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Selected Characteristics of Ground Water–Supplied Community Water Systems

compiled by Charles Job

What is a ground water–supplied community water system? What proportion of the public water supply industry do these systems represent? How many wells does each system have? Do all systems treat their water? What revenues and expenses do they have? These questions and more are addressed in the Community Water System Survey 2000, conducted by the Environmental Protection Agency's Office of Ground Water and Drinking Water. EPA carries out the survey to support its regulation and policy activities by obtaining information to evaluate the effects on the drinking water industry. In the report on the survey, EPA provides summary information, some of which is provided specifically for ground water–supplied community water systems and highlighted here.

What Is a Ground Water–Supplied Community Water System?

A ground water–supplied community water system is a subset of all community water systems. A community water system, defined in the Code of Federal Regulations (40 CFR 141), is a water supplier serving 25 or more persons or 15 or more water connections on a year-round basis. In 1999, the base year for the 2000 survey, 52,186 systems were counted as community water systems meeting this definition. Of these, 35,308 systems used ground water exclusively for their water supply and 3280 used ground water as their principal source, totaling 38,508. Systems that purchase water from a ground water system are not counted in these numbers. Community water systems are themselves a subset of the 160,000 public water systems regulated by EPA under the Safe Drinking Water Act (SDWA), which also include noncommunity water systems that serve consumers at schools, hospitals, and other facilities, such as roadside rest areas, that have their own water source.

Community Water System Survey 2000

The Community Water System Survey 2000 (EPA 815-R–02–005B, December 2002) is the fifth in a series of such surveys that provides important information on the characteristics of the portion of the water industry regulated by EPA under SDWA to ensure safe water is provided to consumers. The survey was stratified by system size, water source, and other features to allow inferences to be drawn about specific populations and to increase the efficiency of its estimates by groupings into homogenous strata. The survey was conducted in July 2000 with responses from a nationally representative sample of 1806 systems, a 67% overall response rate, with a 66% rate for ground water systems. More details of the Community Water System Survey 2000 are available from EPA's Web site at *www.epa.gov/safewater/consumer/cwss_2000_volume_ii.pdf.*

Selected Characteristics of Ground Water–Supplied Systems

Selected characteristics of ground water–supplied community water systems (or ground water systems) from the 2000 survey are presented in Table 1 and summarized as follows. Note that some percentages in the exhibit will not total 100% because more than one item in a category may apply to some systems.

Ownership

Ground water systems can be either publicly or privately owned. Almost two-thirds of them (62%) are privately

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Table 1
Selected Characteristics of Ground Water–Supplied Community Water Systems in the United States

Category	Ground Water–Supplied[1] Community Water System Service Population Ranges								
	100 or Less	101–500	501–3300	3301–10,000	10,001–50,000	50,001–100,000	100,001–500,000	More Than 500,000	All Sizes
Primarily ground water systems:									
100% ground water	10,358	12,521	8687	2576	971	80	108	7	35,308
Mostly ground water	1398	624	283	495	368	56	53	3	3280
Ownership type:									
Public	489	3556	6694	2560	1080	124	143	9	14,655
Private	11,267	9590	2276	511	259	12	17	1	23,933
Average daily production (mgd):									
100% ground water	0.011	0.034	0.158	1.053	2.628	11.892	17.631	125.642	0.313
Mostly ground water	0.003	0.019	0.524	0.872	3.718	11.225	29.778	144.963	3.587
Average unaccounted for water as a % of water produced:[2]									
Public	1.140	5.990	9.935	11.562	8.528	9.693	6.306	7.959	8.949
Private	0.187	2.188	6.237	10.686	12.330	11.093	10.636	7.744	2.323
Average number of wells	1.4	1.9	2.6	4.1	7.8	18.1	20.5	132.2	2.5[3]
Systems not providing any treatment:									
Percent of systems	35.2	22.1	14.8	13.9	2.0	3.0	2.6	0.0	22.9
Average number of entry points	1.2	1.4	2.6	3.3	2.0	20.0	3.0	0.0	1.6
Average miles of pipe in place[2]	1	4	28	85	232	395	579	2414	39
Average service connections per mile[2]	57	58	49	55	65	68	59	64	55
Average annual pipe replaced in the past 5 years (miles)[2]	0	0	1	4	5	7	20	65	1
Average cost per mile of pipe replaced in the past 5 years ($000)[2]	45	107	129	222	252	386	481	1719	163
Average % of pipe that is:									
Less than 40 years old	93.2	92.6	84.5	75.3	68.9	62.5	61.6	78.3	75.2
40–80 years old	6.8	7.4	14.9	20.8	25.4	29.5	31.9	19.1	21.1
More than 80 years old	0.0	0.0	0.6	3.9	5.7	8.0	6.5	2.6	3.8
Average total revenue ($000)	5	23	146	622	2179	7878	14,013	75,183	286
Average % not charging directly for water	43	32	4	5	6	0	0	0	25
Average total expenses ($000)	7	25	133	568	2147	6779	18,175	62,201	253
Average total expenses per thousand gallons produced ($)	4.16	2.53	2.97	1.95	2.01	1.70	2.02	1.36	3.01
Residential rate structure (% of systems with each structure)[2]									
Metered charges:									
Uniform rate	23.8	31.9	50.4	60.4	58.1	23.5	59.3	29.5	36.8
Declining block rate	0.0	6.4	26.1	30.0	30.3	24.8	24.4	0.0	11.7
Increasing block rate	3.3