and water system inventory—required and non-required information. Each State uploads information individually. Data can be accessed by the public through the World Wide Web.

Most of the SDWIS data in this report was drawn in November 1998. Limited data comes from the 1994 *National Compliance Report* and the precursor to the SDWIS database (known as FRDS).

## Section 2: OWNERSHIP CHARACTERISTICS

All CWSs serve the public, but not all of them are publicly owned. The percentage breakdown of ownership for all CWSs is depicted in Figure 2.1. Only forty-three percent of CWSs are publicly owned. This group comprises water systems that are owed by municipalities, townships, counties, water districts, and water authorities. On the other hand, the vast majority of water system customers, about 84 percent, receive their water from publicly owned systems (Figure 2.2); publicly owned water systems usually serve much larger populations than privately owned systems.

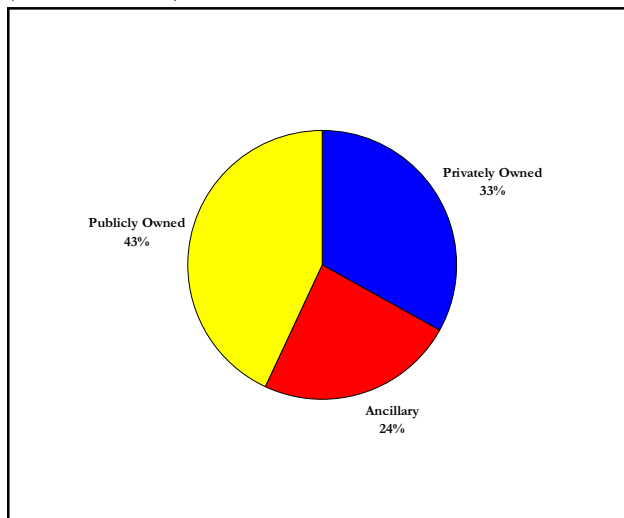
Thirty-three percent of CWSs are privately owned. Private ownership encompasses a broad range of owners, from homeowners' associations to investor-owned water companies. Approximately 15% of CWS customers receive their water from privately owned systems. The remaining 24 percent of CWSs are ancillary systems. Most of these systems serve 500 or fewer persons, providing water as a convenience to their patrons, employees, or residents. They do not bill users directly for water service. Mobile home parks account for a majority of ancillary systems.

Ownership type varies by system size (Figures 2.3 to 2.7). In systems serving 25-100 people, ancillary systems—specifically mobile home parks—dominate ownership (Figure 2.3). They also comprise almost a third of the systems serving 101-500 people (Figure 2.4). A minority of systems in these smallest size categories are publicly owned.

A dramatic shift in ownership type occurs in systems serving more than 500 persons (Figures 2.5 to 2.7). Governments own a substantial majority of these systems, and ancillary systems comprise an insignificant percentage. Although the percentage of privately owned systems declines steadily as system size increases, there are privately owned systems in even the largest size categories.

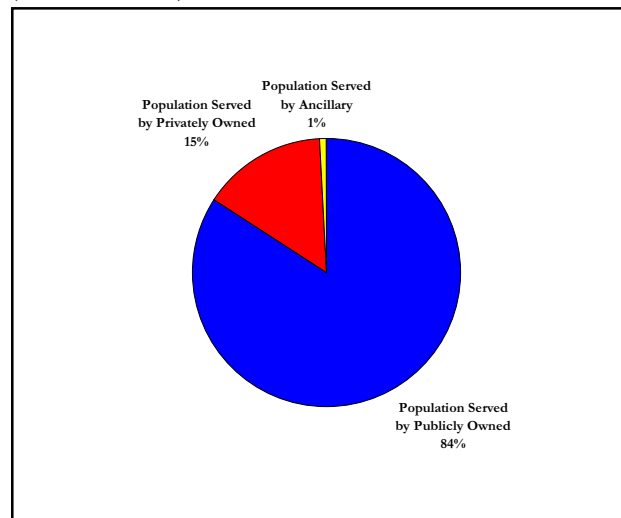
**Figure 2.1: Ownership of Community Water Systems**

Source: 1995 Community Water System Survey  
(Data from Table 3)



**Figure 2.2: Percentage of CWS Customers Served by Privately Owned, Publicly Owned, and Ancillary Systems**

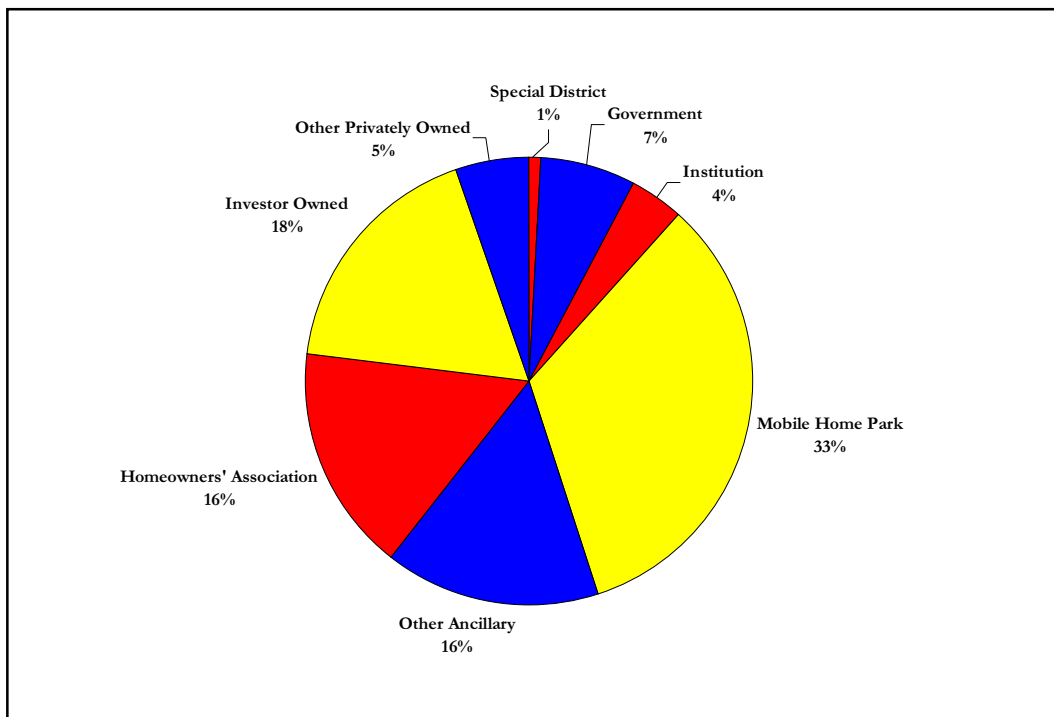
Source: 1995 Community Water System Survey  
(Data from Table 4)



## WATER SYSTEM OWNERSHIP

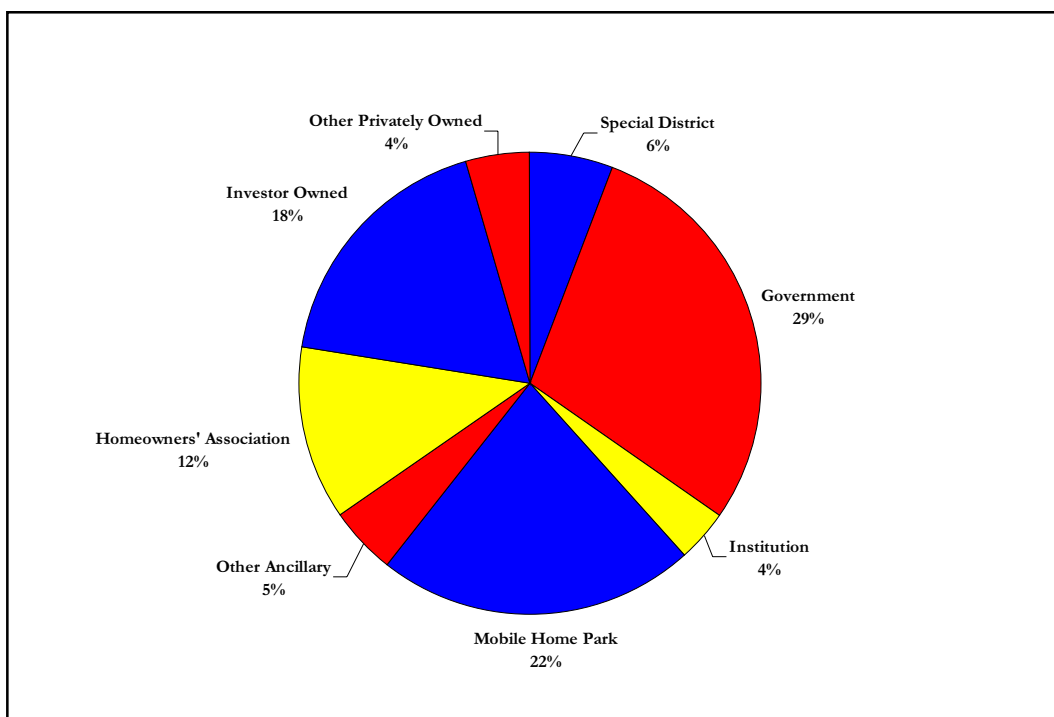
**Figure 2.3: Ownership of Systems Serving Population 25-100**

Source: 1995 Community Water System Survey (Data from Table 3)



**Figure 2.4: Ownership of Systems Serving Population 101-500**

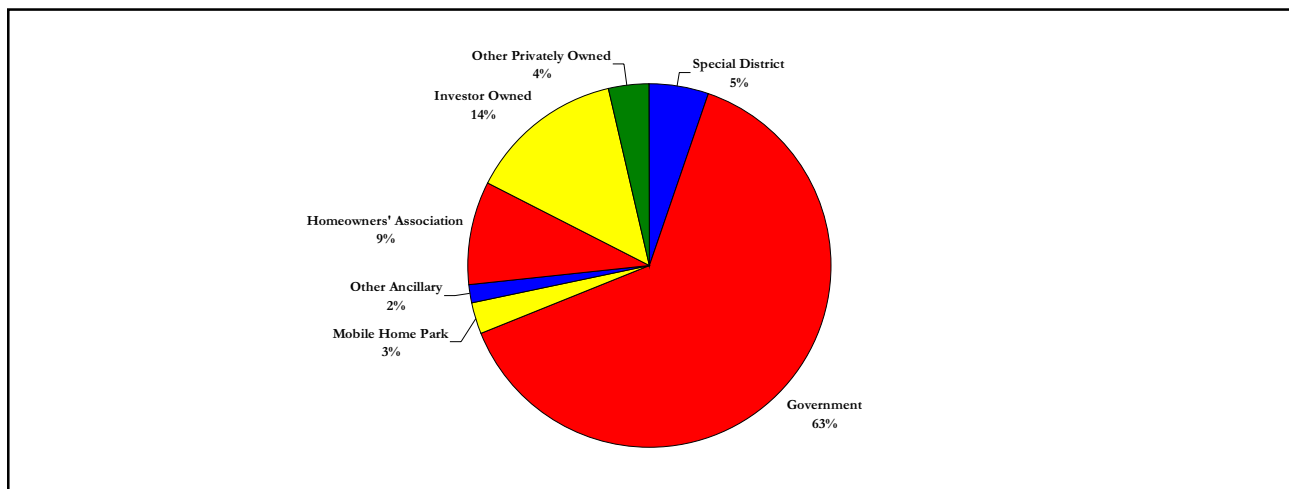
Source: 1995 Community Water System Survey (Data from Table 3)



## WATER SYSTEM OWNERSHIP

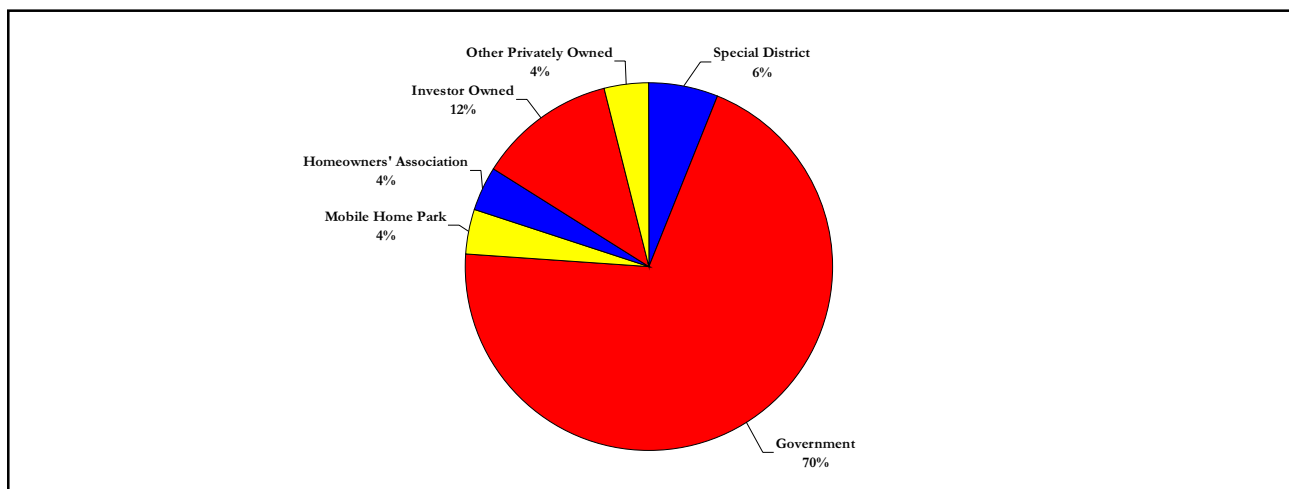
**Figure 2.5: Ownership of Systems Serving Population 501-3,300**

Source: 1995 Community Water System Survey (Data from Table 3)



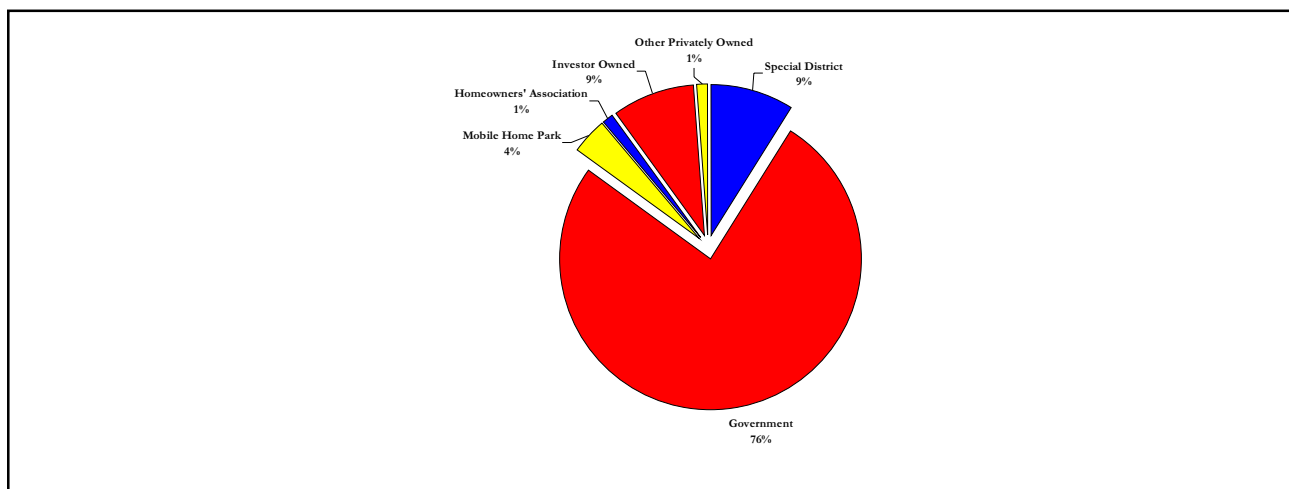
**Figure 2.6: Ownership of Systems Serving Population 3,301-10,000**

Source: 1995 Community Water System Survey (Data from Table 3)



**Figure 2.7: Ownership of Systems Serving Population 10,001+**

Source: 1995 Community Water System Survey (Data from Table 3)



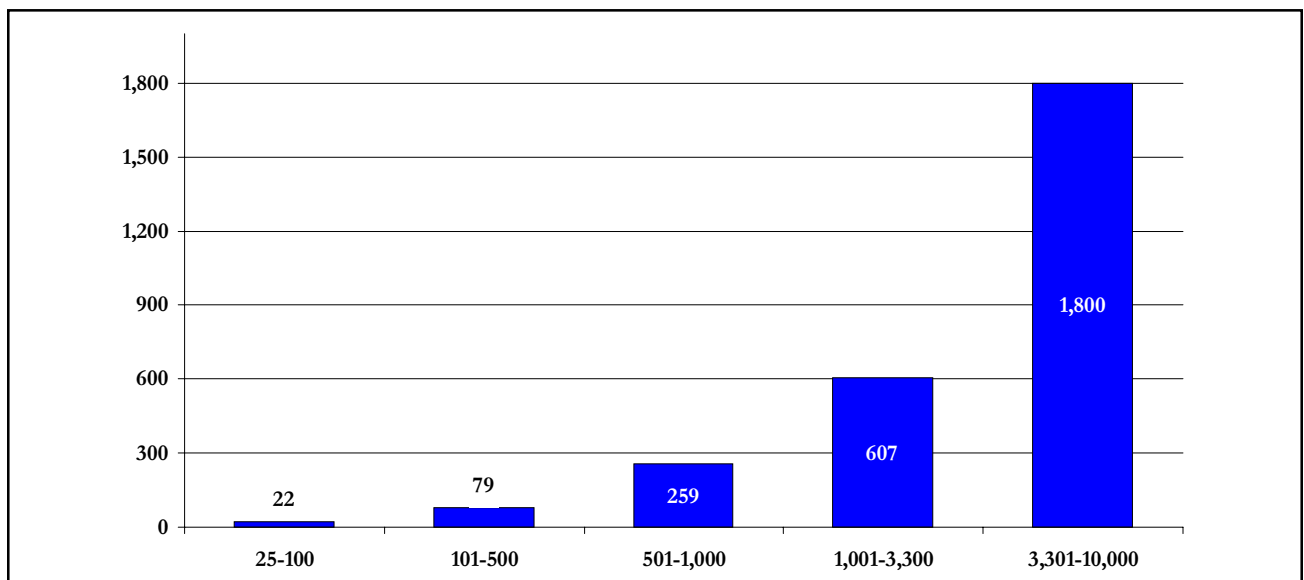
# Section 3: OPERATING CHARACTERISTICS

## Service Population

The median number of connections per system varies from 22 connections for systems serving 25-100 persons to 1,800 connections for systems serving 3,301-10,000 persons (Figure 3.1). Median service population varies from 58 people for systems serving 25-100 persons to 5,474 people for systems serving 3,301-10,000 persons (Figure 3.2).

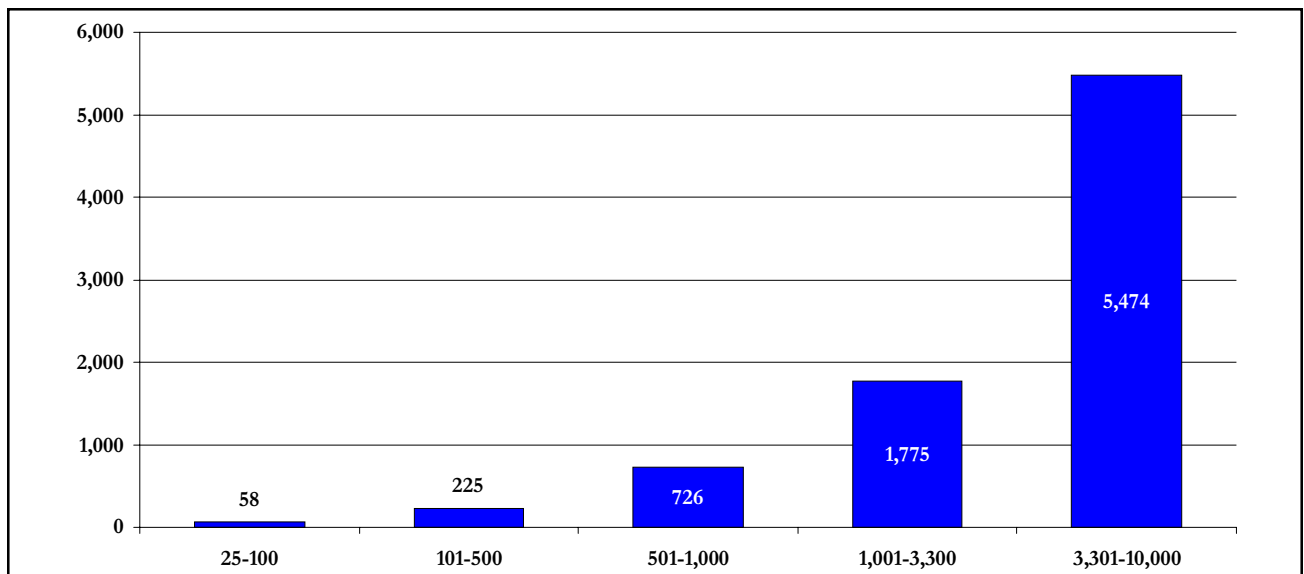
**Figure 3.1: Median Number of Connections by System Size**

Source: FRDS Database as of 7/96 (Data from Table 5)



**Figure 3.2: Median Number of People Served by System Size**

Source: FRDS Database as of 7/96 (Data from Table 5)





Although many small systems, such as mobile home parks, are located on the urban fringe in heavily populated areas, the smallest size categories also include systems that serve rural and less densely populated areas. The prevalence of rural systems within the small system category is reflected in the median miles of pipe per connection, which is considerably higher in systems serving fewer than 10,000 persons than in systems serving more than 10,000 persons (Figure 3.3).

**Figure 3.3: Median Miles of Pipe per Connection by System Size**

Source: 1995 Community Water System Survey (Data from Table 6)

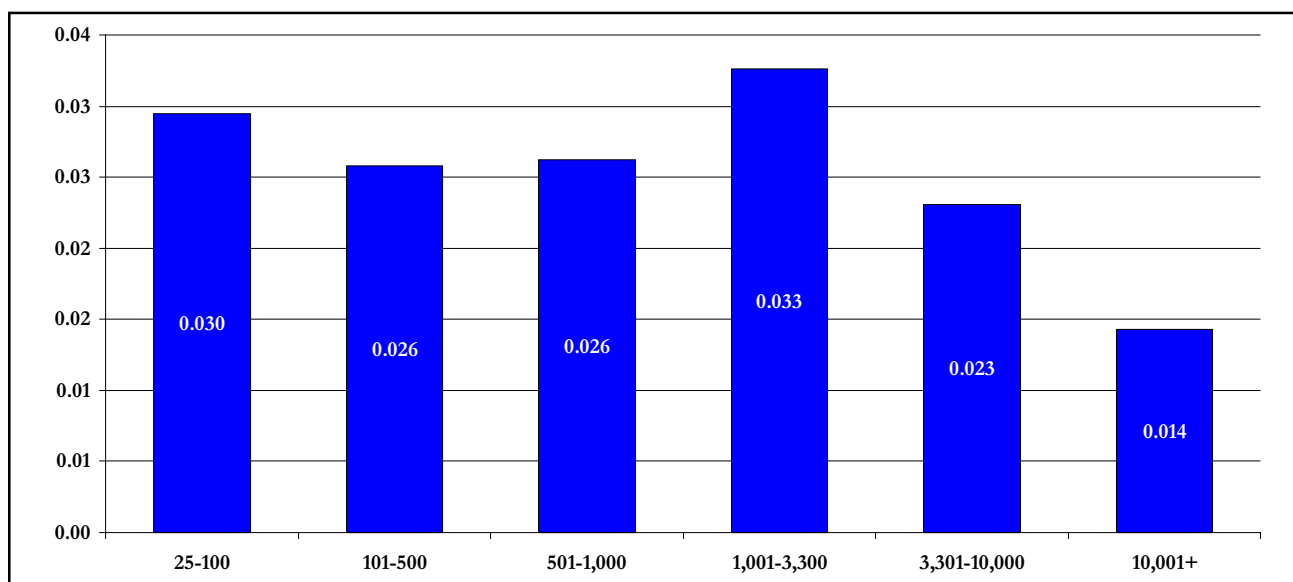
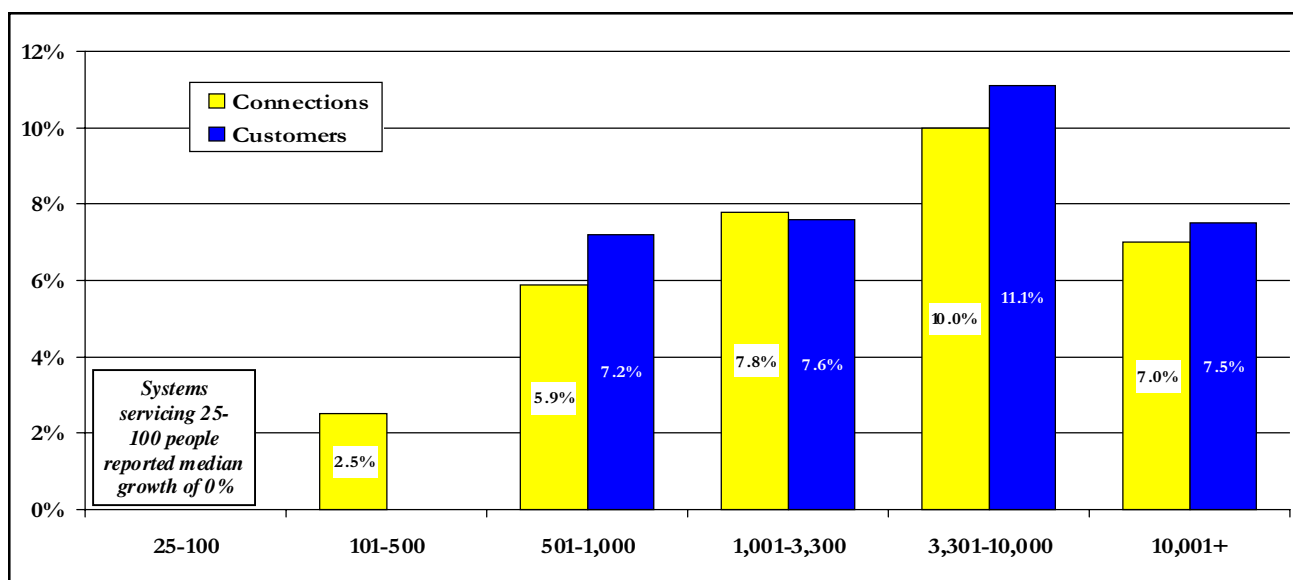


Figure 3.4 shows the growth rate of system customers and connections between 1990 and 1994, as reported by the 1995 Community Water System Survey (CWSS). The smallest systems appear to have experienced no growth in their customer base and little growth in their number of

**Figure 3.4: Median Growth in Customers and Connections by System Size (1990-1994)**

Source: 1995 Community Water System Survey (Data from Table 7)



connections. Median connections in systems serving 101-500 persons grew by only 2.5 percent for this period. Systems serving 3,301-10,000 persons saw the largest rate of growth in their customer base; 11.1 percent. This group also experienced the largest median increase in connections; 10 percent for the period.

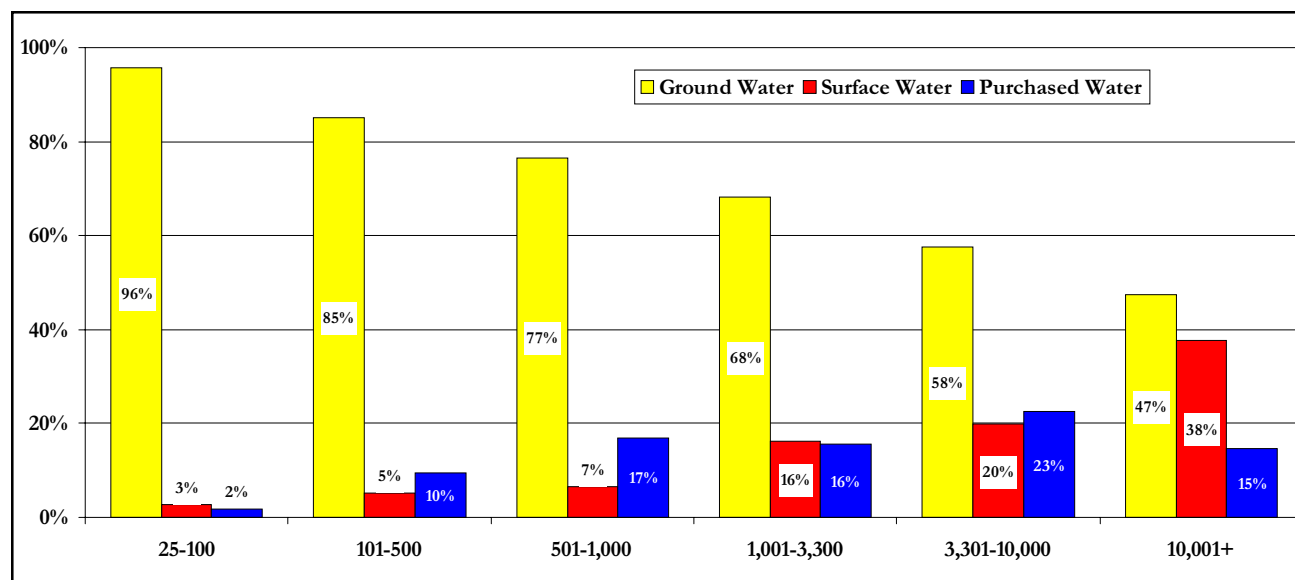
## Source

A system's water source is a key factor in determining operating characteristics, and source corresponds closely to system size. As Figure 3.5 indicates, larger systems are more likely than smaller systems to use surface water or purchased water as their primary source; most small systems use ground water. About 96 percent of systems serving 25-100 persons use ground water as their primary source. Only 47 percent of systems serving over 10,000 persons use ground water as their primary source. This trend has important implications for treatment and capital investment, as raw water obtained from ground water sources typically requires less treatment than raw water from surface water sources.

The percentage of systems that use purchased water as their primary source tends to increase with system size for systems serving less than 10,000 persons. Of systems serving 25-100 people, only 2 percent use purchased water as their primary source. Purchased water is the primary source for 23 percent of systems serving 3,301-10,000 persons.

**Figure 3.5: Percentage of Systems by Source and System Size**

Source: 1995 Community Water System Survey (Data from Table 8)

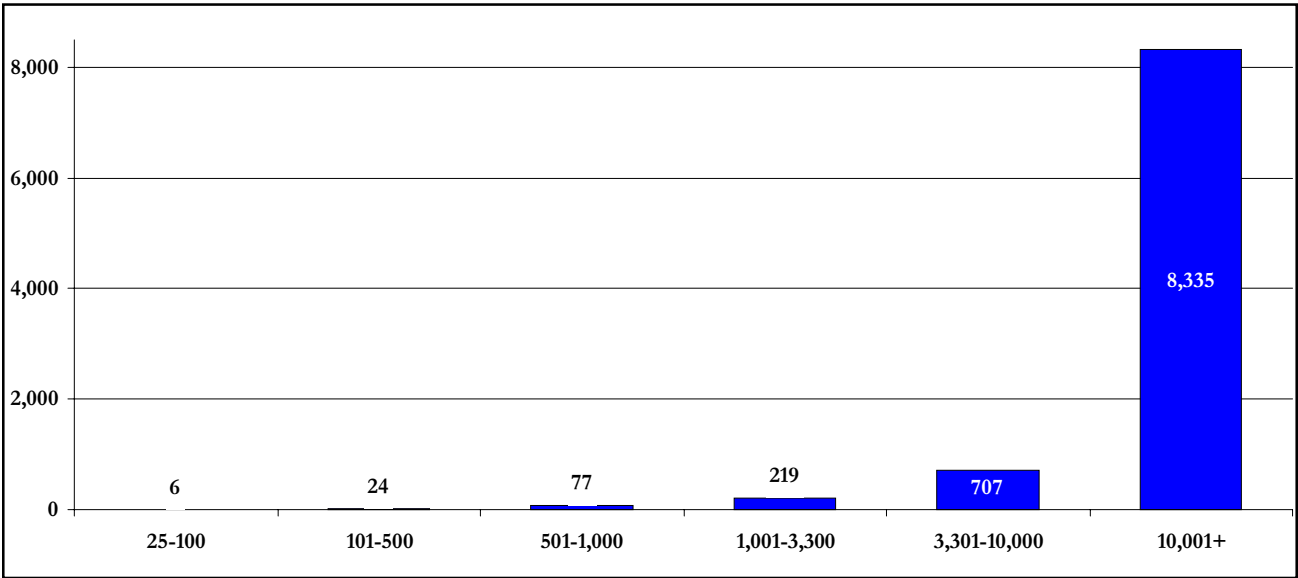


# Production

The amount of water produced per day has a direct relationship to system size. This relationship is demonstrated in Figure 3.6. As the chart illustrates, median production per connection increases with system size. Figure 3.6 shows the median number of gallons produced per day growing from approximately 6,000 gallons per day in systems serving 25-100 persons to about 8,335,000 gallons per day in systems serving over 10,000 persons.

**Figure 3.6: Median Thousands of Gallons Produced per Day by System Size**

Source: 1995 Community Water System Survey (Data from Table 9)



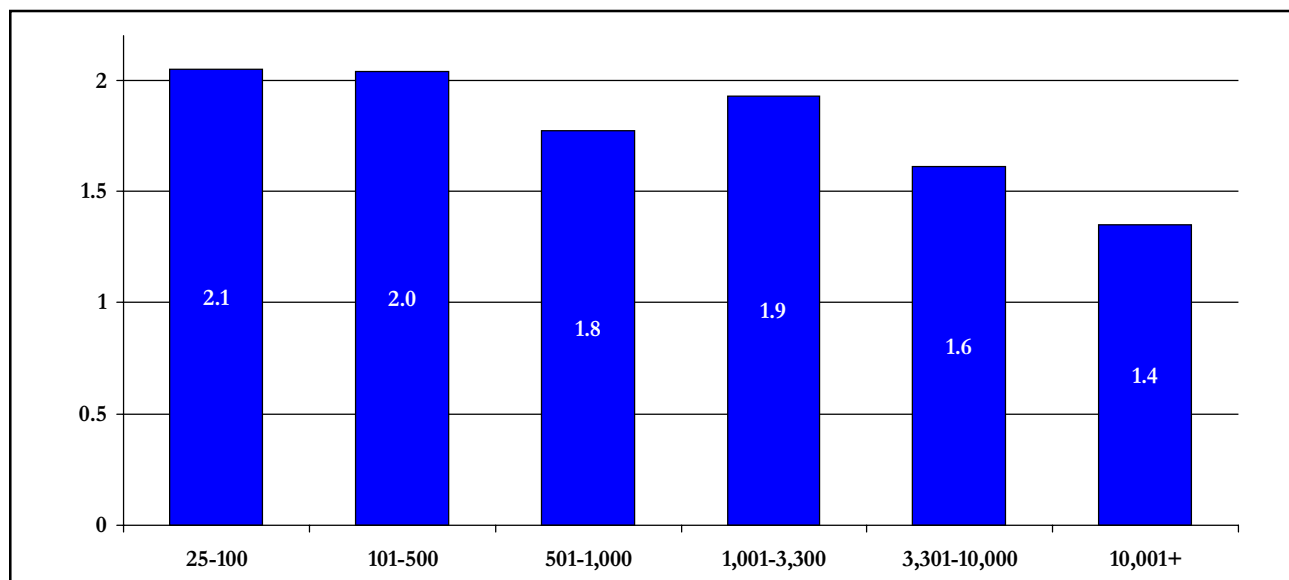
The differences in production between small and large systems are likely indicative of differences in their customer bases. Data discussed in *Section 4: Financial Characteristics*, depict the customer bases served by different sized systems by showing the revenue by customer type. Larger systems tend to have a higher percentage of industrial, commercial, and agricultural customers, while smaller systems serve primarily residential customers. Residential customers usually use less water than industrial, commercial, and agricultural customers, lowering the per connection production of small systems. The data show that about 89 percent of revenue for systems serving between 25 and 100 persons is from residential customers. Systems serving more than 10,000 persons derive only about 53 percent of their revenue from residential customers (Figure 4.7).

For both ground water and surface water systems, the ratio of maximum daily treatment design capacity to peak daily production declines with system size. Figure 3.7 shows the relationship between the maximum amount of water a system can technically produce and the amount of water that is actually produced at peak demand. Figure 3.7 demonstrates that small systems have much larger capacity in relation to their peak daily production than large systems. Systems serving

25-100 persons have a median ratio of 2.1, while systems serving more than 10,000 persons have a median ratio of only 1.4. This difference in ratios suggests that large systems have more efficient operations.

**Figure 3.7: Ratio of Maximum Daily Treatment Design Capacity to Peak Daily Production by System Size**

Source: 1995 Community Water System Survey (Data from Table 9)



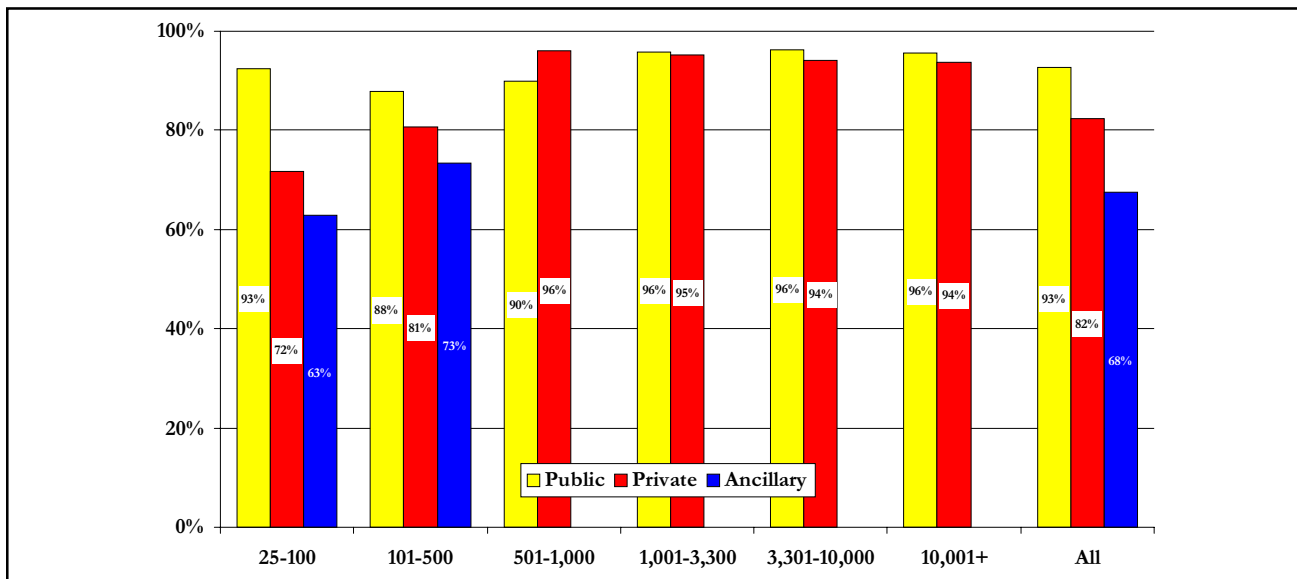
However, the ratio of maximum daily treatment to peak daily production also appears to reflect the treatment and storage conditions associated with different sources of water. Ground-water systems generally rely on additional pumping and treatment capacity to meet peak demands. Surface water systems, in contrast, generally use more capital-intensive treatment techniques and tend to rely on storage facilities to meet peak momentary and hourly demands.

## Technical Assistance

Technical assistance is classified in three categories. Governmental support includes assistance from federal, State, and local governments. Third-party assistance comprises State rural water associations, rural community assistance programs, other associations, and contracted engineering services. Other technical services include technical publications, radio or television, local newspapers, and the *Federal Register*. The final column in Figure 3.8, which shows the percentage of CWSs receiving technical assistance by ownership type, indicates that 93 percent of all publicly owned systems, 82 percent of all privately owned systems, and 68 percent of all ancillary systems receive technical assistance in some form.

**Figure 3.8: Percentage of All CWSs that Recieve Technical Assistance by Ownership Type**

Source: 1995 Community Water System Survey (Data from Table 10)

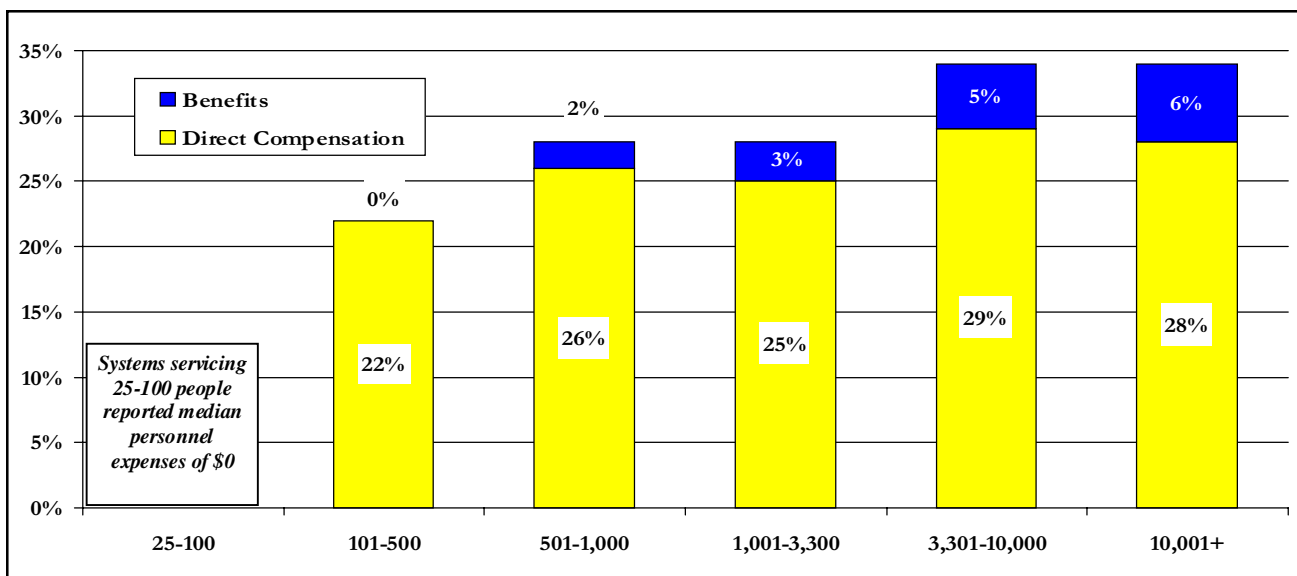


## Personnel

Figure 3.9 shows that the median value of expenditures for direct compensation and benefits for systems serving 25-100 persons is \$0.00, indicating that at least half of the respondents of systems of this size report no expenditures for employee compensation and benefits. Systems serving 101-500 persons spend 22 percent of their total expenditures on direct compensation, but report a median value of \$0.00 for employee benefits. This could be due in part to the prevalence of part-time employees and contracted labor in small systems. Another reason that personnel

**Figure 3.9: Median Personnel Expenses as a Percentage of Total Expenses by System Size**

Source: 1995 Community Water System Survey (Data from Table 11)



expenses for systems serving less than 500 persons appear low could be due to the fact that ancillary systems have been included in the data. Benefits and direct compensation for ancillary system personnel are most likely included in the expenses of the parent company and therefore were often not reported as a separate water system expense.

Systems serving more than 3,300 people report expenditures for direct compensation and benefits totaling more than one-third of total expenses. In general, both direct compensation and benefits appear to increase with system size. This could be attributed to the higher levels of certification and technical sophistication required for the operation of larger systems.

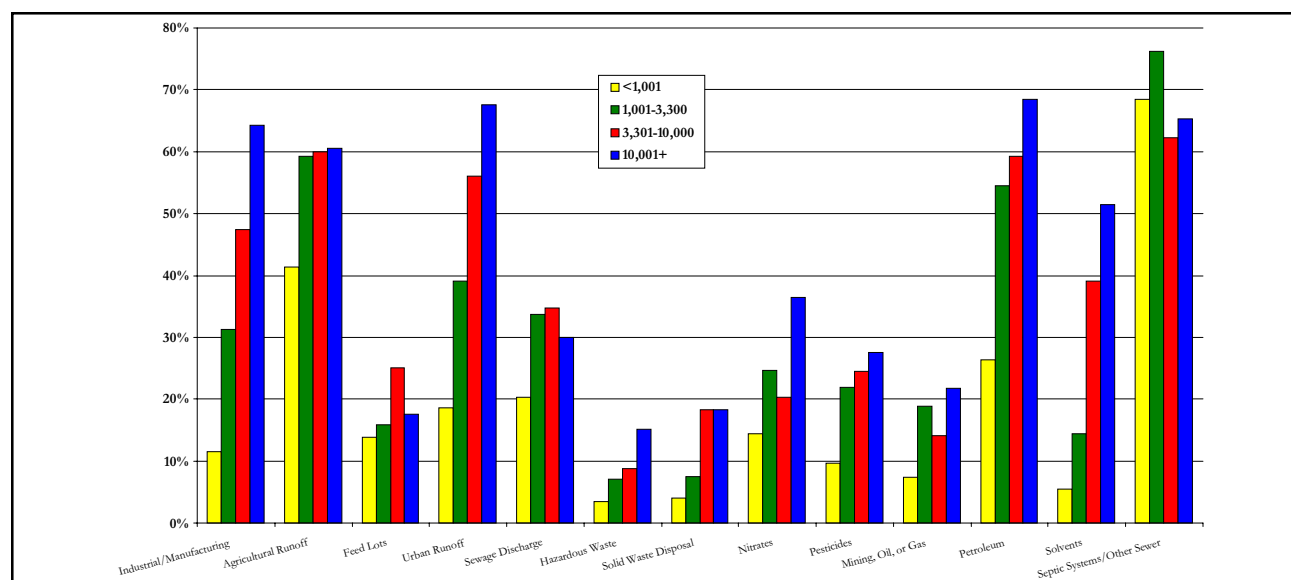
## Source Water Protection

Water systems can improve the quality of their raw water, decrease the likelihood of water-borne disease outbreaks, and reduce the need for future capital expenditures for treatment plants and equipment by adopting source water and wellhead protection programs. Figures 3.10 and 3.11 show the percentage of groundwater systems (Figure 3.10) and surface water systems (Figure 3.11) reporting potential sources of contamination within 2 miles of their intake or well. More than 84 percent of all systems have at least one potential source of contamination within 2 miles of their water intake or well. A higher percentage of larger systems tend to have multiple potential contamination sources near their intakes or wells.

Figure 3.10 shows that with the exception of three potential contaminant categories (feedlots, sewage discharge, and septic systems/other sewer), ground water systems serving over 10,000 people comprised the greatest percentage of systems reporting potential contamination within 2 miles of wells for each contaminant category. Septic systems and other sewer systems pose the

**Figure 3.10: Percentage of Groundwater Systems Reporting Potential Sources of Contamination within 2 Miles of Well(s) by System Size**

Source: 1995 Community Water System Survey (Data from Table 12)

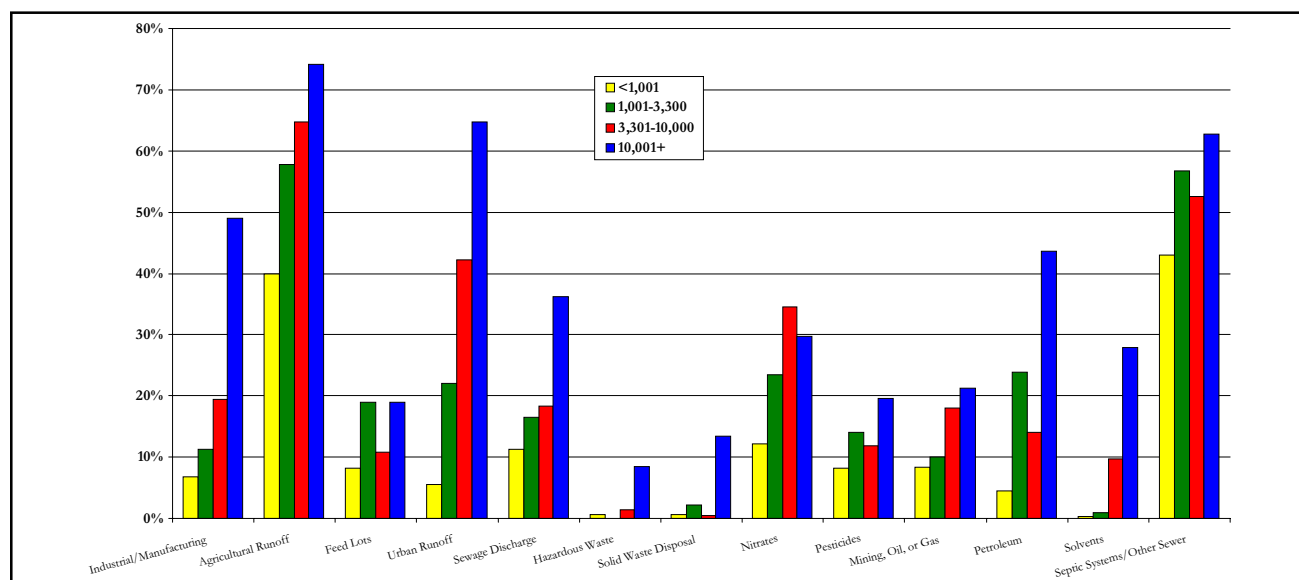


greatest threat of potential contamination for small systems. Figure 3.10 also shows that 76 percent of groundwater systems serving 1,001-3,300 people have septic or other sewer systems within 2 miles of their well(s) and 69 percent of small systems serving less than 1,001 people reported septic systems or other sewer systems as potential sources of contamination.

Figure 3.11 shows that for surface water systems serving more than 1,000 people, agricultural runoff poses the greatest threat of potential contamination. For surface water systems serving less than 1,001 people, septic systems and other sewer systems are reported as the greatest potential sources of contamination. Almost 65 percent of surface water systems serving over 10,000 people reported urban runoff as a potential source of contamination within two miles of the intake.

**Figure 3.11: Percentage of Surface Water Systems Reporting Potential Sources of Contamination within 2 Miles of Water Intake by System Size**

Source: 1995 Community Water System Survey (Data from Table 12)

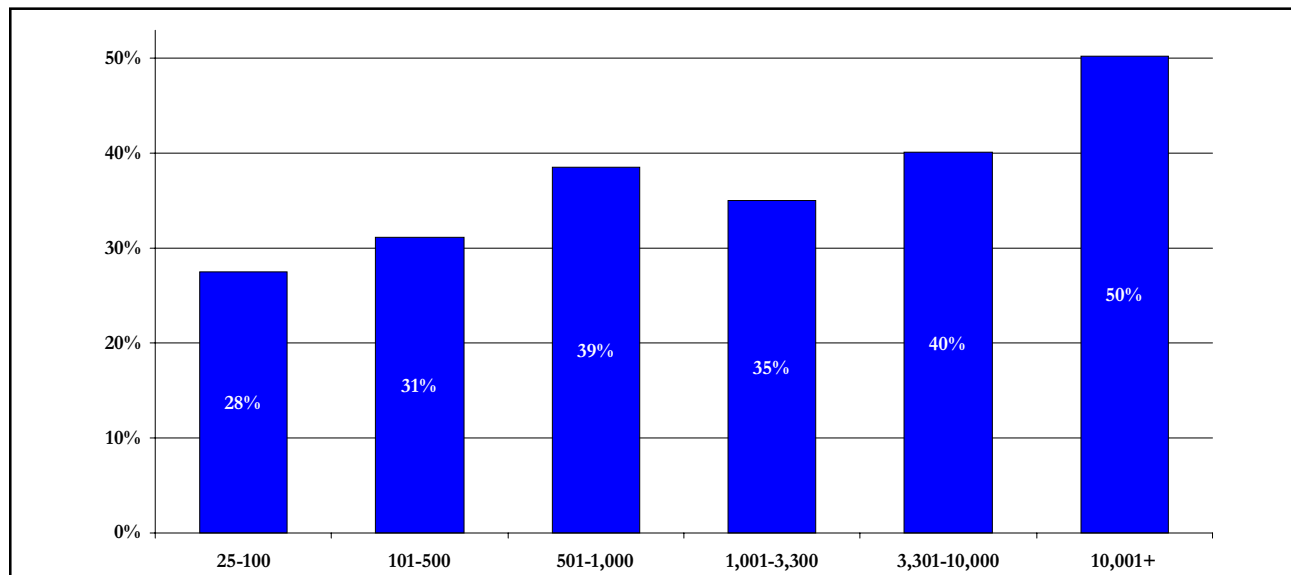


Despite the obvious need for source water protection, Figure 3.12 shows that just 28 percent of the smallest systems and only 50 percent of systems serving 10,000 or more persons participate in some form of source water or wellhead protection program. Some small systems might be less likely to adopt wellhead protection or source water protection programs than larger systems because they lack the technical and financial resources to implement and manage such programs.

Four widely-used methods of source water protection are: zoning or land use controls, best management practices, education on land use impacts, and watershed ownership. Figure 3.13 depicts the breakdown of the measures used by systems that participate in protection programs. Each of these measures can be an effective barrier to contamination, but the greatest gains in public health protection are most likely to be realized when a combination of several methods is used.

**Figure 3.12: Percentage of Systems Participating in Source Water or Wellhead Protection Programs by System Size**

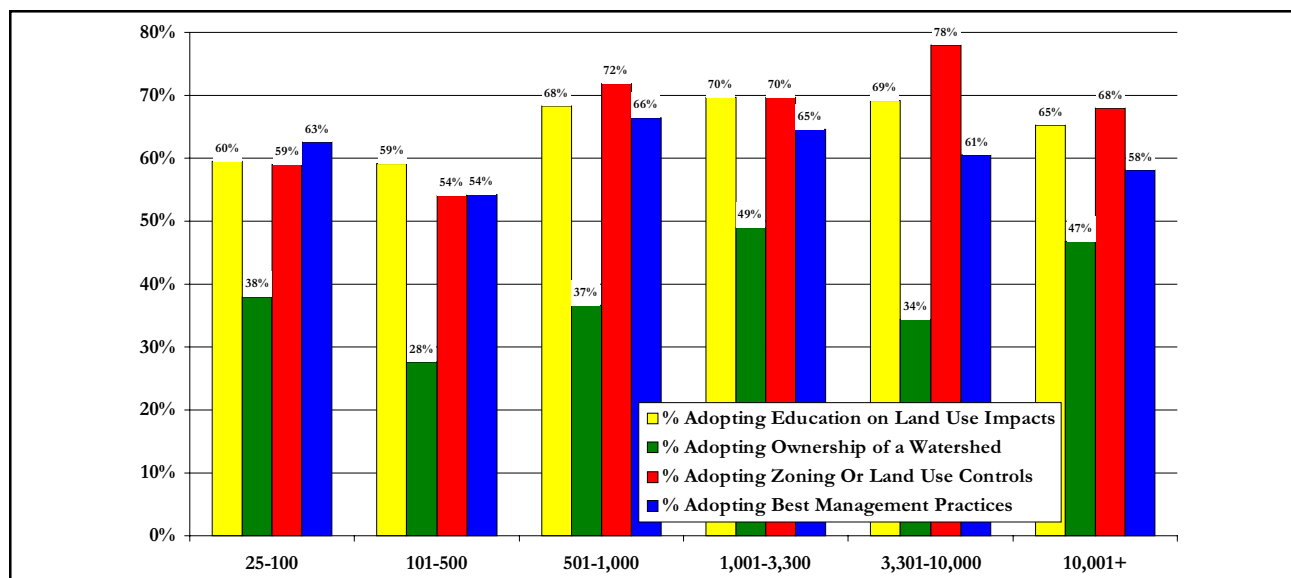
Source: 1995 Community Water System Survey (Data from Table 13)



Of systems that do implement source water or wellhead protection programs, the most widely-used methods are zoning or land use controls, best management practices, and education on land use impacts. Watershed ownership is the method least used by water systems in every size category. Systems serving 25-100 persons use education on land use impacts, best management practices, and zoning or land use controls most often. This is most likely because these measures are less costly and less complex than measures such as watershed ownership.

**Figure 3.13: Of Systems Participating in Source Water or Wellhead Protection: Percentage of Systems Adopting Particular Measures by System Size**

Source: 1995 Community Water System Survey (Data from Table 13)





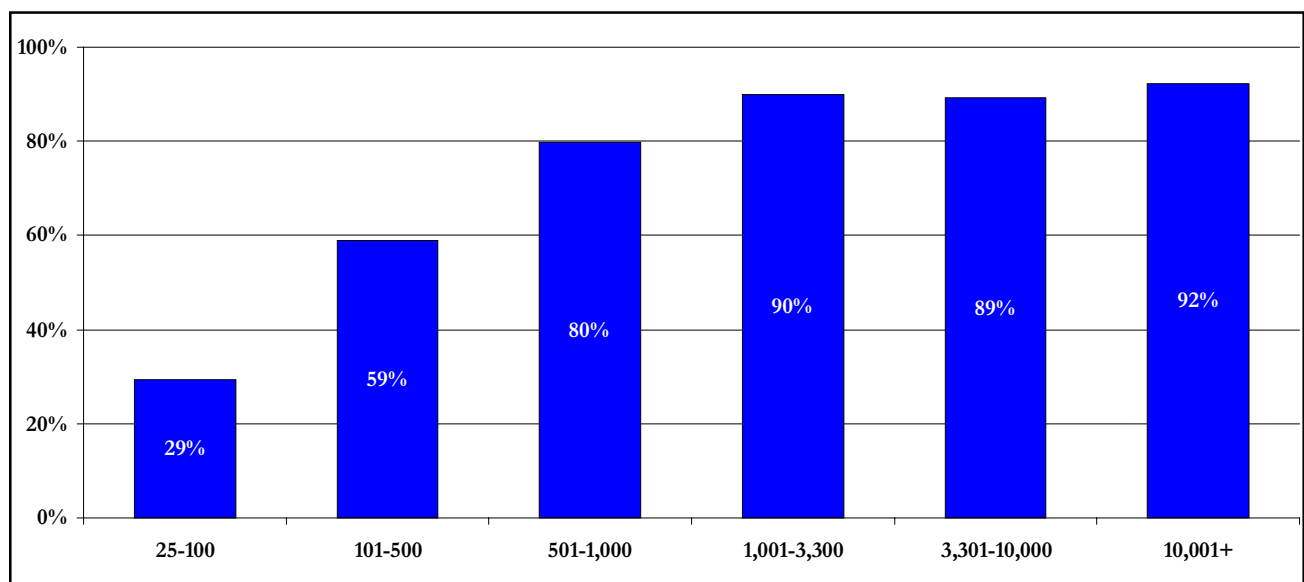
# Section 4: FINANCIAL CHARACTERISTICS

## Accounting

Larger systems are significantly more likely than smaller systems to use generally accepted accounting principles (GAAP). As shown in Figure 4.1, fewer than 30 percent of systems serving 25-100 persons report using GAAP, while GAAP is used in approximately 90 percent of systems serving more than 1,000 persons.

**Figure 4.1: Percentage of Systems that Use GAAP by System Size**

Source: 1995 Community Water System Survey (Data from Table 14)

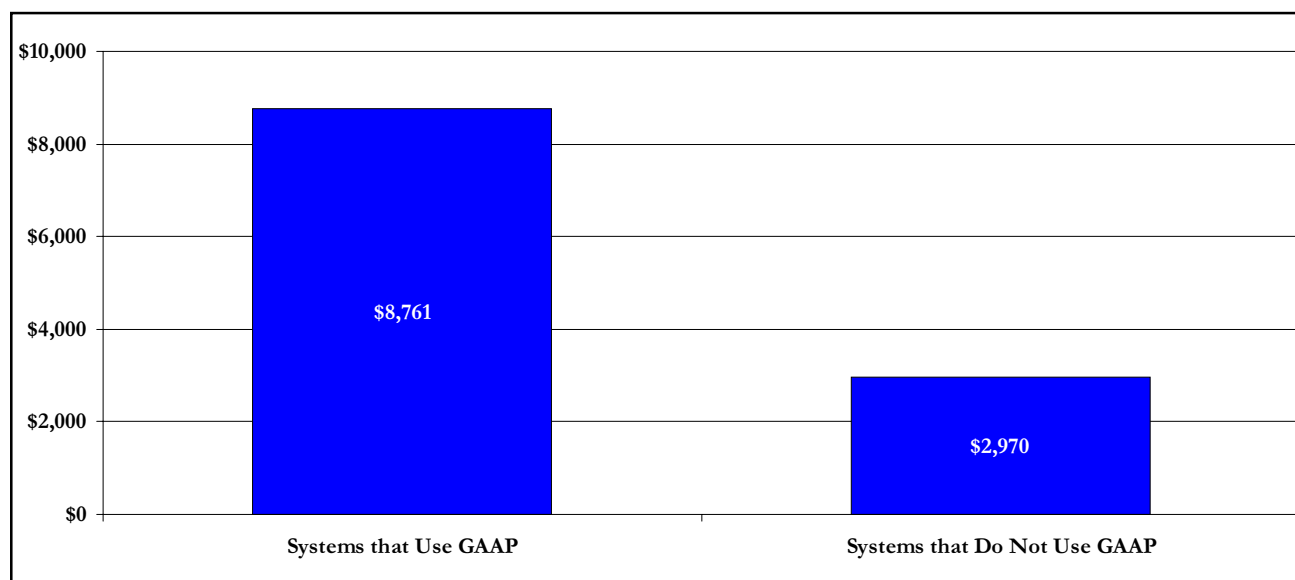


Use of GAAP is likely related to the ability of systems to identify all costs, set appropriate rates, and maintain accurate records of expenses and revenue. Figure 4.2 shows that revenue in systems serving 25-100 persons that use GAAP is more than twice as large as revenue in like-sized systems that do not use GAAP.

Larger systems are more likely to separate financial statements for income and expenses from other financial reporting statements; only 4 percent of systems serving over 10,000 people do not have separate financial statements for drinking water operations (Figure 4.3). For systems serving 25-100 persons, more than 50 percent do not use this fundamental financial capability. This trend might be attributed to the large number of ancillary systems in this category and to the fact that ancillary systems do not record water-related expenses separately.

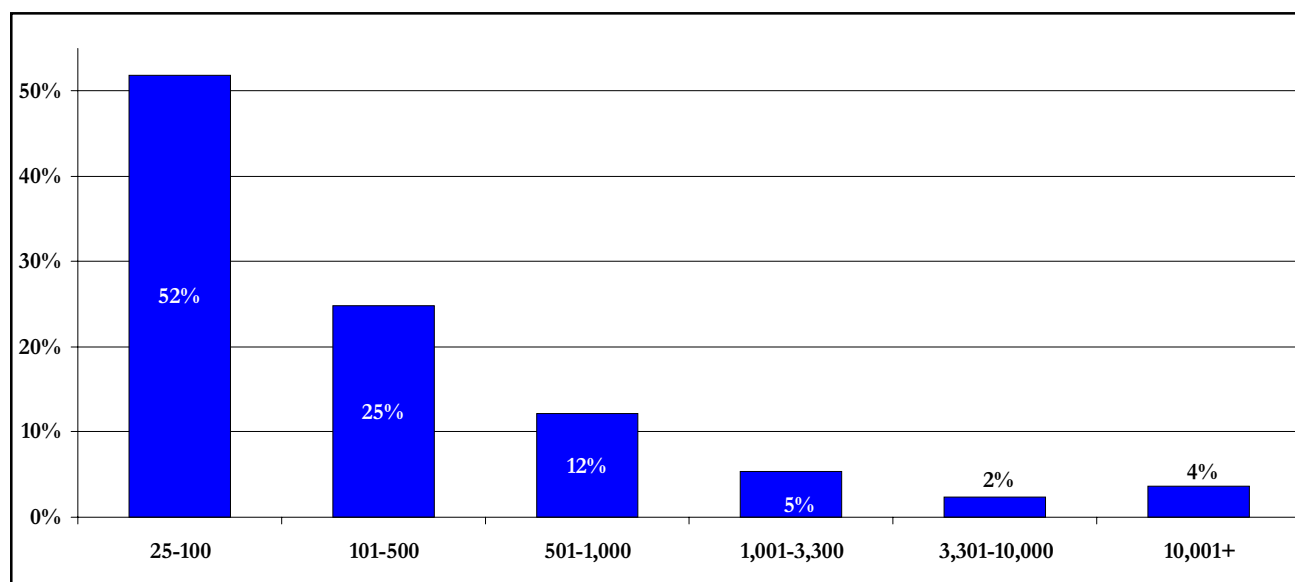
**Figure 4.2: Median Revenues of Systems Serving 25-100 Persons by Use of GAAP**

Source: 1995 Community Water System Survey (Data from Table 15)



**Figure 4.3: Percentage of Systems that Do Not Have Separate Financial Statements for their Drinking Water Operation by System Size**

Source: 1995 Community Water System Survey (Data from Table 16)



## Revenues

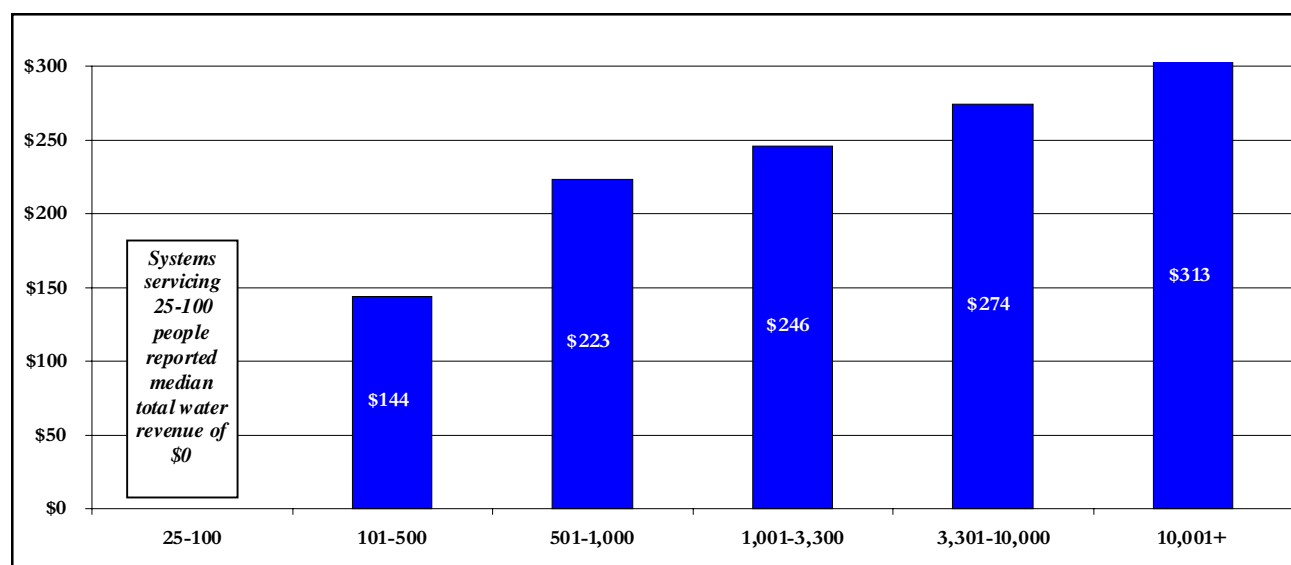
Water systems' total water revenues are generated from water sales, fees, fines, and other water-related revenue. Systems can also generate revenues from non-consumption based charges, such as interest earnings. Publicly owned water systems sometimes receive additional contributions from

governments through general fund revenues. Ancillary systems do not generate water sales or water-related revenue. Rather, revenue is generated by the principal business of the system, of which the provision of water is merely an ancillary function. Water rates are the primary mechanism through which customers are charged for service and the main vehicle through which non-ancillary systems generate revenue.

When discussing total water system revenue, it is useful to break it into water sales and water-related revenue. Water sales (or rates) comprise the revenue collected for the actual provision of water, based on consumption. Water-related revenues comprise several types of non-consumption based charges, such as connection fees, inspection fees, usage fees, and revenue from municipal general funds. Figure 4.4 depicts median total water revenue per connection for each size category.

**Figure 4.4: Median Total Water Revenue per Connection**

Source: 1995 Community Water System Survey (Data from Table 17)



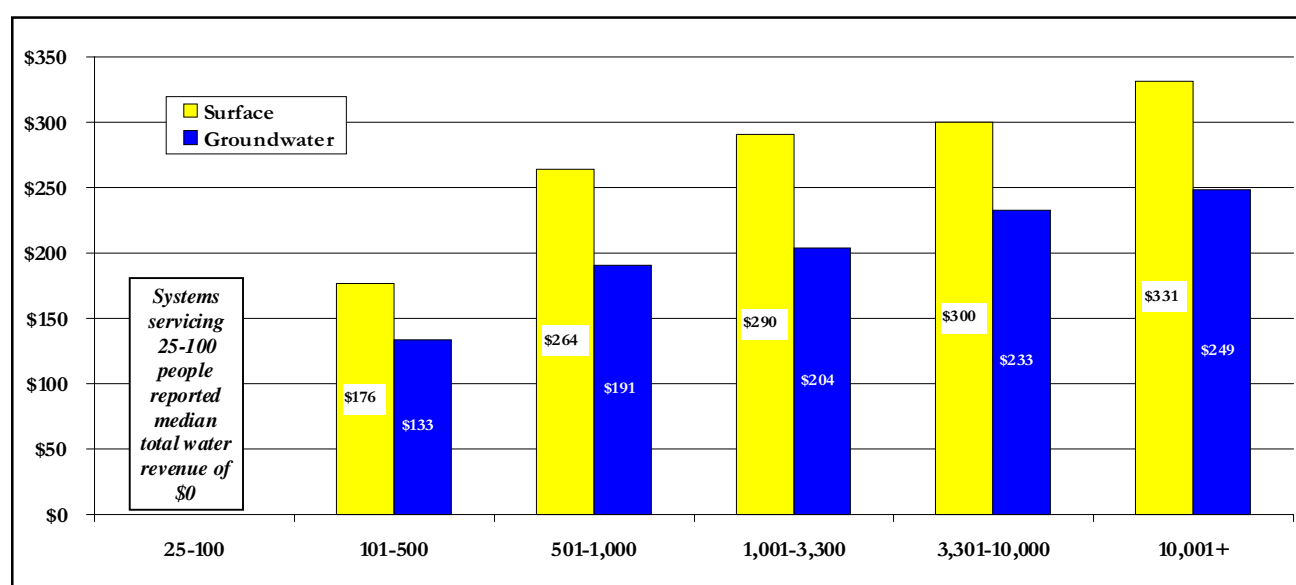
Total water revenue, water sales revenue, and water-related revenue generally increase per connection as system size increases. Median total water revenue per connection for systems serving 25-100 persons is \$0, indicating that at least half of the smallest CWSs do not charge for water through rates or fees. Systems serving more than 10,000 persons report approximately \$313 per connection in median total water revenue.

The upward trend in revenue per connection with system size could reflect numerous factors. Larger systems may have higher usage per connection, caused in part by a higher percentage of commercial, agricultural, and multifamily housing connections. Larger systems are also far less likely to be ancillary systems (thus reporting no water revenue) than smaller systems.

Source also affects water system revenue, and larger systems are more likely to use surface water sources. Figure 4.5 shows that total revenue per connection is consistently higher for surface water systems than for groundwater systems across all size categories. This trend likely reflects the greater complexity generally associated with surface water sources. These systems often require more technically sophisticated and capital-intensive treatment, which in turn requires more highly-trained personnel. These factors lead to higher expenditures by the water system for the treatment and provision of water. Higher costs are passed on to water users in the form of higher water rates and fees, thus generating higher water revenues.

**Figure 4.5: Median Total Revenue per Connection by Source and System Size**

Source: 1995 Community Water System Survey (Data from Table 17)

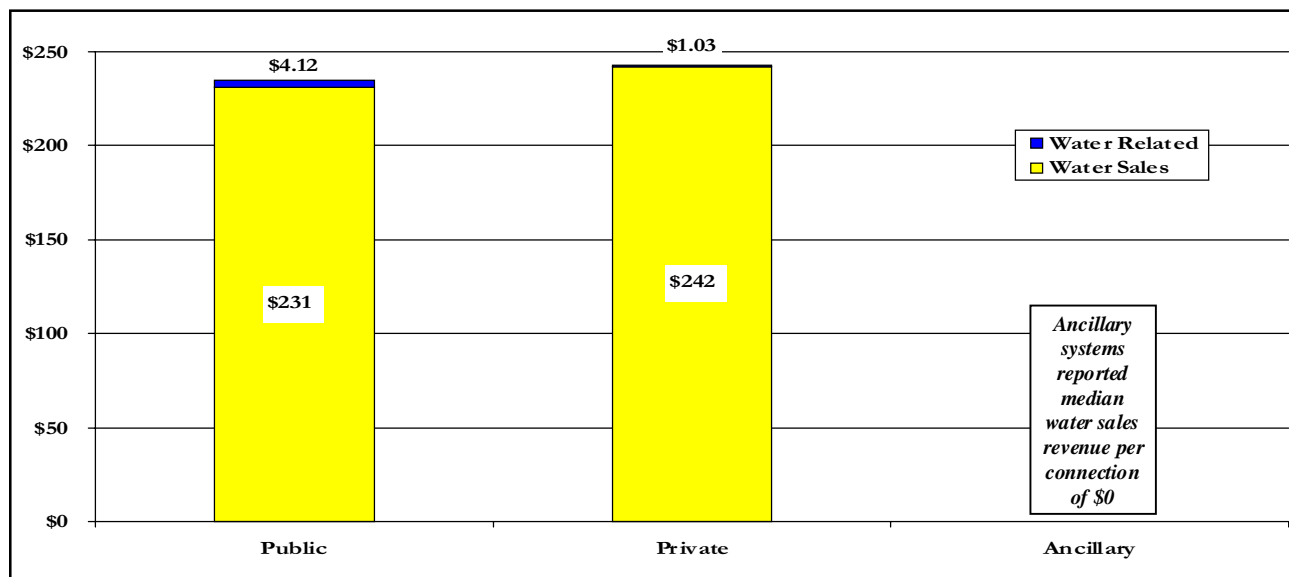


Median water sales revenue per connection is higher for privately owned systems than for publicly owned systems. However, median water-related revenues per connection are higher for publicly owned systems (Figure 4.6). In privately owned systems, nearly all total water revenue comes from water sales, while publicly owned systems tend to have slightly lower water sales revenues that are supplemented by less visible water-related revenues such as connection fees, other non-consumption based charges, grants, and general revenues.

Although the proportion of revenue from various sources differs in publicly and privately owned systems, total revenues per connection are fairly similar, with privately owned systems generating about \$8 more than publicly owned systems per connection. It is significant that the majority of ancillary systems do not report any water revenue at all (median revenue for ancillary systems is \$0 in all revenue categories).

**Figure 4.6: Median Water-Sales and Water-Related Revenue per Connection by Ownership Type**

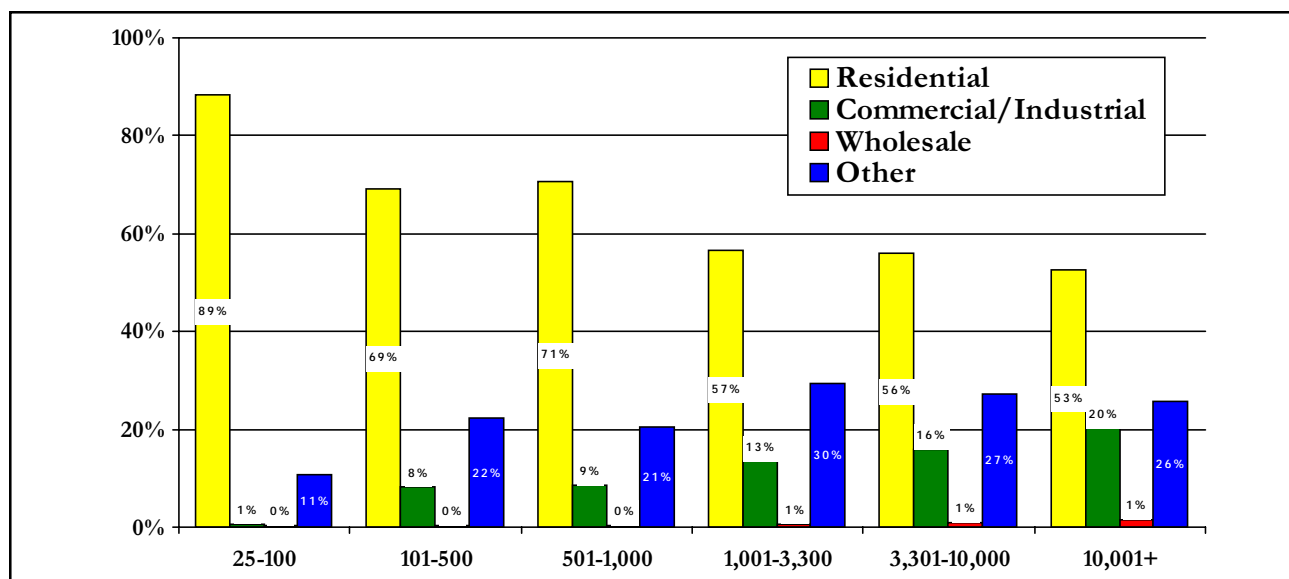
Source: 1995 Community Water System Survey (Data from Table 17)



Small system revenue is primarily dependent upon residential customers. Eighty-nine percent of small system water sales revenue is derived from residential customers for systems serving less than 100 persons, as shown in Figure 4.7. Large systems derive approximately 53 percent of their revenues from residential customers.

**Figure 4.7: Total Water Revenue by Customer Type and System Size**

Source: 1995 Community Water System Survey (Data from Table 18)

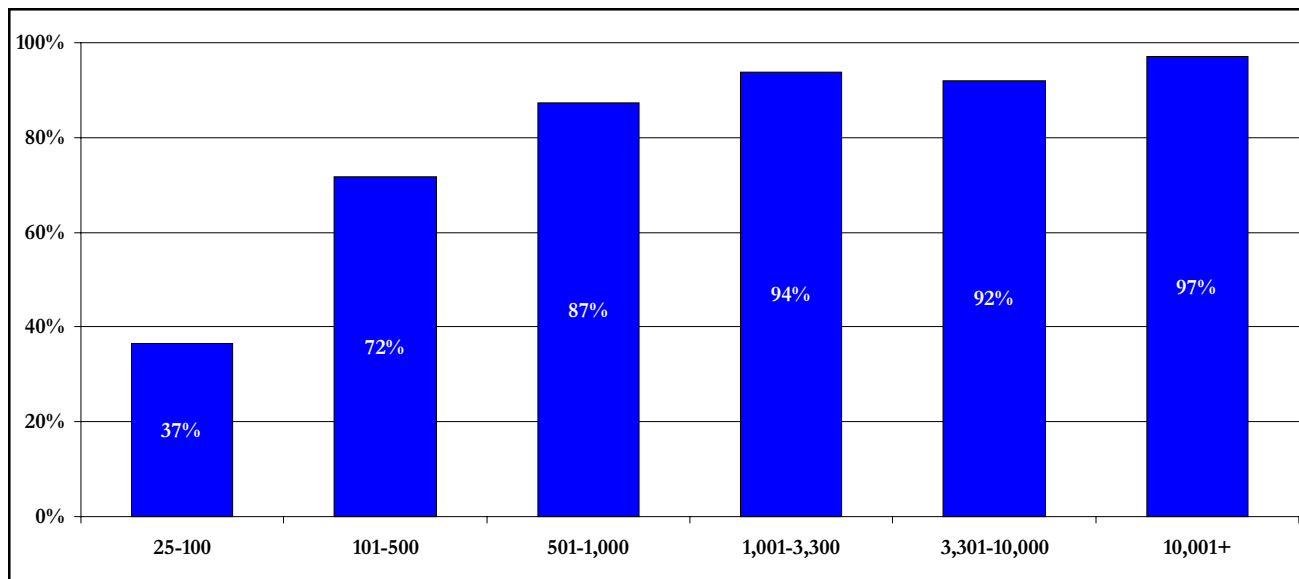


## Rate Structure

Approximately 74 % of all CWS residential connections are metered. Water meters allow systems to monitor consumption and establish rates that are based on usage. Figure 4.8 shows that as system size increases, systems are more likely to meter connections. The use of metered rate structures shows a similar increase.

**Figure 4.8: Percentage of Connections Metered by System Size**

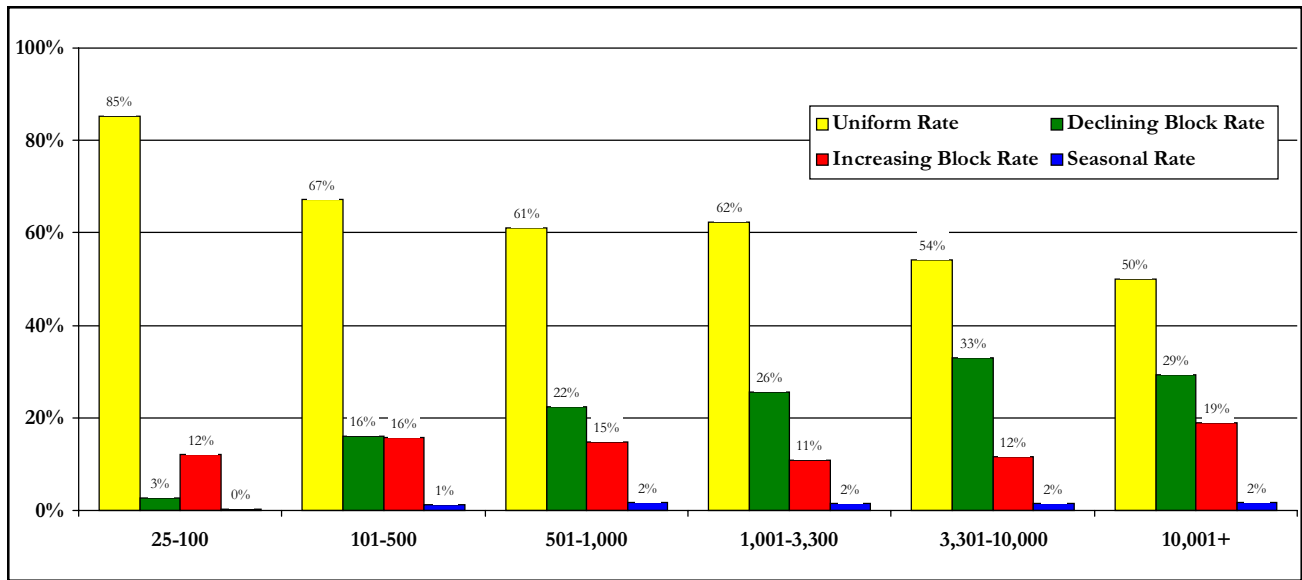
Source: 1995 Community Water System Survey (Data from Table 19)



Several types of rate structures are used by systems with metered billing: uniform rates, declining block rates, increasing block rates, and seasonal rates. Uniform rates are used by a large percentage of systems overall; as shown in Figure 4.9. The use of uniform rates is particularly dominant among smaller systems, which are much more likely to use a uniform rate structure than another rate structure because of its simplicity. Although larger systems also rely on uniform rates, they tend to use more sophisticated rate structures more frequently, such as declining or increasing block rates (Figure 4.9). This diversity is likely due to the many types of customers these systems serve.

**Figure 4.9: Use of Metered Rate Structures by System Size**

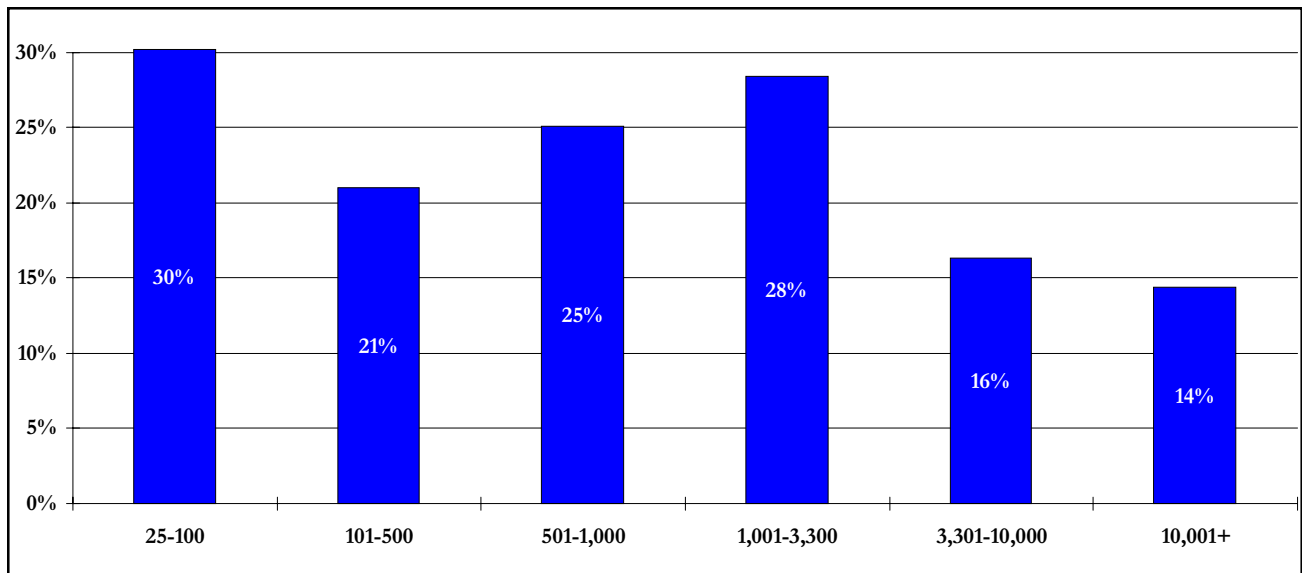
Source: 1995 Community Water System Survey (Data from Table 19)



The financial health of water systems can depend on their ability to establish water rates that accurately reflect the cost of providing water. Figure 4.10 shows that the last rate increase in systems serving 25-100 persons was a 30 percent increase. In recent years, the costs of providing water have increased significantly; water systems may therefore need to negotiate rate increases fairly regularly. Figure 4.11 shows that it has been at least two years since the last rate increase for systems of all size categories.

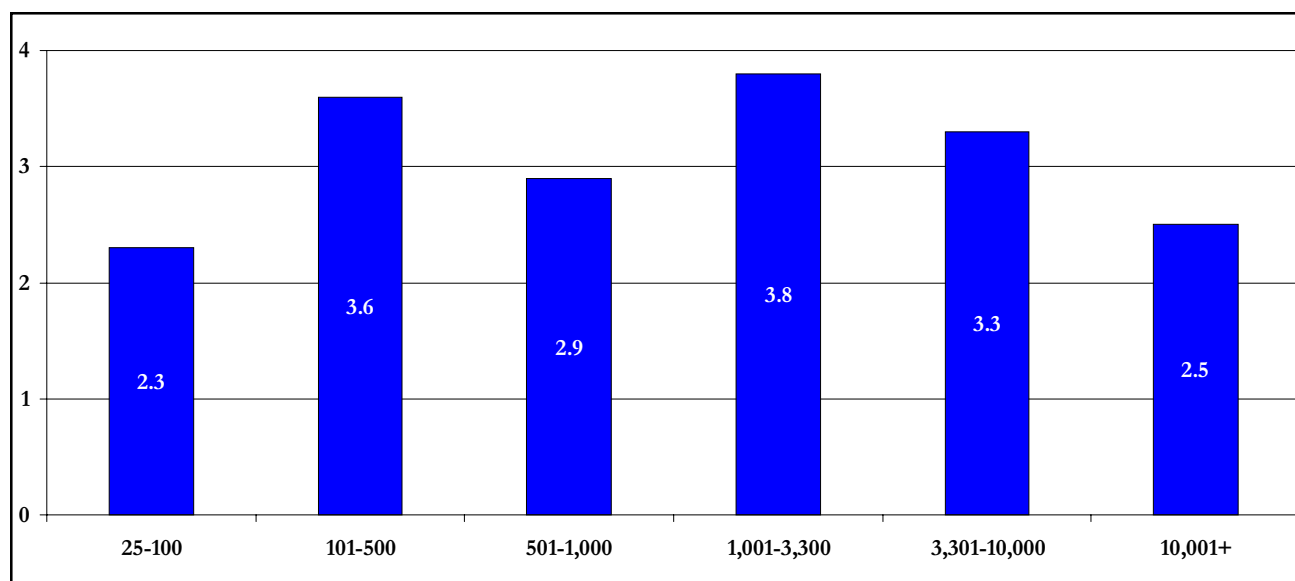
**Figure 4.10: Percentage of Last Rate Increases by System Size**

Source: 1995 Community Water System Survey (Data from Table 20)



**Figure 4.11: Years Since Last Rate Increase by System Size**

Source: 1995 Community Water System Survey (Data from Table 20)



**Figure 4.12: Comparison of Water Expenditures with other Household Expenses**

Source: Bureau of Labor Statistics, Consumer Expenditure Survey (1997)

Expense Category	Expenditure	% of Total Expenditures
Transportation	6,457	18.5%
Food	4,801	13.8%
Health Care	1,841	5.3%
Entertainment	1,813	5.2%
Gasoline & Motor Oil	1,098	3.2%
Electricity	909	2.6%
Telephone Services	809	2.3%
Natural Gas & Fuel Oil	409	1.2%
Pets, toys, etc.	327	0.9%
Alcoholic Beverages	309	0.9%
Water & Other Public Services	286	0.8%
Tobacco Products	264	0.8%
TOTAL	34,819	62.4%

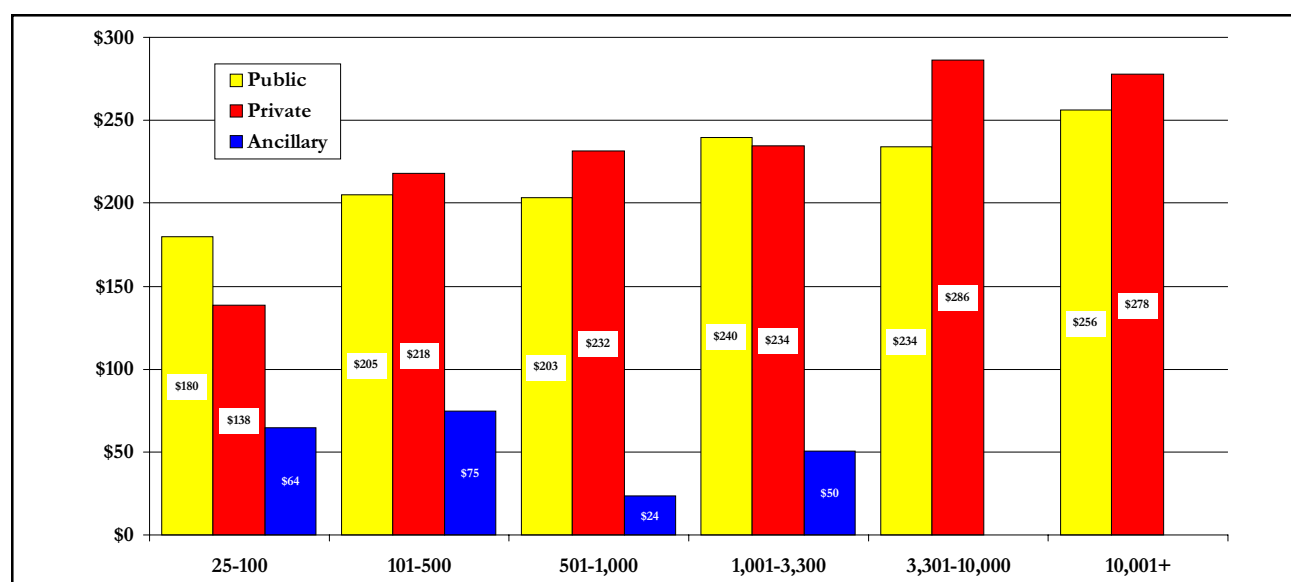


Rate increases within the water system industry have not kept pace with increases of other industries. Figure 4.12 shows that water expenditures are well below other household expenses—including expenditures for utilities, electricity, and telephone services. Only 0.8 percent of household expenditures are devoted to costs associated with the provision of water.

In spite of substantial rate increases, the data show that very small water systems are still not raising enough revenue to cover costs (Figure 4.13). Most systems serving fewer than 500 persons still have expenditures that exceed revenues. The data also show that the gap between revenues and expenditures widens as system size increases. This is probably because large systems are more likely to incorporate capital or emergency expenditures into their water rates, and are more likely to accurately estimate the true cost of water.

**Figure 4.13: Comparison of Water Expenditures per Connection with Water Revenues per Connection**

Source: 1995 Community Water System Survey (Data from Table 17 and Table 21)



## Expenditures

As defined in the 1995 CWSS, total expenses include compensation for employees, energy costs, costs for chemicals and other materials, outside lab fees, other contractor services, depreciation expenses, water purchasing expenses, interest payments, principal payments, capital improvements, and contributions to sinking funds. The 1995 CWSS organizes expenditures into three categories: operating expenses, debt service expenditures (such as principle and interest payments), and other expenses (such as capital improvements). This report uses operating and debt service expenditures to define expenditures. Principal payments, contributions to sinking funds, and capital improvements are excluded.

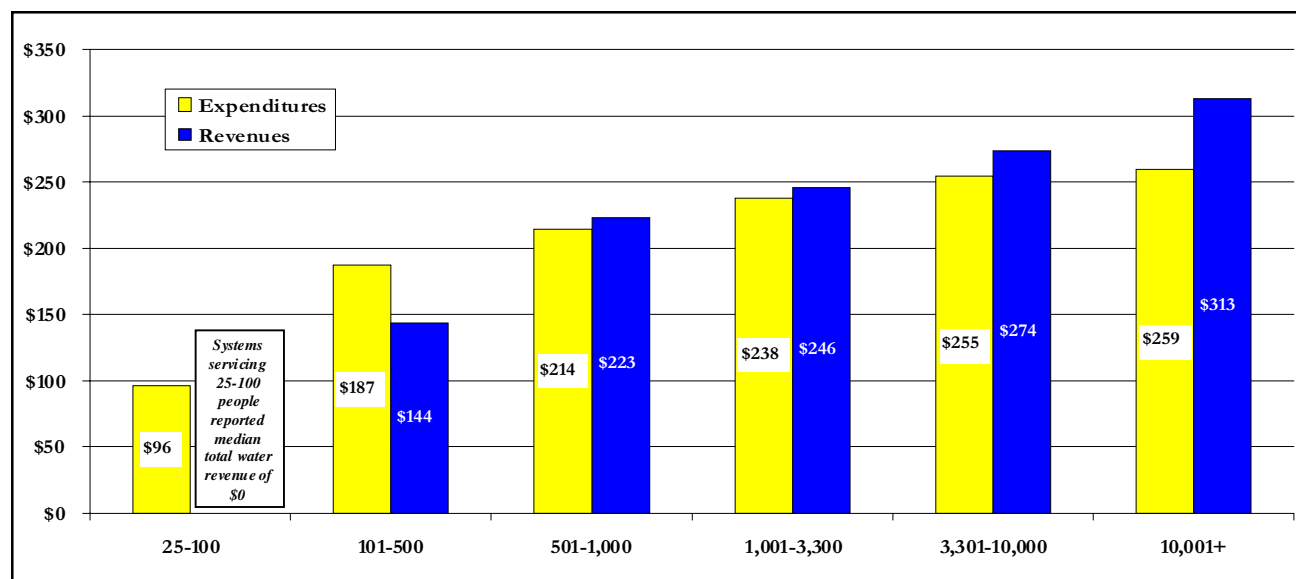
Operations and maintenance expenses (O&M) include all direct costs of production, such as labor, materials, chemicals, electricity, taxes, and payments in lieu of taxes. Nationally, CWSs spend \$16.9 billion for O&M expenses; 76.5 percent of total industry expenses. Of the water industry's remaining expenses, depreciation accounts for \$2.4 billion, interest expenses were \$2.7 billion, and all other expenses totaled \$0.1 billion.

O&M is usually greater in larger systems because of the increasingly complex infrastructure, which also demands highly trained (and more experienced) operators. The equipment used by large systems can also be more costly to repair and maintain than the equipment found in smaller systems, particularly given that large systems are more likely to use a surface water source.

For systems serving fewer than 10,001 persons, median expenditures per connection increase as system size increases for all ownership types (Figure 4.14). Figure 4.14 also shows that expenditures per connection for privately owned systems are higher than those for publicly owned systems, with the exception of two size categories.

**Figure 4.14: Median Expenditures per Connection for Public, Private, and Ancillary Systems by System Size**

Source: 1995 Community Water System Survey (Data from Table 21)



## Ratios

Financial ratios are frequently used to gauge the financial health of water systems. Two of the most frequently used financial ratios are the operating ratio and the debt service ratio. Some very clear distinctions emerge between small and large systems when examining their respective financial ratios.

The operating ratio is a system's total operating revenue divided by its operating and maintenance expenses. O&M expenses is the sum of direct compensation (managers, operators, and others), benefits, energy (electricity and other), chemicals (disinfectant, precipitation, and other), materials and supplies, outside lab services, other outside contractors, water purchases, pilot/other cash, other operating expenses, federal taxes, State taxes, and local taxes. Depreciation, primary business expenses, interest payments, principal payments, other debt service, capital improvements, advanced contributions to sinking funds, and other expenses are excluded.

Total operating revenues is defined as the sum of water sales, and the following water related revenues: connection fees, inspection fees, developer fees, usage fees, other fees, and general fund revenues. Interest earned, primary business revenues, fines/penalties, and other water related revenues are excluded from the total. Systems that reported zero operating expenses were excluded from the analysis.

Generally, an operating ratio below 1 is considered to be an indicator of weak financial health. Ratios above 1.5 are usually a good indicator of a system with a strong financial situation. Figure 4.15 shows that more than half of systems serving fewer than 101 people have operating ratios below 1. As system size increases, the ratios improve. More than half of systems in the largest size category have an operating ratio above 1.5.

**Figure 4.15: Operating Ratio Breakdown by System Size**

Source: 1995 Community Water System Survey (Data from Table 22)

System Size	Percentage of Systems with Operating Ratios:			
	Less than 1	1 — 1.5	1.5 — 2	Greater than 2
<b>25-100</b>	61%	21%	6%	11%
<b>101-500</b>	43%	28%	21%	8%
<b>501-1,000</b>	29%	39%	16%	15%
<b>1,001-3,300</b>	23%	45%	20%	12%
<b>3,301-10,000</b>	17%	41%	27%	16%
<b>10,001+</b>	13%	35%	28%	24%

The debt service coverage ratio measures the ability of water systems to cover their debt service after all operating expenses have been paid. Debt service coverage is computed by dividing net available revenue by annual principal and interest (i.e., debt service charges). Net available revenues is the cash available to pay debt service expenses after current O&M expenses have been paid. It is equal to total water revenues (i.e., operating plus non-operating revenues) less O&M expenses.

The numerator in the debt service coverage ratio represents annual net revenues available to pay debt service, and the denominator is the amount of debt to be retired and the interest on that debt for one year. It is a critical ratio used by lenders and bond rating services. This ratio should exceed 1.0, and analysts consider a range of 1.0 to 1.5 as acceptable. Systems without debt service expenses may be financially healthy and not in need of the large investments that require systems to do into debt. On the other hand, a system without debt may not be properly leveraging its resources and assets to make necessary investments.

As shown in Figure 4.16, a vast majority of the smallest systems have no debt. Of those systems serving fewer than 100 people that do have debt, most have debt service coverage ratios below 1. As with operating ratios, the debt service coverage ratio improves with system size. A significant majority of large systems have debt service coverage ratios above 1.

**Figure 4.16: Debt Service Coverage Ratio Breakdown by System Size**

Source: 1995 Community Water System Survey (Data from Table 22)

System Size	Percentage of Systems with Debt Service Coverage Ratios:			
	Less than 1	1 — 1.5	Greater than 1.5	No Debt Service
<b>25-100</b>	7%	0%	5%	88%
<b>101-500</b>	18%	7%	10%	65%
<b>501-1,000</b>	25%	5%	23%	46%
<b>1,001-3,300</b>	29%	9%	29%	34%
<b>3,301-10,000</b>	24%	19%	26%	32%
<b>10,001+</b>	20%	16%	36%	27%

## Section 5: INFRASTRUCTURE NEEDS

Much of the nation's drinking water infrastructure suffers from long term neglect and deterioration. An EPA-sponsored infrastructure needs survey of 4,000 CWSs conducted in 1995 found widespread infrastructure deterioration in all sizes of water systems.

The total dollar need for all systems for the 20-year period from 1995 to 2015, shown in Figure 5.1, is \$138.4 billion. Of this total, small systems need approximately \$37.2 billion. It is important to note that the definition of "small systems" used in the 1995 Needs Survey differs from the definition used elsewhere in this report. Small systems in the 1995 Needs Survey are defined as systems serving 3,300 and fewer people, while systems serving 3,301 to 10,000 are included in the medium system category. The 1995 Needs Survey shows that the total need for systems serving 25 to 10,000 persons is \$53.1 billion.

**Figure 5.1: Total 20-Year Need by Component of Need and System Size  
(billions of dollars)**

Source: 1995 Infrastructure Needs Survey

System Size	Transmission and Distribution	Treatment	Storage	Source	Other	Total
Large Systems (serving more than 50,000)	\$30.5	\$17.2	\$3.5	\$5.6	\$1.6	<b>\$58.5</b>
Medium Systems (serving 3,301 to 50,000)	\$22.2	\$12.0	\$4.2	\$2.8	\$0.3	<b>\$41.4</b>
Small Systems* (serving 3,300 and fewer)	\$23.8	\$6.7	\$4.2	\$2.5	\$0.04	<b>\$37.2</b>
American Indian and Alaska Native Systems	\$0.6	\$0.3	\$0.3	\$0.1	\$0.03	<b>\$1.3</b>
<b>Total</b>	<b>\$77.2</b>	<b>\$36.2</b>	<b>\$12.1</b>	<b>\$11.0</b>	<b>\$1.9</b>	<b>\$138.4</b>

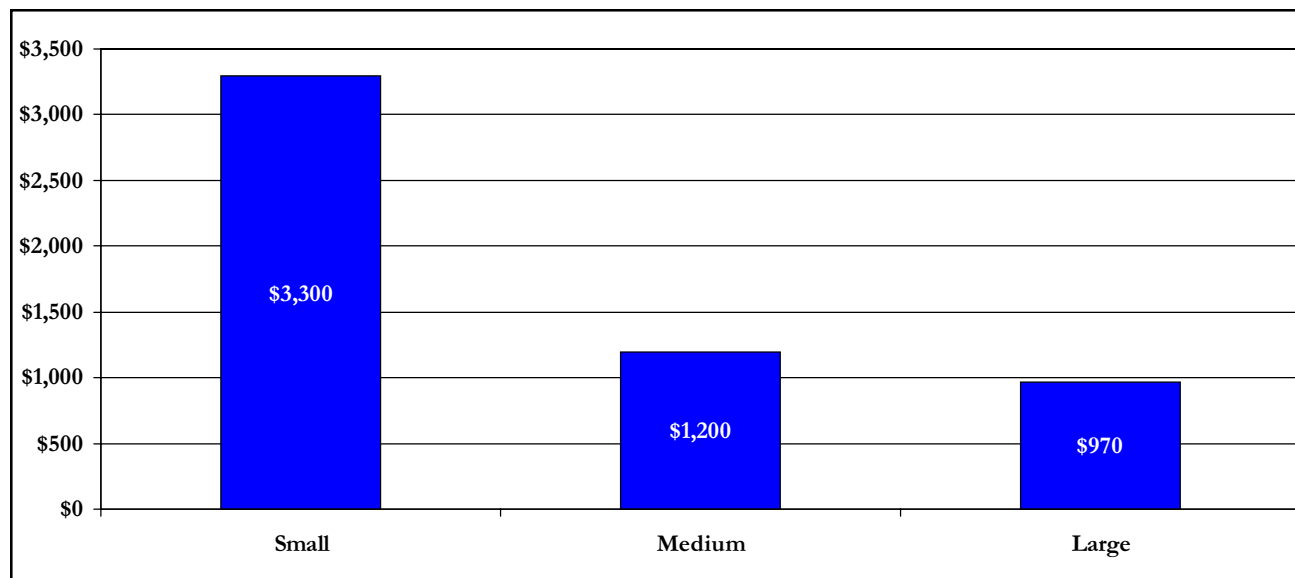
\*Note: The rest of this report defines small systems as systems serving 10,000 or fewer persons.

Note: Totals may not sum exactly due to rounding.

Figure 5.2 reveals that small systems have more than three times the per-household need of large systems. Small systems' infrastructure needs amount to \$3,300 per household over the 20-year period. These systems demonstrate greater need per household because they must spread the considerable cost of infrastructure improvement and replacement over a relatively small customer base. Large systems have the lowest need per household (less than \$1,000) because infrastructure costs are shared by much larger service populations.

**Figure 5.2: Need Per Household by System Size**

Source: 1995 Infrastructure Needs Survey (Data from Table 23)



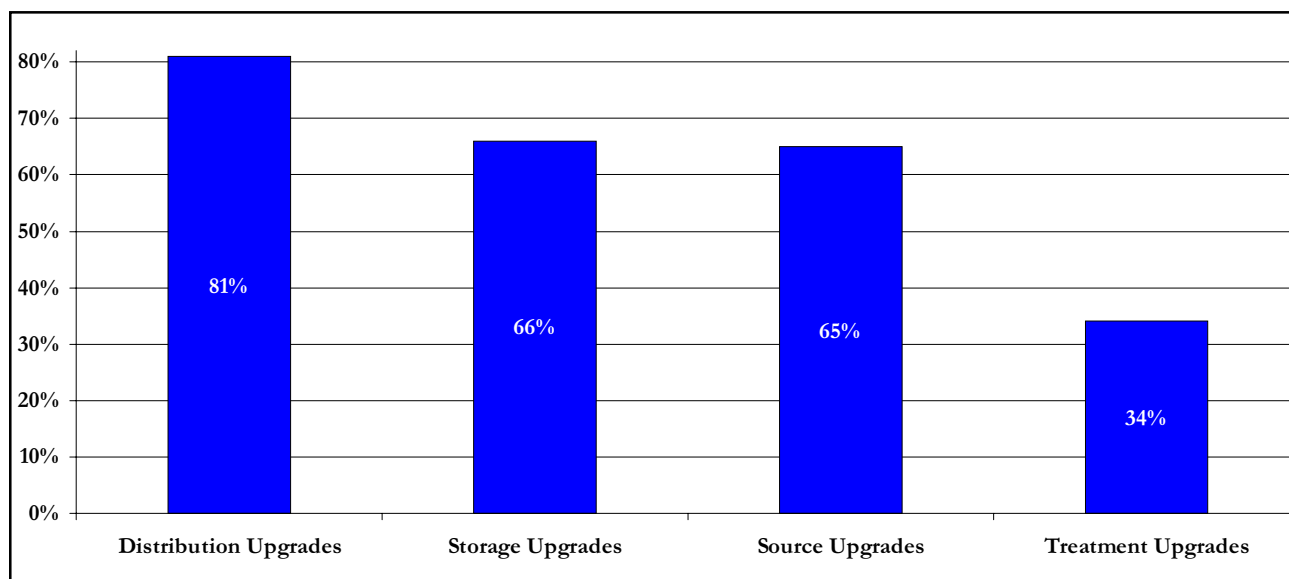
There are four major categories of need for all CWSs: transmission and distribution, treatment, storage, and source. For CWSs, transmission and distribution needs total \$77.2 billion, more than half of the total dollar need for CWSs (Figure 5.1). The overwhelming need in small systems for transmission and distribution infrastructure is demonstrated in Figure 5.3. Eighty-one percent of systems serving fewer than 3,301 persons require replacement of poorly designed or deteriorating distribution and transmission infrastructure.

Two-thirds of small water systems, as shown in Figure 5.3, reported a need for improvements to storage facilities, making it the second-most prevalent category of need among small systems. Storage is critical for water systems because it ensures the positive water pressure necessary to prevent contamination. It also provides water for periods when demand exceeds the capacity of source and treatment facilities. Small system storage needs per household are larger than the needs of medium and large systems because the majority of these systems rely on small wells without back-up systems. Most larger systems have existing storage facilities.

Source needs range in size and type. Figure 5.1 reveals that source development is a small portion of the total dollar need for CWSs. While the dollar figure is comparatively low, Figure 5.3 shows that source development is a need for many small systems (65 percent). Wells (especially smaller wells) can be clogged by sediment, calcium carbonate deposits, and accumulation of iron bacteria; this can lead to supply and contamination problems. Treatment need is the least prevalent category of need for small systems. Figure 5.3 shows that only 34 percent of small systems have treatment needs.

**Figure 5.3: Percentage of Small Systems Reporting Needs by Category of Need**

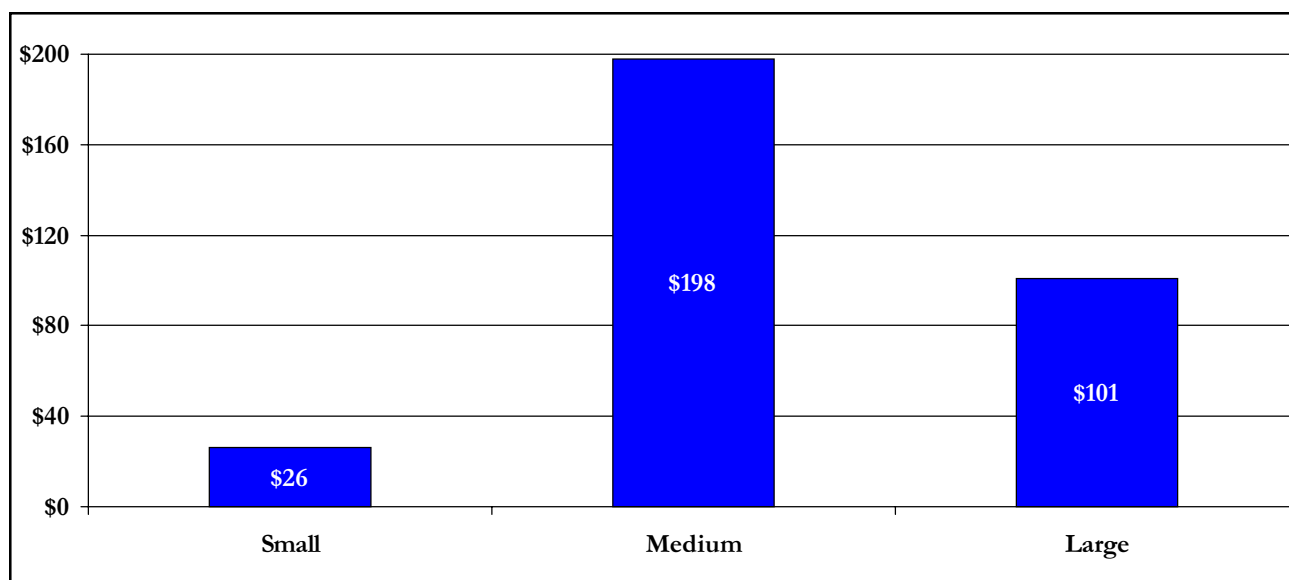
Source: 1995 Infrastructure Needs Survey (Data from Table 24)



In 1998, the American Water Works Association (AWWA) published its own estimate of infrastructure needs related to distribution in *Infrastructure Needs for the Public Water Supply Sector*. AWWA's Monte Carlo analysis, which did not include small systems, estimated a greater need than EPA's 1995 Needs Survey for infrastructure investment for distribution in large and medium systems. The study incorporated the estimate for small systems from the EPA's *Drinking Water Infrastructure Needs Survey*. Again, small systems were defined in this study as those systems serving fewer than 3,301 persons, medium systems were defined as those serving 3,301-50,000 persons, and large systems were defined as those serving more than 50,000 persons.

**Figure 5.4: AWWA Estimate of 20-Year Total Need (in billions of dollars)**

Source: 1998 Infrastructure Needs for the Public Water Supply Section (Data from Table 25)



## Section 6: COMPLIANCE AND VIOLATIONS

The FY98 SDWIS data track compliance with NPDWRs in CWSs. Figure 6.1 shows the percentage of CWSs that have had violations by system size and type of violation. These violations include maximum contaminant levels (MCLs), monitoring and reporting violations (M/R), treatment technique violations (TT), and other violations. M/R violations make up the largest percentage of violations for each system size. Systems serving 25-500 persons also have the largest percentage of M/R violations at 21.1%. M/R violations decrease as system size increases. MCL violations are most prevalent in systems serving between 25 and 500 people.

**Figure 6.1: Percentage of CWSs with Violations by System Size**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 26)

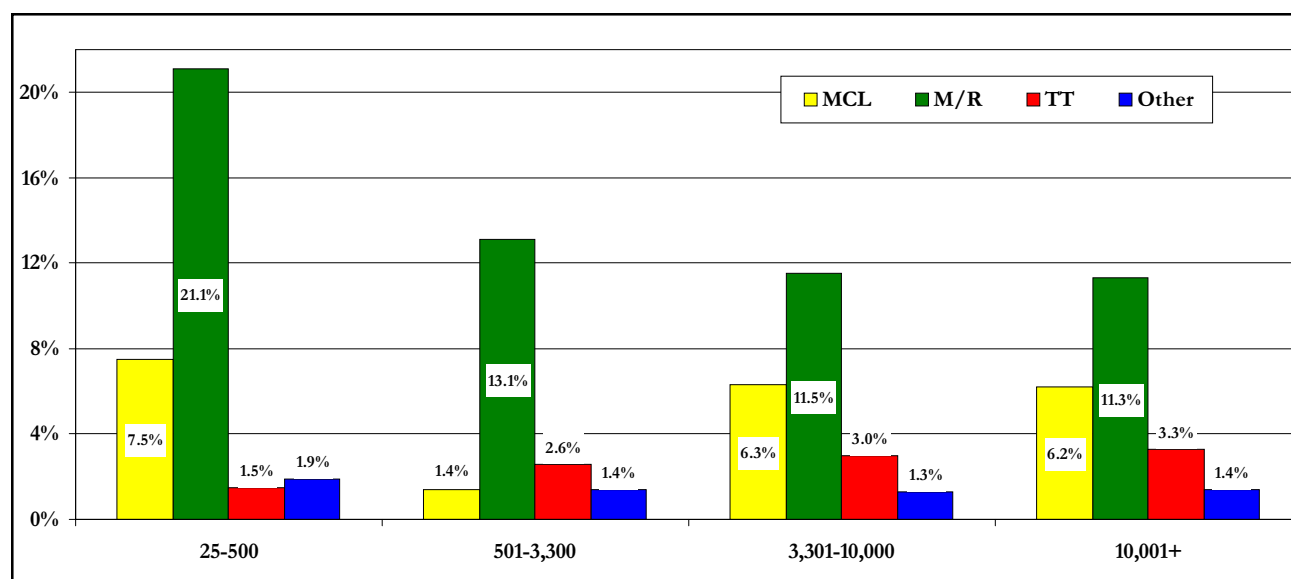


Figure 6.2 shows violations per 1,000 people served for CWSs. Systems serving 25-500 persons have the greatest number of violations per 1,000 people for all violation types. The number of violations per 1,000 persons decreases as system size increases for all violation categories. For every one million persons served by the smallest category of systems, there are approximately 807 MCL violations and 7,164 total violations. In contrast, for every one million customers of systems serving over 10,000 persons, there are less than 2 MCL violations and 10 total violations. M/R violations are the most frequent violation type for all size systems, with over 160 violations occurring per one million persons served by CWSs.



**Figure 6.2: Violations per 1,000 People Served for CWS**

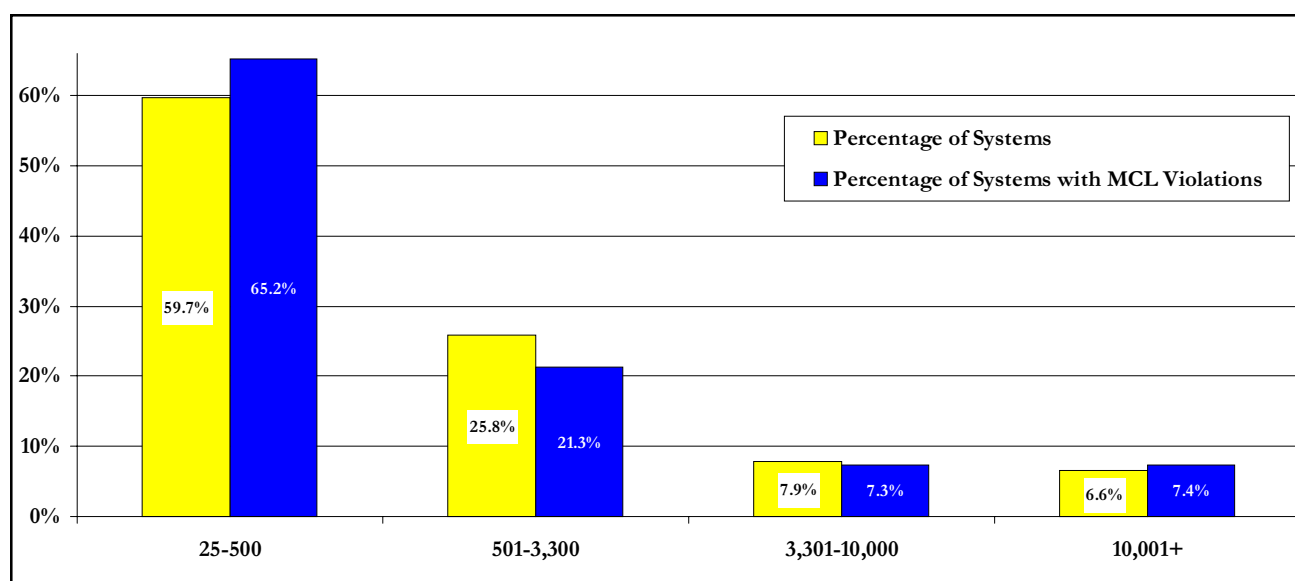
Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 27)

System Size		Violation Type				
		MCL	TT	M/R	Other	All
<10,001	25-500	0.8072	0.2079	5.9245	0.2247	7.1644
	501-3,300	0.0722	0.0428	0.3027	0.0146	0.4323
	3,301-10,000	0.0143	0.0099	0.0896	0.0029	0.1167
	Total	0.1200	0.0436	0.7828	0.0307	0.9770
10,001+		0.0016	0.0017	0.0062	0.0004	0.0098
All		0.0251	0.0100	0.1604	0.0061	0.2015

Although small systems, especially those serving 25-500 persons, have the highest percentage of systems with MCL violations among CWSs, Figure 6.3 demonstrates that this percentage is largely a reflection of the number of small systems in the United States. The percentage of systems with MCL violations in each size category closely tracks the percentage of systems within that category for all system sizes.

**Figure 6.3: Comparison of CWSs with MCL Violations by System Size**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 1 and Table 26)



## Section 7: NONCOMMUNITY WATER SYSTEMS

The previous sections of this report contain information on the operating and financial practices and the infrastructure needs of CWSs. Much of this data was drawn from several national surveys of CWSs. There are no comparable national surveys examining NCWSs. The primary sources of information on NCWSs are the federally-maintained SDWIS database and the reports written based on SDWIS data. Therefore, available data focuses on inventory and compliance information. There is much about the financial and operating characteristics of NCWSs left to be studied.

There are two types of NCWSs: nontransient noncommunity water systems (NTNCWSs) and transient noncommunity water systems (TNCWSs). There are about 116,009 NCWSs in the United States serving over 23 million people. Over 98 percent of NCWSs use ground water as their primary source. As shown in Figure 7.1, over 99 percent of systems serve fewer than 3,301 people.

**Figure 7.1: Percentage of NCWSs by System Size**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 28)

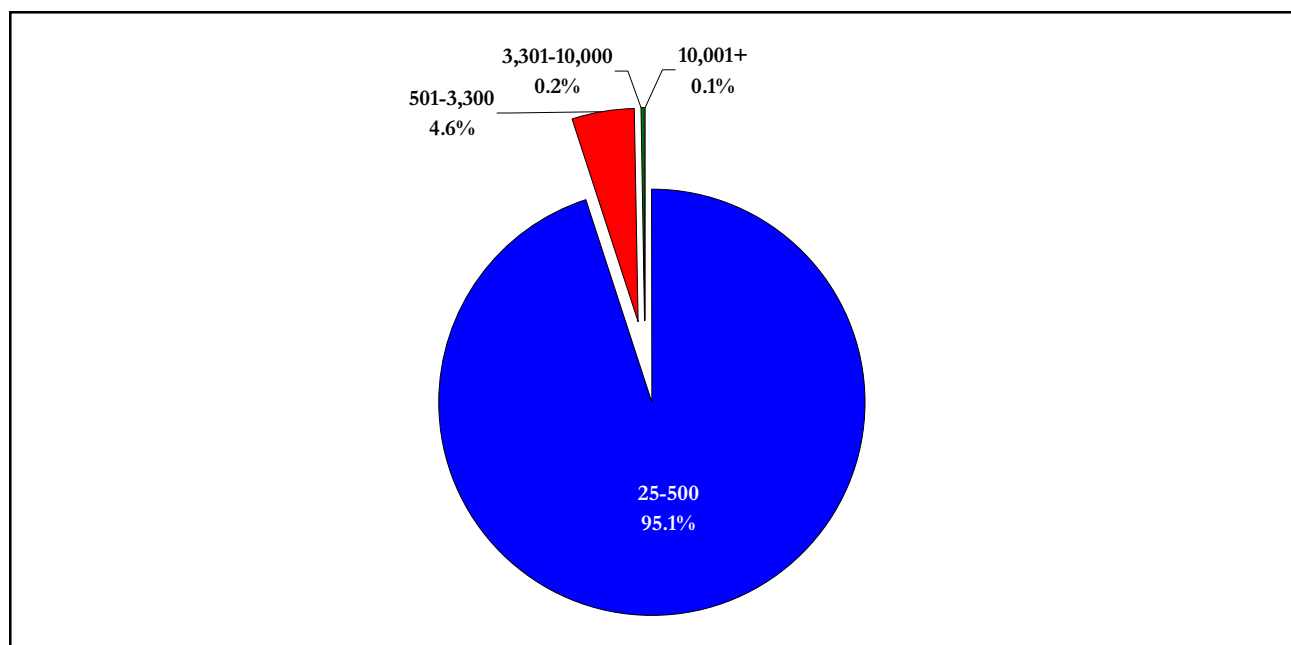
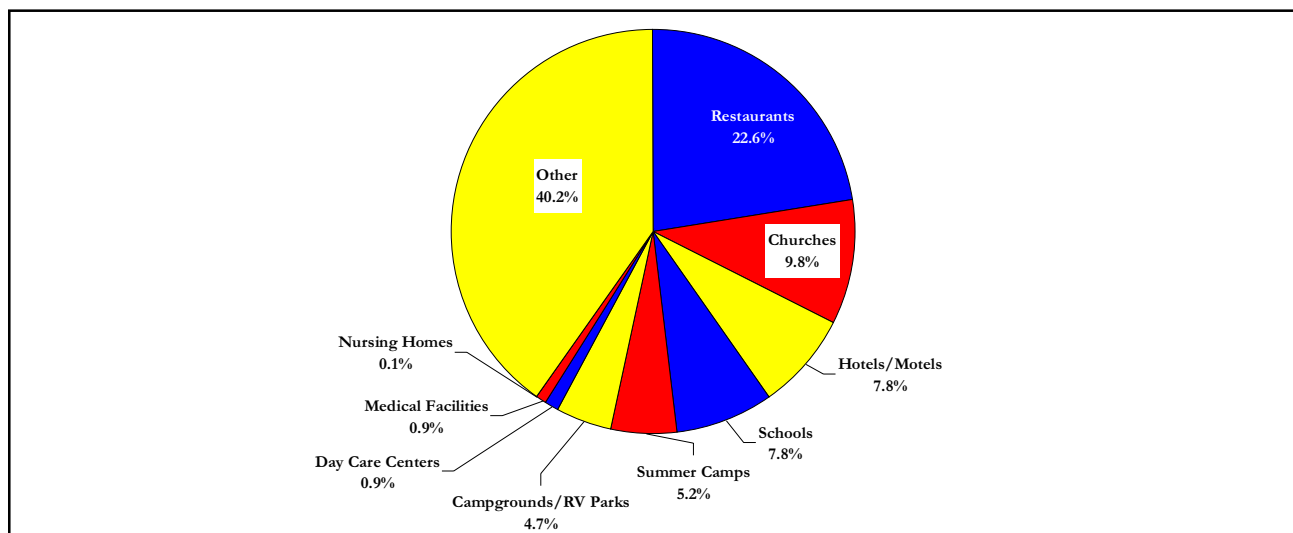


Figure 7.2 shows the breakdown by ownership type for all NCWSs. Almost a quarter of these systems are restaurants. Schools, churches, day care centers, summer camps, and medical facilities combined make up another quarter of all NCWSs.

**Figure 7.2: Ownership of all NCWSs**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 29)



## NTNCWS

A NTNCWS is “a public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.” (40 CFR §141.2) Examples of NTNCWSs are schools, factories, office and industrial parks, and major shopping centers. Approximately 20,000 NTNCWSs across the nation serve some 6 million people. About 97 percent of these systems use ground water as their primary source.

**Figure 7.3: Percentage of NTNCWSs by System Size**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 28)

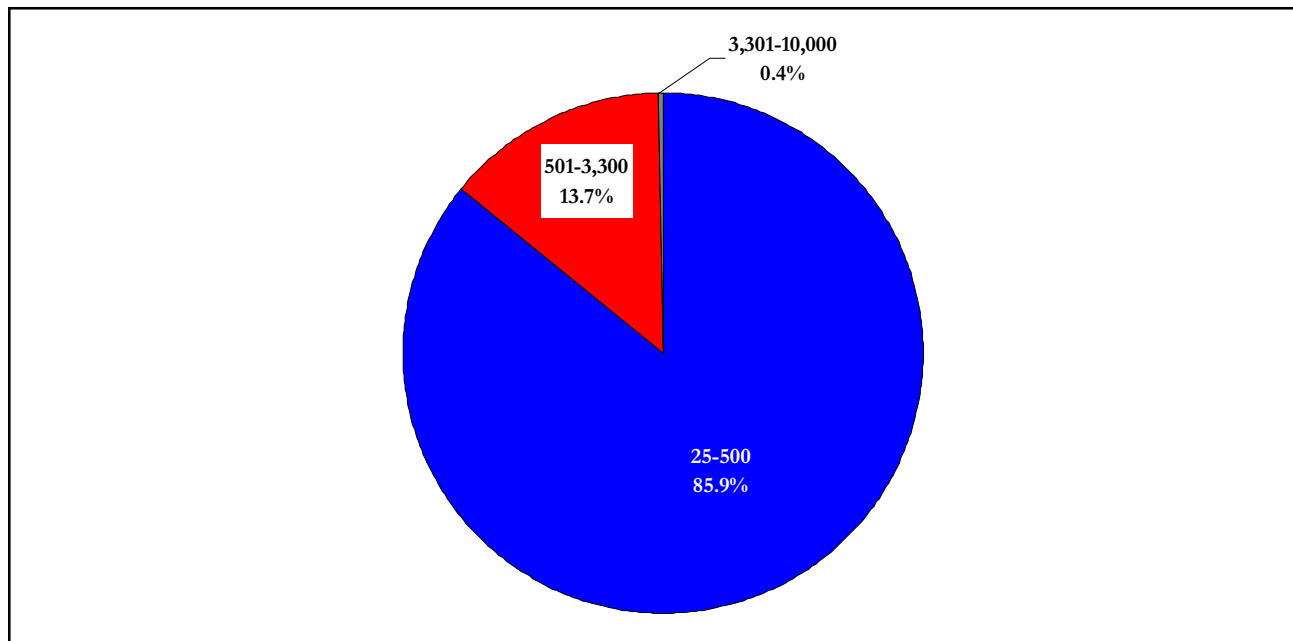
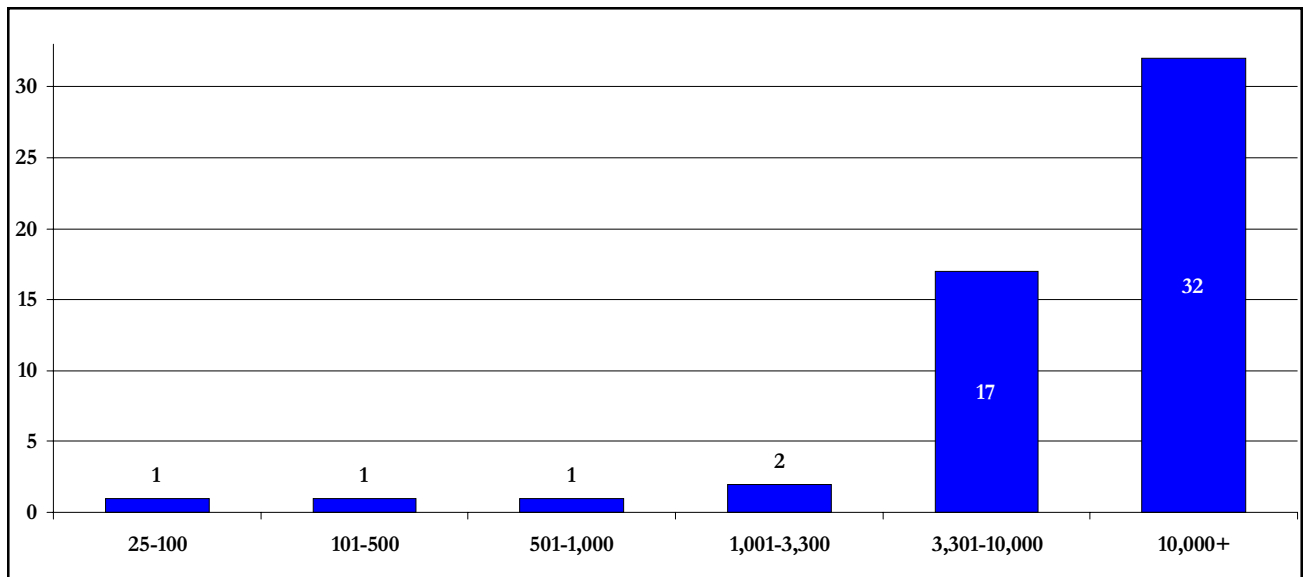


Figure 7.3 shows that close to 99 percent of NTNCWS serve fewer than 3,301 people; 86 percent of NTNCWSs have a service population of less than 501 persons. Figures 7.4 and 7.5 show that NTNCWSs serving fewer than 100 persons have a median service connection of 1 and a median service population of 48, and systems serving between 501 and 1,000 people have a service connection of 1 and a median service population of 700. These data indicate that a single service connection usually serves a large number of people.

**Figure 7.4: Median Number of Connections by NTNCWS Size**

Source: 1994 National Compliance Report (Data from Table 5)



**Figure 7.5: Median Number of Customers by NTNCWS Size**

Source: 1994 National Compliance Report (Data from Table 5)

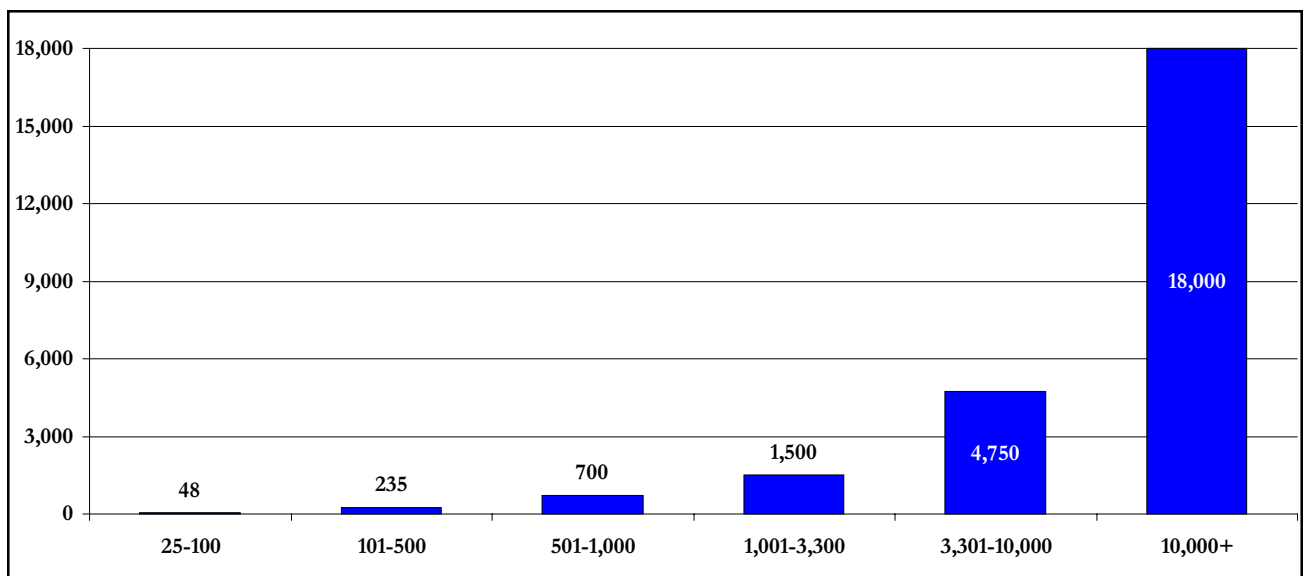
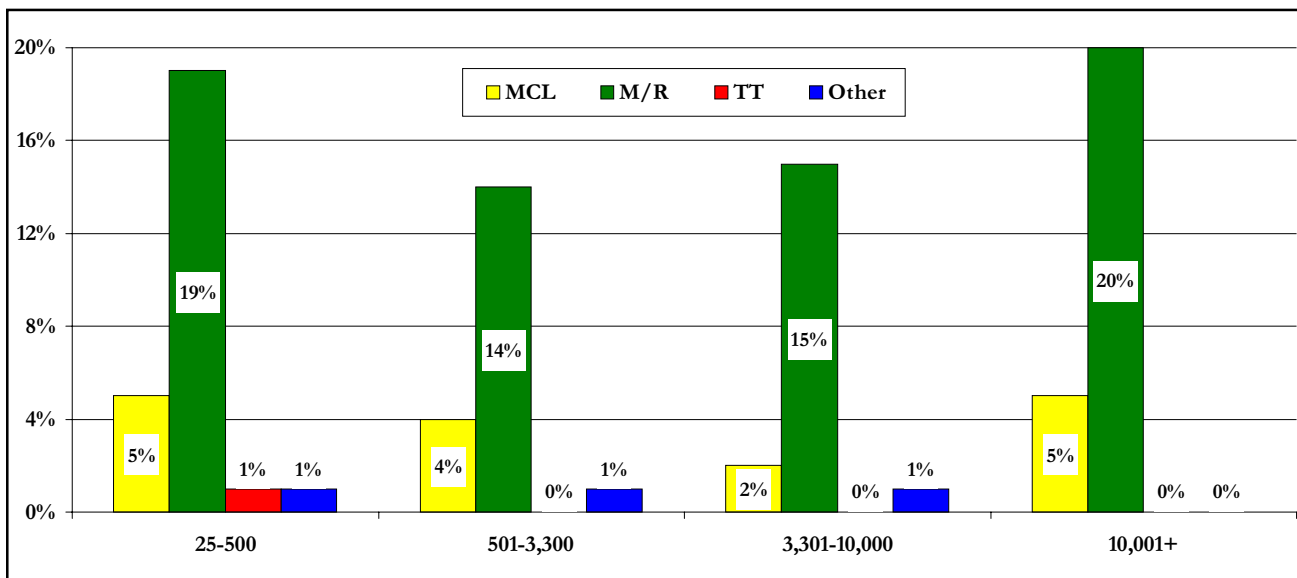


Figure 7.6 shows the percent of NTNCWS violations detailed by system size. Like CWSs, the most common type of NTNCWS violation is a M/R violation. Figure 7.7 shows that the smallest size category of NTNCWSs has more violations per 1,000 customers than does any other size category. As with CWSs, the number of violations per 1,000 people decreases as system size increases (except for systems serving over 10,000 persons, which experience more M/R violations per 1,000 customers than systems serving 3,301-10,000 persons).

Compared with the smallest size category of CWSs, NTNCWSs that serve 25-500 people experience almost half as many MCL violations per 1,000 customers. There are only about 491 MCL violations per one million customers of the smallest NTNCWSs compared to over 800 MCL violations for CWSs of the same size. The largest NTNCWSs have a similar number of MCL violations per 1,000 customers compared to similar sized systems. This trend is reversed when comparing the incidence of total violations, where NTNCWSs serving under 501 persons experience over 1,000 more total violations per one million customers than the same size category of CWSs. The largest category of NTNCWSs has almost 200 more total violations than CWSs of the same size.

**Figure 7.6: Percentage of NTNCWSs With Violations by Violation Type for each Size Category**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 26)



The proportion of NTNCWSs with MCL violations accounted for by each size category of systems is illustrated in Figure 7.8. The smallest systems make up about 85 percent of all NTNCWSs, but account for a slightly greater share of systems reporting MCL violations (89 percent). Generally, the other system sizes of NTNCWSs seem to account for violations proportionally.

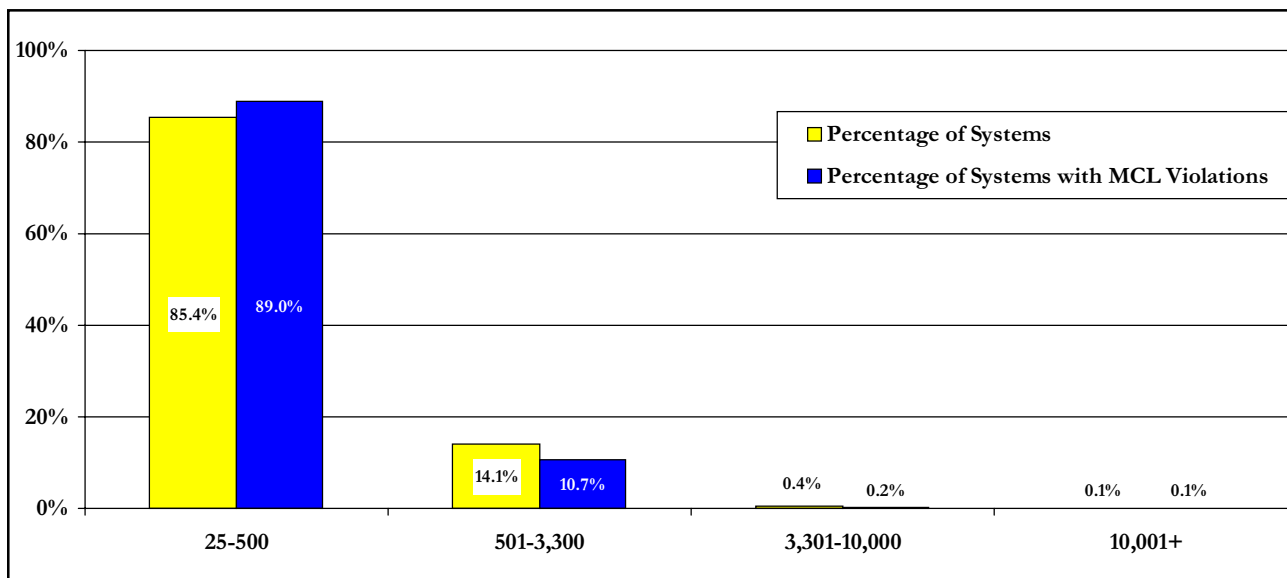
**Figure 7.7: Violations per 1,000 People Served for NTNCWS**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 27)

System Size		Violation Type				
		MCL	TT	M/R	Other	All
<10,001	25-500	0.491	0.064	8.299	0.089	8.944
	501-3,300	0.048	0.004	0.712	0.014	0.777
	3,301-10,000	0.004	0.000	0.127	0.002	0.134
	Total	0.234	0.029	3.910	0.045	4.218
10,001+		0.002	0.000	0.293	0.000	0.294
All		0.212	0.026	3.564	0.041	3.843

**Figure 7.8: Comparison of NTNCWSs with MCL Violations by System Size**

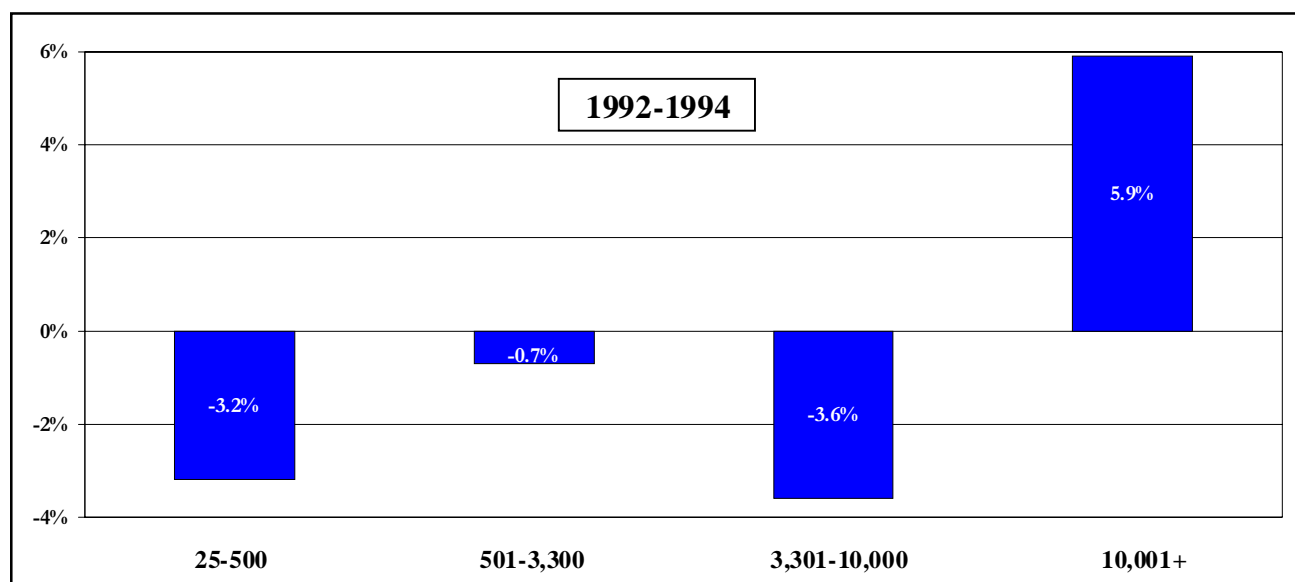
Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 1 and Table 26)



Based on NCR data, the number of NTNCWSs serving more than 10,000 people increased 5.9 percent from 1992 to 1994 (see Figure 7.9). The data show a 3.2 percent decrease in the number of NTNCWSs serving 500 or fewer people, and a 3.6 percent decrease in the number of NTNCWSs serving 3,301-10,000 people. Over the same time period, the number of systems serving over 10,000 people increased by 5.9 percent. These changes could be due to the consolidation of NTNCWSs into CWSs or to the correction of inventory errors.

**Figure 7.9: Percent Change in the Number of TNCWSs by System Size (1992-1994)**

Source: 1994 National Compliance Report (Data from Table 2)

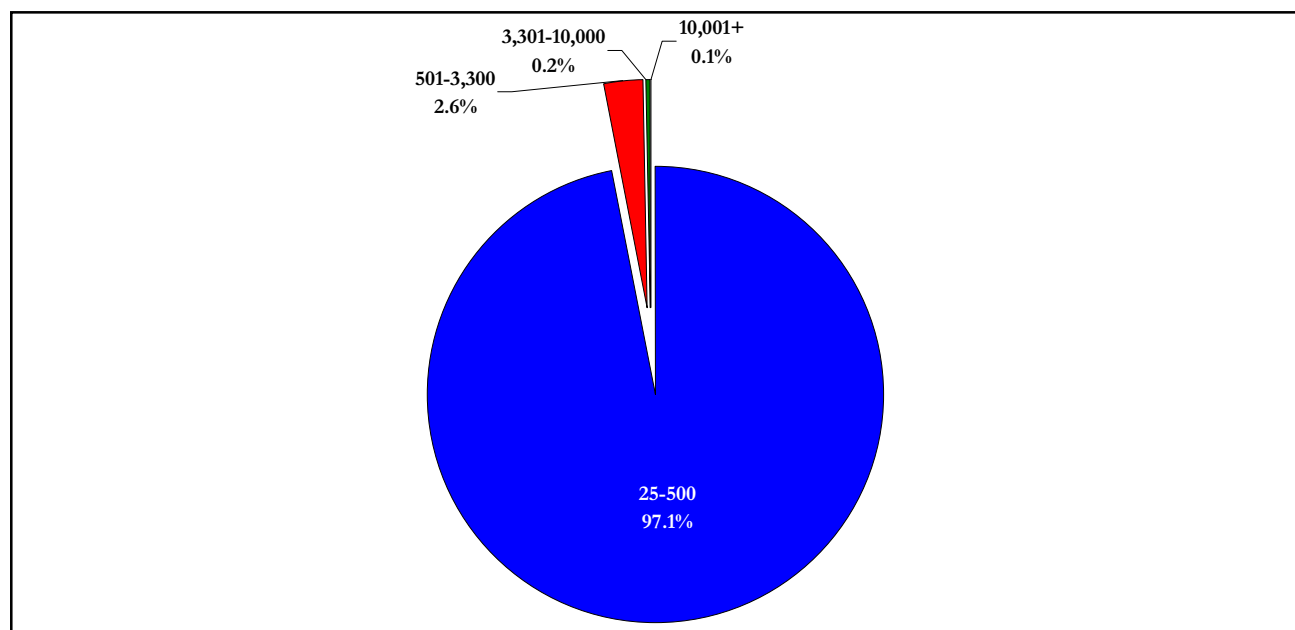


## TNCWS

A TNCWS is “a noncommunity water system that does not regularly serve at least 25 of the same persons over six months per year.” (40 CFR §141.2) Examples of TNCWSs are highway rest stops, restaurants, and recreation areas. More than 95,000 TNCWSs serve approximately 17 million people. Like NTNCWSs, the vast majority of TNCWSs have 3,300 customers or fewer (Figure 7.10).

**Figure 7.10: Percentage of TNCWSs by System Type**

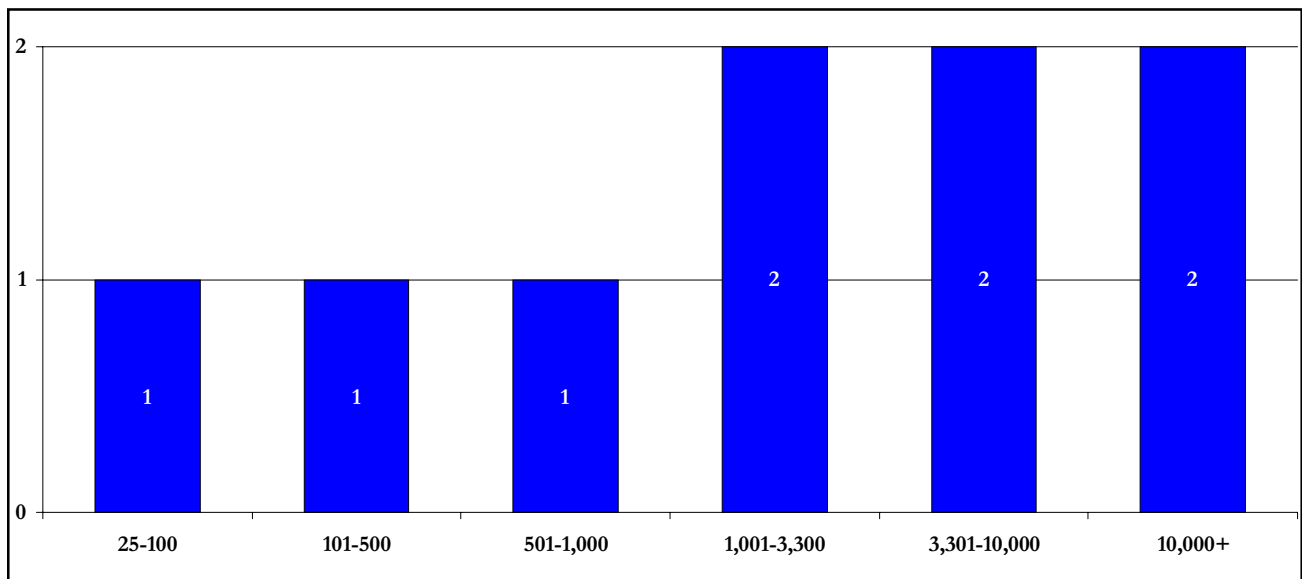
Source: 1994 National Compliance Report (Data from Table 28)



Figures 7.11 and 7.12 show that the smallest size category of TNCWSs has a median service connection of 1 and a median service population of 30 persons, suggesting that TNCWSs have a limited distribution system. Even the largest TNCWSs have a median number of only 2 connections.

**Figure 7.11: Median Number of Connections by TNCWS Size**

Source: 1994 National Compliance Report (Data from Table 5)



**Figure 7.12: Median Number of Customers by TNCWS Size**

Source: 1994 National Compliance Report (Data from Table 5)

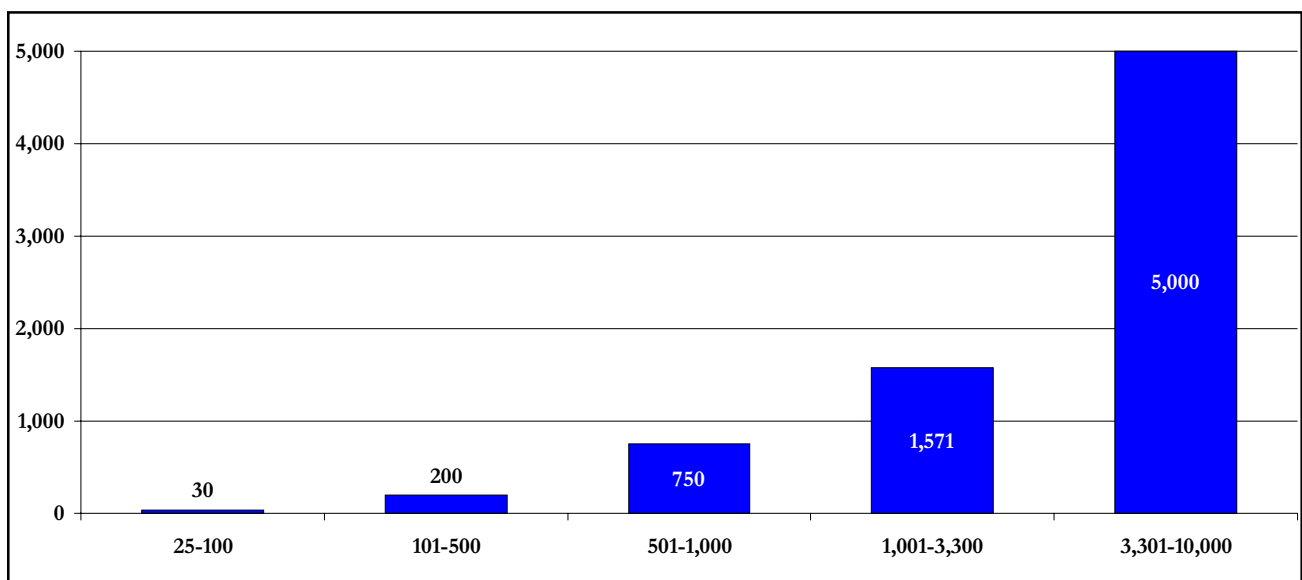


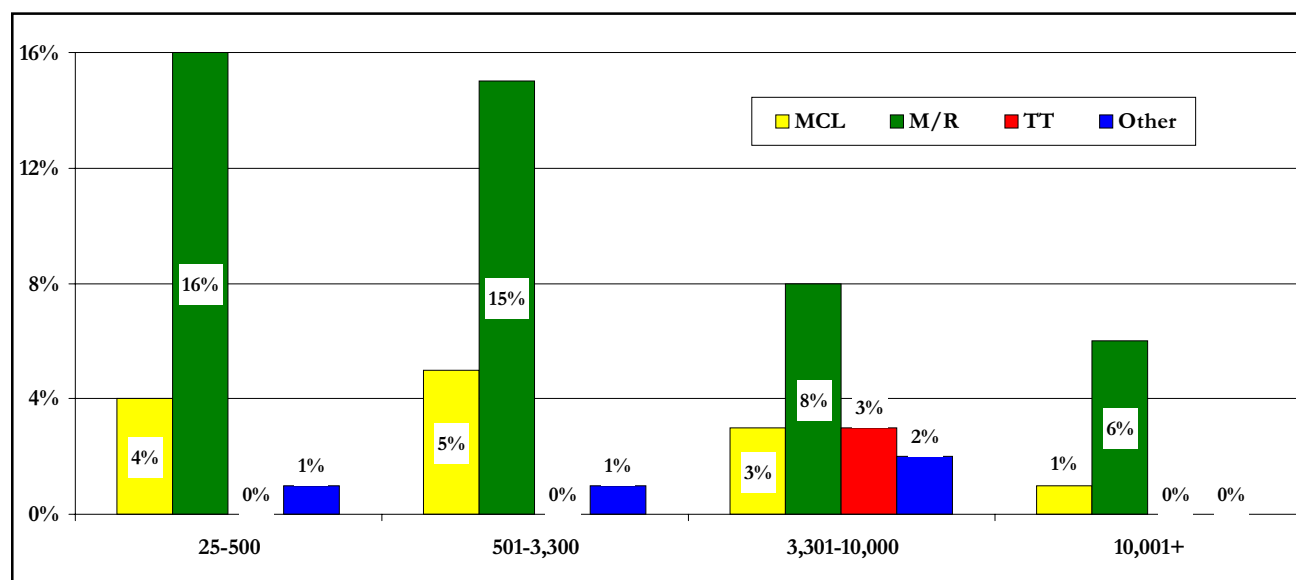


Figure 7.13 shows the percentage of TNCWSs with each type of violation by system size. Like with other types of water systems, TNCWSs violate M/R rules most frequently. But compared to NTNCWSs, a lower percentage of systems in each size category commit a M/R violation.

Figure 7.14 shows that the smallest TNCWSs experience many more violations per 1,000

**Figure 7.13: Percentage of TNCWSs With Violations by Violation Type for each Size Category**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 26)



people than do any other size category of TNCWSs. As with CWSs and NTNCWSs, the number of violations per 1,000 people generally declines as system size increases (except for treatment technique violations, which were less common per 1,000 people for systems serving 501-3,300 persons than for systems serving 3,301-10,000 persons). For every one million customers, the

**Figure 7.14: Violations per 1,000 People Served for TNCWS**

Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 27)

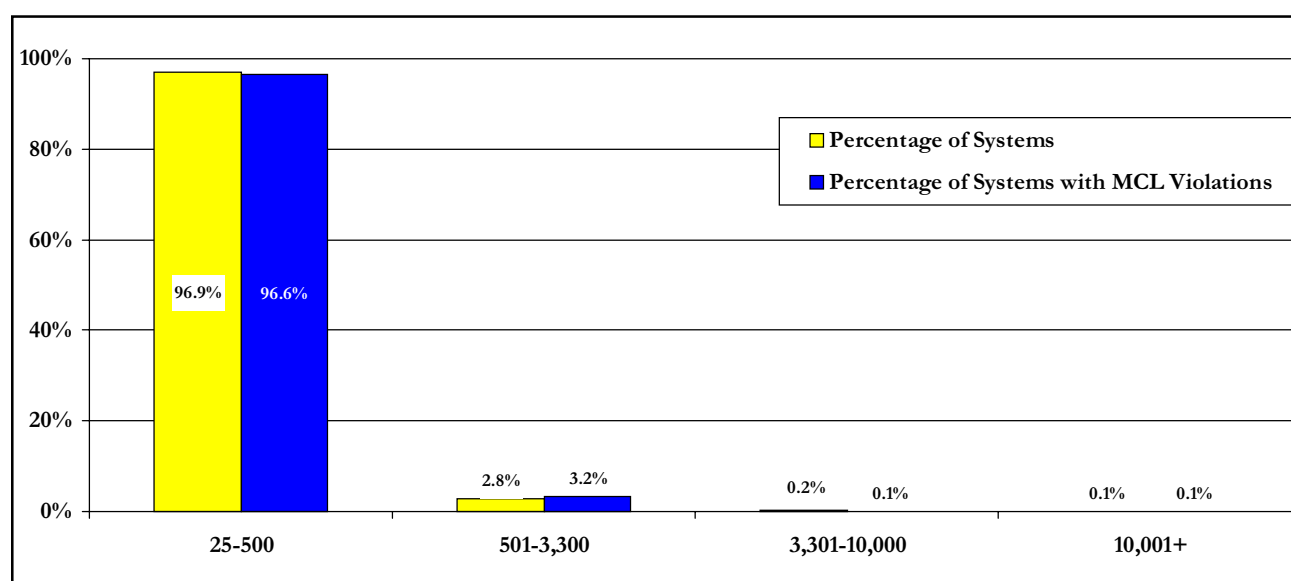
System Size		Violation Type				
		MCL	TT	M/R	Other	All
<10,001	25-500	0.660	0.032	3.306	0.278	4.277
	501-3,300	0.061	0.002	0.229	0.014	0.306
	3,301-10,000	0.006	0.032	0.056	0.008	0.101
	Total	0.459	0.025	2.279	0.190	2.953
10,001+		0.000	0.000	0.001	0.000	0.001
All		0.310	0.026	1.543	0.041	1.999

smallest of TNCWSs incurred 660 MCL violations (more than NTNCWSs, but less than CWSs) and the largest of TNCWSs had no violations (less than both NTNCWSs and CWSs). When all types of violations are taken into consideration, TNCWSs experienced fewer violations per 1,000 customers than both CWSs and NTNCWSs across all size categories.

Figure 7.15 shows that systems serving up to 500 persons actually account for a smaller share of systems with violations than might be expected since systems this size constitute approximately 97 percent of TNCWSs. On the other hand, TNCWSs serving between 501 and 3,301 people have a disproportionate percentage of systems with at least 1 violation.

**Figure 7.15: Comparison of TNCWSs with MCL Violations by System Size**

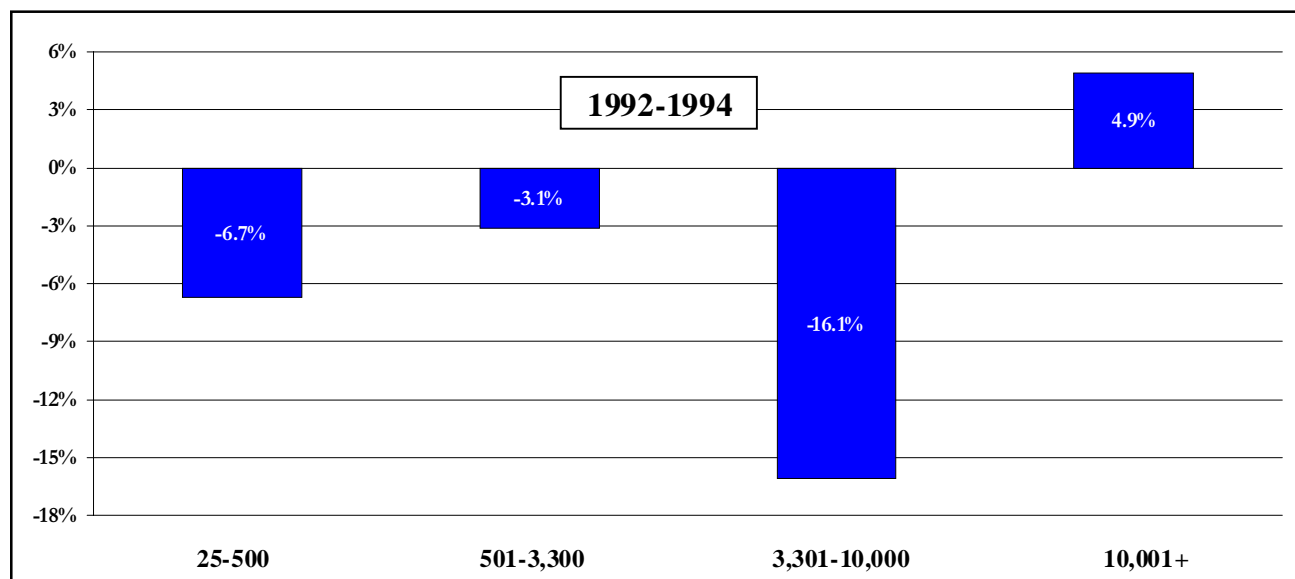
Source: SDWIS FY98Q4 Frozen Violations Table (Data from Table 1 and Table 26)



The 1994 NCR data show a decrease between 1992 and 1994 in TNCWSs of all sizes (see Figure 7.16) except for those serving over 10,000 people. The largest decrease in TNCWSs was found in those serving between 3,301 and 10,000 people—a decrease of 16.1 percent.

**Figure 7.16: Percent Change in the Number of TNCWSs by System Size**

Source: 1994 National Compliance Report (Data from Table 2)



# MISSING DATA

The following questions were raised by the working group and could not be addressed due to insufficient or unreliable data:

- *The percentage of total expenses that each expense category represents, by size and by ownership type.*
- *Mean and median percentage of systems violating standards for individual contaminants.*
- *Financing sources: percentages of private and public funding sources for debt financing by system size and ownership type; funding for capital investments by size and ownership type.*
- *Universe of threatened systems: financial ratios of threatened systems; comparison of operating and debt coverage ratios of threatened systems with these systems' compliance records.*
- *Percentage of systems purchasing treated water or raw water by size and by ownership type.*
- *Mean and median total expenditures for capital improvements per customer and per connection by size and by ownership type.*
- *The water rates for systems with and without treatment.*
- *The number of paid staff.*
- *The length of service of water system operators and managers; the number of certified operators reported per system by size and ownership type; and the percentage of systems reporting a certified operator by size and ownership type.*
- *Collection rates.*
- *Mapping water rates and compliance rates to income.*
- *Percentage of systems reporting a need for cross-connection control equipment by ownership type.*
- *Types of management structures used by water systems.*
- *Level of capitalization.*

## **APPENDIX**

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### **Data Tables**

**Table 1: Number of People Served and Number of Systems by System Type**  
**(Data for Figures 1.1, 1.2, 6.3, 7.8, and 7.15)**  
**Source: SDWIS 98Q4 frozen inventory table**

System Type		System Size					Small System Percentage of National Total
		<501	501-3,300	3,301-10,000	10,001+	All	
<b>CWSs</b>	Number of People Served	5,232,692	19,807,889	25,090,995	202,398,998	252,530,574	19.9%
	Percentage of Total	2.1%	7.8%	9.9%	80.1%	100.0%	
	Number of Systems	32,430	14,043	4,303	3,591	54,367	93.4%
	Percentage of Total	59.7%	25.8%	7.9%	6.6%	100.0%	
<b>NTNCWSs</b>	Number of People Served	2,414,623	2,784,933	447,258	597,801	6,244,615	90.4%
	Percentage of Total	38.7%	44.6%	7.2%	9.6%	100.0%	
	Number of Systems	17,294	2,856	85	20	20,255	99.9%
	Percentage of Total	85.4%	14.1%	0.4%	0.1%	100.0%	
<b>TNCWSs</b>	Number of People Served	7,608,051	2,724,266	1,007,691	5,416,541	16,756,549	67.7%
	Percentage of Total	45.4%	16.3%	6.0%	32.3%	100.0%	
	Number of Systems	92,784	2,690	178	102	95,754	99.9%
	Percentage of Total	96.9%	2.8%	0.2%	0.1%	100.0%	

**Table 2: Percentage Change in the Number of Water Systems**  
**(Data for Figures 1.3, 7.9, and 7.16)**  
**Source: 1994 National Compliance Report**

System Type	Time Period	System Size					
		<501	501-3,300	3,301-10,000	<10,001	10,001+	All
<b>CWSs</b>	<b>1992-1994</b>	-4.3%	-1.9%	-2.1%	-3.5%	0.7%	-3.3%
<b>NTNCWSs</b>	<b>1992-1994</b>	-3.2%	-0.7%	-3.6%	-3.0%	5.9%	-2.9%
<b>TNCWs</b>	<b>1992-1994</b>	-6.7%	-3.1%	-16.1%	-6.7%	4.9%	-6.7%
<b>All</b>	<b>1992-1994</b>	-5.8%	-1.9%	-2.8%	-5.3%	0.8%	-5.2%

**Table 3: Ownership of Water Systems by System Size**  
**(Data for Figure 2.1, 2.3, 2.4, 2.5, 2.6, and 2.7)**  
**Source: 1995 Community Water System Survey**

Owner Type	Population Served					
	25-100	101-500	501-3,300	3,301-10,000	10,000+	All
<b>Public</b>						43.0%
<b>Special District</b>	0.7%	5.7%	5.3%	6.2%	9.1%	
<b>Other Government</b>	7.0%	29.1%	63.4%	70.4%	76.4%	
<b>Private</b>						33.0%
<b>Homeowner's Association</b>	16.4%	12.1%	9.1%	4.0%	1.0%	
<b>Investor Owned</b>	17.8%	18.1%	13.9%	12.3%	9.2%	
<b>Other Privately Owned</b>	5.3%	4.4%	3.6%	4.2%	1.4%	
<b>Ancillary</b>						24.0%
<b>Institution</b>	4.1%	3.5%	0.2%	0.1%	0.1%	
<b>Mobile Home Park</b>	33.3%	22.3%	2.9%	4.4%	4.3%	
<b>Other Ancillary</b>	15.5%	4.8%	1.7%	0.4%	0.4%	
<b>Respondents</b>	131	243	404	197	348	1,323



**Table 4: Percent of Population Served by Owner Type**  
**(Data for Figure 2.2)**  
**Source: 1995 Community Water System Survey and FRDS Database as of 7/96**

Owner Type	System Size							Respondents
	25-100	101-500	501-1,000	1,001-3,300	3,301-10,000	10,001+	All	
<b>Public</b>	7.8%	34.4%	61.4%	74.4%	77.8%	87.4%	84.1%	1,043
<b>Private</b>	40.6%	36.0%	35.2%	24.9%	22.2%	12.6%	15.1%	745
<b>Ancillary</b>	51.6%	29.6%	3.4%	0.7%	0.0%	0.0%	0.8%	192
<b>Respondents</b>	245	402	276	282	282	493	1,980	1,980

**Table 5: Median Population and Service Connections**  
**(Data for Figures 3.1, 3.2, 7.4, 7.5, 7.11, and 7.12)**  
**Source: FRDS Database as of 7/96**

System Type	Measure	Size Category							
		< 101	100-500	501-1,000	1,001-3,300	3,301-10,000	< 10,001	10,001+	All
CWS	Population	58	225	726	1,775	5,474	250	23,000	300
	Connections	22	79	259	607	1,800	83	6,892	98
NTN CWS	Population	48	235	700	1,500	4,750	102	18,000	102
	Connections	1	1	1	2	17	1	32	1
TNC	Population	30	200	750	1,571	5,000	50	29,500	50
	Connections	1	1	1	2	2	1	2	1

Percentage of Public vs. Private (within Size Category/within Ownership Category)											
System Type	Owner Type	System Size									
		< 501		501-3,300		3,301-50,000		50,000+		Total	
CWSs	Public	23.9%	34.6%	65.5%	39.3%	80.1%	23.7%	79.3%	2.5%	42.1%	100.0%
	Private	76.1%	80.2%	34.5%	15.1%	19.9%	4.3%	20.7%	0.5%	57.9%	100.0%
NTNCWSs	Public	28.3%	77.1%	52.4%	22.5%	29.3%	0.4%	na	0.0%	31.6%	100.0%
	Private	71.7%	90.2%	47.6%	9.4%	70.7%	0.4%	na	0.0%	68.4%	100.0%
All	Public	25.3%	43.6%	63.4%	35.7%	79.6%	18.7%	79.3%	2.0%	39.3%	100.0%
	Private	74.7%	83.2%	36.6%	13.4%	20.4%	3.1%	20.7%	0.3%	60.7%	100.0%

**Table 6: Median Miles of Pipe per Connection by System Size**  
**(Data for Figure 3.3)**  
**Source: 1995 Community Water System Survey**

<b>System Size</b>	<b>Miles of Pipe per Connection</b>	<b>Number of Respondents</b>
<b>25-100</b>	0.0295	168
<b>101-500</b>	0.0258	297
<b>501-1,000</b>	0.0262	208
<b>1,001-3,300</b>	0.0326	237
<b>3,301-10,000</b>	0.0231	225
<b>10,001+</b>	0.0143	402

**Table 7: Median Percentage Growth in Customers and Connections by Size Categories  
(Data for Figure 3.4)**

**Source: 1995 Community Water System Survey**

Type of Growth	<101	101-500	501-1,000	1,001-3,300	3,301-10,000	<10,001	10,000+	All
Connections	0	2.5%	5.9%	7.8%	10.0%	5.3%	7.0%	na
Respondents	176	321	225	251	236	1209	445	na
Customers	0	0	7.2%	7.6%	11.1%	5.7%	7.5%	na
Respondents	182	314	208	228	225	1157	437	na

**Table 8: Percentage of Systems by Source and System Size**  
**(Data for Figure 3.5)**

**Source: 1995 Community Water System Survey**

System Size	Primary Water Source			Respondents
	Ground Water	Surface Water	Purchased Water	
<b>25-100</b>	95.7%	2.6%	1.7%	245
<b>101-500</b>	85.2%	5.3%	9.5%	403
<b>501-1,000</b>	76.6%	6.6%	16.9%	NA
<b>1,001-3,300</b>	68.2%	16.2%	15.6%	NA
<b>3,301-10,000</b>	57.6%	19.8%	22.6%	NA
<b>10,001+</b>	47.4%	37.8%	14.7%	493
<b>All</b>	79.8%	9.6%	10.6%	NA

**Table 9: Daily Drinking Water Production by CWSs by Owner-type and System Size**  
**(Data for Figures 3.6 and 3.7)**  
**Source: 1995 Community Water System Survey**

Owner Type	Type of Water Production	System Size							
		25-100	101-500	501-1,000	1,001-3,300	3,301-10,000	< 10,001	10,000+	All
All	Median Production (gal per day)	5,501	24,000	76,712	219,178	706,849	NA	8,335,356	NA
	Respondents	179	335	254	267	275	NA	476	NA
	Peak Daily Production (gal.)	9,740	32,700	142,000	337,500	1,206,000	NA	11,847,500	NA
	Respondents	139	240	172	196	204	NA	422	NA
	Treatment Design Capacity (gal.)	20,000	66,548	252,000	651,736	1,937,000	NA	16,000,000	NA
	Respondents	119	213	163	188	200	NA	414	NA
Ratio of TDC to PDP		2.05	2.04	1.77	1.93	1.61	NA	1.35	NA
Public	Median Production (gal per day)	7,315	27,397	80,304	245,249	775,068	115,343	9,865,205	506,630
	Respondents	44	139	141	158	146	328	345	973
	Peak Daily Production (gal.)	13,500	44,000	150,000	415,000	1,360,000	219,300	12,959,000	1,100,000
	Respondents	38	100	95	122	111	466	306	772
	Treatment Design Capacity (gal.)	25,000	85,000	252,000	750,000	2,000,000	470,000	17,110,000	2,000,000
	Respondents	33	91	93	115	113	445	298	743

**Table 9 Continued**

Owner Type	Type of Water Production	System Size							
		25-100	101-500	501-1,000	1,001-3,300	3,301-10,000	< 10,001	10,000+	All
<b>Private</b>	Median Production (gal per day)	5,490	27,397	68,493	175,836	574,238	84,795	4,663,014	145,753
	Respondents	70	121	110	108	127	536	131	667
	Peak Daily Production (gal.)	7,200	38,985	110,833	250,000	1,084,000	150,000	7,531,000	312,640
	Respondents	55	74	72	74	93	368	116	484
	Treatment Design Capacity (gal.)	28,800	72,000	255,500	547,200	1,440,000	327,500	10,250,000	720,000
	Respondents	44	67	66	72	87	336	116	452
<b>Ancillary</b>	Median Production (gal per day)	4,932	11,951	91,233	115,068		8,219		8,219
	Respondents	65	75	3	1		144		144
	Peak Daily Production (gal.)	7,750	16,750	208,000			14,000		14,000
	Respondents	46	66	5			117		117
	Treatment Design Capacity (gal.)	5,000	40,000	297,000	200,000		27,900		27,900
	Respondents	42	55	4	1		102		102

**Table 10: Percentage of CWSs that Receive Technical Assistance by Ownership Type and System Size**  
**(Data for Figure 3.8)**  
**Source: 1995 Community Water System Survey**

Owner Type	Percentage of Systems that Specified Technical Assistance (TA)	System Size							
		25-100	101-500	501-1,000	1,001-3,300	3,301-10,000	< 10,001	10,000+	All
<b>Public</b>	Government TA	74.2%	65.8%	67.8%	78.0%	82.0%	72.9%	77.1%	73.4%
	Other TA	29.8%	35.9%	32.4%	28.2%	37.2%	32.9%	56.7%	36.2%
	Third Party TA	61.1%	70.7%	79.1%	88.3%	88.9%	79.9%	87.3%	81.0%
	<i>Any</i>	<i>92.5%</i>	<i>87.9%</i>	<i>90.0%</i>	<i>95.9%</i>	<i>96.2%</i>	<i>92.2%</i>	<i>95.5%</i>	<i>92.7%</i>
	Respondents	60	161	151	164	150	686	357	1043
<b>Private</b>	Government TA	52.8%	62.8%	76.5%	61.9%	60.3%	61.0%	74.9%	61.4%
	Other TA	19.0%	28.4%	32.9%	32.3%	43.7%	27.1%	67.4%	28.1%
	Third Party TA	41.6%	60.4%	81.6%	83.9%	90.5%	61.1%	86.2%	61.8%
	<i>Any</i>	<i>71.8%</i>	<i>80.7%</i>	<i>96.0%</i>	<i>95.1%</i>	<i>94.2%</i>	<i>82.1%</i>	<i>93.7%</i>	<i>82.4%</i>
	Respondents	97	143	120	117	132	609	136	745
<b>Ancillary</b>	Government TA	51.8%	56.0%	47.1%	0.0%	na	53.1%	na	53.1%
	Other TA	7.0%	11.7%	74.7%	0.0%	na	10.0%	na	10.0%
	Third Party TA	30.6%	43.0%	78.1%	100.0%	na	36.5%	na	36.5%
	<i>Any</i>	<i>62.8%</i>	<i>73.3%</i>	<i>100.0%</i>	<i>100.0%</i>	na	<i>67.6%</i>	na	<i>67.6%</i>
	Respondents	88	98	5	1	na	192	na	192
<b>All</b>	Government TA	54.0%	61.8%	70.2%	73.5%	77.2%	63.7%	76.8%	64.6%
	Other TA	13.7%	26.0%	34.0%	29.0%	38.6%	25.1%	58.0%	27.3%
	Third Party TA	37.4%	58.8%	80.0%	87.3%	89.3%	62.4%	87.2%	64.1%
	<i>Any</i>	<i>68.7%</i>	<i>81.0%</i>	<i>92.4%</i>	<i>95.7%</i>	<i>95.8%</i>	<i>82.5%</i>	<i>95.2%</i>	<i>83.3%</i>
	Respondents	245	402	276	282	282	1487	493	1980



**Table 11: Median Personnel Expenses as a Percentage of Total Expenses by System Size**  
**(Data for Figure 3.9)**  
**Source: 1995 Community Water System Survey**

Personnel Expense	System Size							All
	< 101	101-500	501-1,000	1,001-3,300	3,301-10,000	< 10,001	10,000+	
<b>Direct Compensation</b>	0	22%	26%	25%	29%	na	28%	na
<b>Manager</b>	0	0	0	2%	4%	na	2%	na
<b>Operator</b>	0	4%	5%	7%	8%	na	4%	na
<b>Other</b>	0	0	1%	3%	5%	na	10%	na
<b>Benefits</b>	0	0	2%	3%	5%	na	6%	na

**Table 12. Potential Sources of Contamination Within 2 Miles of Water Supply Intakes**  
**(Data for Figures 3.10 and 3.11)**  
**Source: 1995 Community Water System Survey**

Potential Source of Contamination		100 or Less	101-500	501-1,000	<1,001	1,001-3,300	3,301-10,000	10,000+	All System Sizes
<b>Industrial/ Manufacturing Facilities</b>	<b>Groundwater Source</b>	9.2%	11.6%	16.8%	11.5%	31.3%	47.4%	64.3%	18.3%
	<b>Surface water Source</b>	0.0%	8.4%	9.0%	6.8%	11.3%	19.4%	49.0%	22.4%
	<b>All Sources</b>	9.1%	11.4%	15.5%	11.2%	27.8%	38.7%	56.6%	18.9%
<b>Agricultural Runoff</b>	<b>Groundwater Source</b>	34.6%	42.4%	55.9%	41.4%	59.3%	60.0%	60.6%	45.5%
	<b>Surface water Source</b>	28.4%	45.9%	38.8%	40.0%	57.8%	64.7%	74.1%	58.5%
	<b>All Sources</b>	34.5%	42.3%	53.1%	41.2%	57.8%	57.1%	65.7%	46.5%
<b>Animal Feedlots</b>	<b>Groundwater Source</b>	7.5%	15.8%	24.3%	13.8%	28.2%	25.1%	17.6%	16.4%
	<b>Surface water Source</b>	4.6%	5.6%	14.7%	8.1%	19.0%	10.8%	18.9%	14.3%
	<b>All Sources</b>	7.5%	15.8%	22.5%	13.8%	25.3%	19.6%	17.8%	16.1%
<b>Urban Runoff</b>	<b>Groundwater Source</b>	15.8%	18.1%	26.8%	18.6%	39.0%	56.0%	67.6%	25.4%
	<b>Surface water Source</b>	8.1%	3.0%	8.0%	5.6%	22.0%	42.2%	64.8%	33.2%
	<b>All Sources</b>	15.7%	18.1%	25.3%	18.4%	35.1%	51.4%	65.8%	26.7%
<b>Sewage Discharge</b>	<b>Groundwater Source</b>	18.9%	17.2%	32.1%	20.3%	33.7%	34.8%	30.0%	23.3%
	<b>Surface water Source</b>	13.6%	10.0%	11.7%	11.3%	16.5%	18.4%	36.2%	21.0%
	<b>All Sources</b>	18.6%	16.6%	29.8%	19.7%	29.2%	31.0%	32.6%	22.9%

**Table 12 Continued**

Potential Source of Contamination		100 or Less	101-500	501-1,000	<1,001	1,001-3,300	3,301-10,000	10,000+	All System Sizes
<b>Hazardous Waste Site</b>	<b>Groundwater Source</b>	4.5%	3.2%	1.8%	3.5%	7.1%	8.8%	15.1%	4.7%
	<b>Surface water Source</b>	0.0%	1.3%	0.0%	0.6%	0.0%	1.4%	8.5%	2.9%
	<b>All Sources</b>	4.3%	3.1%	1.6%	3.3%	5.1%	6.9%	12.0%	4.5%
<b>Solid Waste Disposal</b>	<b>Groundwater Source</b>	5.7%	2.7%	4.0%	4.1%	7.5%	18.3%	18.3%	6.0%
	<b>Surface water Source</b>	0.0%	1.3%	0.0%	0.6%	2.2%	.4%	13.4%	4.7%
	<b>All Sources</b>	5.5%	2.8%	3.3%	3.9%	6.5%	12.1%	15.8%	5.8%
<b>Nitrates</b>	<b>Groundwater Source</b>	9.8%	17.5%	18.3%	14.4%	24.6%	20.3%	36.5%	17.0%
	<b>Surface water Source</b>	6.2%	9.1%	21.5%	12.2%	23.5%	34.5%	29.8%	23.9%
	<b>All Sources</b>	9.6%	16.8%	17.4%	14.1%	22.9%	21.2%	33.0%	17.2%
<b>Pesticides, Rodenticides, Fungicides</b>	<b>Groundwater Source</b>	5.8%	9.5%	19.6%	9.6%	21.9%	24.5%	27.5%	12.8%
	<b>Surface water Source</b>	8.6%	7.1%	9.6%	8.2%	14.0%	11.8%	19.5%	13.5%
	<b>All Sources</b>	5.9%	9.2%	17.6%	9.4%	19.1%	18.6%	24.4%	12.5%
<b>Mining, Oil, or Gas Activities</b>	<b>Groundwater Source</b>	4.1%	8.0%	13.2%	7.3%	18.9%	14.1%	21.8%	9.7%
	<b>Surface water Source</b>	8.8%	6.0%	11.9%	8.3%	10.0%	18.1%	21.2%	14.1%
	<b>All Sources</b>	4.4%	8.2%	13.0%	7.6%	16.4%	14.9%	20.5%	10.3%

**Table 12 Continued**

Potential Source of Contamination		100 or Less	101-500	501-1,000	<1,001	1,001-3,300	3,301-10,000	10,000+	All System Sizes
Petroleum Products	Groundwater Source	24.8%	23.9%	37.4%	26.4%	54.5%	59.2%	68.4%	33.6%
	Surface water Source	8.2%	1.3%	6.9%	4.4%	23.9%	14.1%	43.6%	22.2%
	All Sources	24.2%	22.4%	32.8%	24.9%	46.8%	46.3%	57.2%	32.0%
Solvents	Groundwater Source	4.1%	5.5%	8.9%	5.5%	14.4%	39.1%	51.5%	10.6%
	Surface water Source	0.0%	0.0%	1.0%	0.3%	1.0%	9.7%	27.9%	10.2%
	All Sources	3.9%	5.2%	7.9%	5.2%	11.6%	28.8%	40.8%	10.5%
Septic Systems/Other Sewage Discharges	Groundwater Source	75.8%	63.8%	62.8%	68.5%	76.3%	62.2%	65.3%	68.9%
	Surface water Source	36.6%	41.4%	50.2%	43.0%	56.8%	52.6%	62.8%	53.7%
	All Sources	74.5%	61.3%	61.0%	66.3%	69.0%	58.8%	63.5%	65.8%
Other	Groundwater Source	5.3%	2.4%	4.9%	4.0%	3.3%	6.0%	2.9%	4.0%
	Surface water Source	8.8%	10.8%	10.6%	10.3%	3.3%	5.2%	6.3%	6.6%
	All Sources	5.4%	2.7%	4.8%	4.1%	3.7%	4.9%	4.6%	4.1%
All Contaminants	Groundwater Source	82.9%	83.5%	83.2%	83.2%	93.1%	89.7%	93.2%	85.2%
	Surface water Source	63.7%	71.3%	73.0%	70.1%	85.4%	89.9%	93.9%	84.3%
	All Sources	82.2%	81.2%	81.1%	81.6%	89.4%	87.7%	92.8%	84.0%
Number of Observations	Total	206	323	223	752	243	242	445	1692

**Table 13. Source Water Protection Methods by Primary Water Source**  
**(Data for Figures 3.12 and 3.13)**  
**Source: 1995 Community Water System Survey**

<b>Source Water Protection Program/ Specific Protection Measure</b>	<b>100 or Less</b>	<b>101-500</b>	<b>501-1,000</b>	<b>1,001-3,300</b>	<b>3,301-10,000</b>	<b>10,001+</b>
<b>% Systems with any Source Water Protection</b>	27.5%	31.2%	38.5%	35.0%	40.1%	50.3%
<b>Education on land use impacts</b>	59.5%	59.1%	68.3%	69.7%	69.1%	65.3%
<b>Watershed ownership</b>	37.9%	27.7%	36.6%	49.0%	34.4%	46.8%
<b>Zoning or land use controls</b>	58.9%	54.0%	71.9%	69.7%	77.9%	67.9%
<b>Best management practices</b>	62.6%	54.2%	66.4%	64.5%	60.5%	58.2%
<b>Other</b>	11.2%	16.3%	0.2%	2.0%	8.8%	18.1%

**Table 14: Percentage of Systems that Use GAAP by System Size  
(Data for Figure 4.1)**

**Source: 1995 Community Water System Survey**

<b>System Size</b>	<b>Percent of Systems that Use GAAP</b>	<b>Respondents</b>
<b>25-100</b>	29.31%	216
<b>101-500</b>	58.93%	363
<b>501-1,000</b>	79.90%	251
<b>1,001-3,300</b>	89.75%	262
<b>3,301-10,000</b>	89.28%	250
<b>10,001+</b>	91.91%	447

**Table 15: Median Revenues of Systems Serving 25-100 Persons by Use of GAAP**  
**(1995 Data for Figure 4.2)**

**Source: 1995 Community Water System Survey**

<b>System Type</b>	<b>Median Revenues</b>	<b>Respondents</b>
<b>Systems that use GAAP</b>	\$8,761	61
<b>Systems that Do Not Use GAAP</b>	\$2,970	4

**Table 16: Percentage of Systems that Do Not Have Separate Income and Expense Statements for their Drinking Water Operation by System Size  
(Data for Figure 4.3)  
Source: 1995 Community Water System Survey**

<b>System Size</b>	<b>Percentage of Systems that Do Not Have Separate Income and Expense Statements</b>	<b>Respondents</b>
<b>25-100</b>	51.8%	216
<b>101-500</b>	24.7%	363
<b>501-1,000</b>	12.1%	251
<b>1,001-3,300</b>	5.3%	262
<b>3,301-10,000</b>	2.4%	250
<b>10,001+</b>	3.7%	447



**Table 17: Median Water Revenues and Water-Related per Connection (in dollars)**  
**(Data for Figures 4.4, 4.5, 4.6, and 4.13)**  
**Source: 1995 Community Water System Survey**

Revenue Category	System Type	Size Category							
		<101	101-500	501-1,000	1,001-3,300	3,301-10,000	<10,001	10,001+	All
Median Water Sale Revenues	Public	173.25	149.41	209.82	225.14	239.98	209.37	273.99	230.93
	Private	37.50	226.95	243.01	230.48	270.79	228.53	337.44	241.81
	Ancillary	0	0	0	0	na	0	na	0
	Surface	0	146.37	256.66	270.92	288.63	230.86	324.11	258.85
	Ground	0	128.85	181.09	195.80	214.98	172.30	235.36	185.14
	All	0	131.74	222.05	228.01	252.05	na	288.02	na
Median Water Related Revenues	Public	0	0	2.13	3.85	5.33	2.12	8.94	4.12
	Private	0	0	0.39	5.61	10.80	1.25	0.88	1.03
	Ancillary	0	0	0	0	na	0	na	0
	Surface	0	0	2.11	5.79	8.66	1.11	5.13	2.24
	Ground	0	0	0.97	3.32	6.65	0.79	7.05	1.60
	All	0	0	1.48	3.97	7.92	na	5.74	na
Median Total Water Revenue	Public	180.53	168.53	217.32	247.18	261.91	225.28	295.05	246.81
	Private	77.14	239.57	249.71	245.33	298.39	239.87	355.35	254.16
	Ancillary	0	0	0	0	na	0	na	0
	Surface	0	176.36	264.13	290.47	300.37	241.94	330.86	272.60
	Ground	0	133.29	190.69	204.00	232.54	181.82	248.52	200.59
	All	0	143.96	223.44	245.87	273.68	na	312.50	na

**Table 18: Source of Total Water Revenue by Customer Type and System Size**  
**(Data for Figure 4.7)**  
**Source: 1995 Community Water System Survey**

System Size	Revenue Source			
	Residential	Commercial/ Industrial	Wholesale	Other
<b>25-100</b>	88.5%	0.6%	0.2%	10.7%
<b>101-500</b>	69.0%	8.4%	0.4%	22.2%
<b>501-1,000</b>	70.6%	8.5%	0.2%	20.6%
<b>1,001-3,300</b>	56.5%	13.4%	0.7%	29.5%
<b>3,301-10,000</b>	55.9%	16.0%	1.0%	27.2%
<b>10,001+</b>	52.6%	20.2%	1.4%	25.8%

**Table 19: Rate Structure and Billing Profile for Residential Customers by System Size  
(Data for Figures 4.8 and 4.9)**

**Source: 1995 Community Water System Survey**

<b>Rate Structure</b>	<b>100 or Less</b>	<b>101-500</b>	<b>501-1,000</b>	<b>1,001-3,300</b>	<b>3,301-10,000</b>	<b>10,001+</b>	<b>All Sizes</b>
<b>Percentage of Connections Metered</b>	36.6%	71.8%	87.4%	93.7%	92.0%	97.1%	73.5%
<b>Metered Charges</b>							
<b>Uniform Rate</b>	85%	67%	61%	62%	54%	50%	na
<b>Declining Block Rate</b>	3%	16%	22%	26%	33%	29%	na
<b>Increasing Block Rate</b>	12%	16%	15%	11%	12%	19%	na
<b>Seasonal (Peak) Rate</b>	0%	1%	2%	2%	2%	2%	na

**Table 20: Rate Structure Increase and Billing Profile for Residential Customers**  
**(Data for Figures 4.10 and 4.11)**  
**Source: 1995 Community Water System Survey**

<b>Rate Increase Data</b>	<b>Owner Type</b>	<b>100 or Less</b>	<b>101-500</b>	<b>501-1,000</b>	<b>1,001-3,300</b>	<b>3,301-10,000</b>	<b>10,001+</b>	<b>All</b>
<b>Percentage of Last Increase</b>	<b>Public</b>	45.52%	25.22%	27.51%	29.49%	15.56%	14.55%	24.19%
	<b>Private</b>	35.25%	19.63%	18.88%	24.06%	18.95%	14.41%	23.23%
	<b>Ancillary</b>	10.38%	10.47%	50.00%	na	na	na	12.04%
	<b>All</b>	30.15%	21.03%	25.07%	28.39%	16.30%	14.53%	23.06%
<b>Average Number of Years Since Last Increase</b>	<b>Public</b>	2.03	3.53	2.78	3.80	3.09	2.53	3.18
	<b>Private</b>	2.61	4.10	3.16	3.85	3.98	2.60	3.49
	<b>Ancillary</b>	1.63	1.88	1.00	na	na	na	1.72
	<b>All</b>	2.27	3.61	2.88	3.81	3.27	2.54	3.17
<b>Number of Respondents</b>	<b>All</b>	245	402	276	282	282	493	1980

**Table 21: Median Total Expenditures per Customer and per Connection**  
**(in dollars; excludes principal payments, contributions in sinking funds, and capital improvements)**

**(Data for Figures 4.13 and 4.14)**

**Source: 1995 Community Water System Survey**

System Type	Unit of Measure	Size Category						
		< 100	100-500	501-1,000	1,001-3,300	3,301-10,000	10,001+	All
<b>Public</b>	Connection	180.06	205.03	203.12	239.87	234.08	256.43	231.37
	Respondents	54	148	144	162	144	349	1,001
	Customer	91.66	80.52	85.12	89.16	85.49	75.39	81.05
	Respondents	50	148	142	154	144	350	988
<b>Private</b>	Connection	138.49	218.24	231.78	234.48	286.23	277.84	243.79
	Respondents	91	137	113	113	129	132	715
	Customer	67.58	75.95	82.86	86.55	89.50	87.05	83.74
	Respondents	78	126	105	104	126	132	671
<b>Ancillary</b>	Connection	64.41	74.50	23.57	50.44	na	na	58.79
	Respondents	73	85	4	1	na	na	163
	Customer	26.75	22.95	0	18.92	na	na	23.26
	Respondents	80	92	5	1	na	na	178
<b>All</b>	Connection	96.17	187.13	214.17	237.50	254.50	259.25	227.92
	Respondents	218	370	261	276	273	481	1,879
	Customer	43.24	65.83	83.30	87.82	87.46	77.23	78.76
	Respondents	208	366	252	259	270	482	1,837

**Table 22: Operating and Debt Service Coverage Ratios for Community Water System by System Size**  
(excludes ancillary systems)  
(Data for Figures 4.15 and 4.16)  
Source: 1995 Community Water System Survey

	Ratio Value	System Size						
		25-100	101-500	501-1,000	1,001-3,300	3,301-10,000	<10,001	10,001+
<b>Operating Ratio</b>	< 1	61.41%	42.90%	29.09%	23.32%	16.93%	35.36%	12.65%
	1—1.5	21.49%	27.66%	39.07%	44.78%	40.80%	34.41%	35.43%
	1.5—2	6.07%	21.41%	16.37%	19.67%	26.59%	18.36%	27.89%
	> 2	11.03%	8.03%	15.46%	12.23%	15.68%	11.86%	24.03%
<b>Debt Service Ratio</b>	< 1	7.17%	18.13%	25.13%	28.73%	23.72%	20.07%	20.44%
	1—1.5	0.24%	7.24%	5.41%	9.04%	18.57%	7.27%	16.10%
	> 1.5	4.57%	10.09%	23.03%	28.72%	25.83%	16.94%	36.27%
	No debt service	88.02%	64.54%	46.43%	33.51%	31.89%	55.73%	27.19%

**Table 23: Need Per Household by System Size**  
**(Data for Figure 5.2)**  
**Source: 1995 Infrastructure Needs Survey**

<b>System Size</b>	<b>Need per Household</b>
Small Systems	\$3,300
Medium Systems	\$1,200
Large Systems	\$970

**Table 24: Percentage of Small Systems Reporting Needs by Category of Need**  
**(Data for Figure 5.3)**  
**Source: 1995 Infrastructure Needs Survey**

<b>Type of Need</b>	<b>Percentage of Systems Reporting Need</b>
Distribution Upgrades	81%
Storage Upgrades	66%
Source Upgrades	65%
Treatment Upgrades	34%



**Table 25: AWWA Estimate of 20-Year Total Need (in billions of dollars)**  
**(Data for Figure 5.4)**

**Source: 1998 Infrastructure Needs for the Public Water Supply Section**

<b>System Size</b>	<b>20-Year Total Need (in billions)</b>
Small Systems	\$26
Medium Systems	\$198
Large Systems	\$101

**Table 26: Percentage of Systems with Violations by System Type and System Size**  
**(Data for Figures 6.1, 6.3, 7.6, 7.8, 7.13, and 7.15)**  
**Source: SDWIS FY98Q4 Frozen Violations Table**

Violation Type	System Type	System Size (% of System Type with Violation by System Size; % within Violation Category by System Size)											
		<501		501-3,300		3,301-10,000		<10,001		10,001+		All	
MCL	CWSs	7.5%	65.2%	1.4%	21.3%	6.3%	7.3%	5.7%	93.8%	6.2%	7.4%	5.8%	100.0%
	NTNCWSs	4.9%	89.0%	3.5%	10.7%	2.4%	0.2%	4.7%	99.9%	5.0%	0.1%	4.7%	99.9%
	TNCWSs	4.0%	96.6%	4.6%	3.2%	2.8%	0.1%	4.0%	99.9%	1.0%	0.1%	4.0%	100.0%
TT	CWSs	1.5%	45.1%	2.6%	32.5%	3.0%	11.6%	1.9%	89.2%	3.3%	10.8%	2.0%	100.0%
	NTNCWSs	0.5%	90.9%	0.3%	9.1%	0.0%	0.0%	0.5%	100.0%	0.0%	0.0%	4.9%	100.0%
	TNCWSs	0.1%	89.4%	0.1%	3.2%	3.4%	6.4%	0.1%	99.0%	0.0%	0.0%	0.1%	99.0%
M/R	CWSs	21.1%	71.4%	13.1%	19.2%	11.5%	5.2%	18.1%	95.8%	11.3%	4.2%	17.6%	100.0%
	NTNCWSs	19.0%	88.5%	14.1%	11.0%	15.3%	0.3%	18.4%	99.8%	20.0%	0.1%	18.4%	99.9%
	TNCWSs	15.6%	97.2%	14.9%	2.7%	8.4%	0.1%	15.5%	100.0%	5.9%	0.0%	15.5%	100.0%
Other	CWSs	1.9%	66.7%	1.4%	21.2%	1.3%	6.3%	1.7%	94.2%	1.4%	5.7%	1.7%	99.9%
	NTNCWSs	0.8%	84.1%	0.8%	15.3%	1.2%	0.6%	0.8%	100.0%	0.0%	0.0%	0.8%	100.0%
	TNCWSs	1.2%	97.5%	0.9%	2.2%	2.2%	0.4%	1.2%	100.1%	0.0%	0.0%	1.2%	100.1%
All	CWSs	26.4%	67.7%	18.7%	20.8%	18.7%	6.4%	23.6%	94.9%	17.9%	5.1%	23.2%	100.0%
	NTNCWSs	22.7%	88.2%	17.7%	11.4%	17.6%	0.3%	22.0%	99.9%	20.0%	0.1%	22.0%	100.0%
	TNCWSs	18.5%	97.1%	18.0%	2.7%	11.8%	0.1%	18.5%	99.9%	6.9%	0.0%	18.5%	99.9%

**Table 27: Violations per 1,000 People Served**  
**(Data for Figures 6.2, 7.7, 7.14)**  
**Source: SDWIS FY98Q4 Frozen Violations Table**

Violation Type	System Type	Violations per 1,000 People Served					
		<501	501-3,300	3,301-10,000	<10,001	10,001+	All
<b>MCL</b>	<b>CWSs</b>	0.807	0.072	0.014	0.120	0.002	0.025
	<b>NTNCWSs</b>	0.491	0.048	0.004	0.234	0.002	0.212
	<b>TNCWSs</b>	0.660	0.061	0.006	0.459	0.000	0.310
	<b>All</b>	0.684	0.069	0.014	0.187	0.001	0.047
<b>TT</b>	<b>CWSs</b>	0.208	0.043	0.010	0.044	0.002	0.010
	<b>NTNCWSs</b>	0.064	0.004	0.000	0.029	0.0002	0.026
	<b>TNCWSs</b>	0.032	0.002	0.032	0.025	0.000	0.017
	<b>All</b>	0.098	0.034	0.011	0.039	0.001	0.011
<b>M/R</b>	<b>CWSs</b>	5.924	0.303	0.090	0.783	0.006	0.162
	<b>NTNCWSs</b>	8.299	0.712	0.127	3.910	0.293	3.564
	<b>TNCWSs</b>	3.306	0.229	0.056	2.279	0.001	1.543
	<b>All</b>	4.995	0.340	0.089	1.299	0.006	0.322
<b>Other</b>	<b>CWSs</b>	0.225	0.015	0.003	0.031	0.0004	0.006
	<b>NTNCWSs</b>	0.089	0.014	0.002	0.045	0.000	0.041
	<b>TNCWSs</b>	0.278	0.014	0.008	0.190	0.000	0.129
	<b>All</b>	0.230	0.015	0.003	0.059	0.0003	0.015
<b>All</b>	<b>CWSs</b>	7.164	0.432	0.117	0.977	0.012	0.203
	<b>NTNCWSs</b>	8.944	0.777	0.134	4.218	0.294	3.843
	<b>TNCWSs</b>	4.277	0.306	0.101	2.953	0.001	1.999
	<b>All</b>	6.006	0.457	0.116	1.584	0.010	0.395

**Table 28: NCWSs Source Water Characteristics  
(Data for Figures 7.1, 7.3, 7.10)  
Source: SDWIS FY98Q4 Frozen Violations Table**

NTNCWSs				
Size Category		Ground	Surface	Total
< 501	Raw Number	16,783	394	17,177
	Percentage Within Size Category	97.7%	2.3%	100.0%
	Percentage of All NTNCWSs < 10,001	83.9%	2.0%	85.9%
	Percentage of All NTNCWSs	83.9%	2.0%	85.9%
501-3,300	Raw Number	2,602	145	2,747
	Percentage Within Size Category	94.7%	5.3%	100.0%
	Percentage of All NTNCWSs < 10,001	13.0%	0.7%	13.7%
	Percentage of All NTNCWSs	13.0%	0.7%	13.7%
3,301-10,000	Raw Number	57	12	69
	Percentage Within Size Category	82.6%	17.4%	100.0%
	Percentage of All NTNCWSs < 10,001	0.3%	0.1%	0.3%
	Percentage of All NTNCWSs	0.3%	0.1%	0.4%
Subtotal	Raw Number	19,442	551	19,993
	Percentage Within Size Category	97.2%	2.8%	100.0%
	Percentage of All NTNCWSs < 10,001	97.2%	2.8%	100.0%
	Percentage of All NTNCWSs	97.2%	2.8%	100.0%
10,000+	Raw Number	7	0	7
	Percentage Within Size Category	100.0%	0.0%	100.0%
	Percentage of All NTNCWSs	0.0%	0.0%	0.0%
Total	Raw Number	19,449	551	20,000
	Percentage of All NTNCWSs	97.2%	2.8%	100.0%

**Table 28 Continued**

<b>TNCWSs</b>				
<b>Size Category</b>		<b>Ground</b>	<b>Surface</b>	<b>Total</b>
<b>&lt; 501</b>	<b>Raw Number</b>	90,614	1,452	92,066
	<b>Percentage Within Size Category</b>	98.4%	1.6%	100.0%
	<b>Percentage of All TNCWSs &lt; 10,001</b>	95.6%	1.5%	97.2%
	<b>Percentage of All TNCWSs</b>	95.5%	1.5%	97.1%
<b>501-3,300</b>	<b>Raw Number</b>	2,387	121	2,508
	<b>Percentage Within Size Category</b>	95.2%	4.8%	100.0%
	<b>Percentage of All TNCWSs &lt; 10,001</b>	2.5%	0.1%	2.6%
	<b>Percentage of All TNCWSs</b>	2.5%	0.1%	2.6%
<b>3,301-10,000</b>	<b>Raw Number</b>	152	28	180
	<b>Percentage Within Size Category</b>	84.4%	15.6%	100.0%
	<b>Percentage of All TNCWSs &lt; 10,001</b>	0.2%	0.0%	0.2%
	<b>Percentage of All TNCWSs</b>	0.2%	0.0%	0.2%
<b>Subtotal</b>	<b>Raw Number</b>	93,153	1,601	94,754
	<b>Percentage Within Size Category</b>	98.3%	1.7%	100.0%
	<b>Percentage of All TNCWSs &lt; 10,001</b>	98.3%	1.7%	100.0%
	<b>Percentage of All TNCWSs</b>	98.2%	1.7%	99.9%
<b>10,000+</b>	<b>Raw Number</b>	92	10	102
	<b>Percentage Within Size Category</b>	90.2%	9.8%	100.0%
	<b>Percentage of All TNCWSs</b>	0.1%	0.0%	0.1%
<b>Total</b>	<b>Raw Number</b>	93,245	1,611	94,856
	<b>Percentage of All TNCWSs</b>	98.3%	1.7%	100.0%

**Table 28 Continued**

NCWSs				
Size Category		Ground	Surface	Total
< 501	Raw Number	107,397	1,846	109,243
	Percentage Within Size Category	98.3%	1.7%	100.0%
	Percentage of All TNCWSs	95.1%		
501-3,300	Raw Number	4,989	266	5,255
	Percentage Within Size Category	94.9%	5.1%	100.0%
	Percentage of All TNCWSs	4.6%		
3,301-10,000	Raw Number	209	40	249
	Percentage Within Size Category	83.9%	16.1%	100.0%
	Percentage of All TNCWSs	0.2%		
Subtotal	Raw Number	112,595	2,152	114,747
	Percentage Within Size Category	98.1%	1.9%	100.0%
	Percentage of All TNCWSs	99.9%		
10,000+	Raw Number	99	10	109
	Percentage Within Size Category	90.8%	9.2%	100.0%
	Percentage of All TNCWSs	0.1%		
Total	Raw Number	112,694	2,162	114,856
	Percentage of All TNCWSs	98.1%	1.9%	100.0%

**Table 29: Type of Non-Community Water Systems  
(Data for Figure 7.2)  
Source: SDWIS FY98Q4 Frozen Violations Table**

<b>Type of System</b>	<b>Percentage of NCWSs</b>
Restaurants	22.6%
Churches	9.8%
Hotels/Motels	7.8%
Schools	7.8%
Summer Camps	5.2%
Campgrounds/RV Parks	4.7%
Day Care Centers	0.9%
Medical Facilities	0.9%
Nursing Homes	0.1%
Other	40.2%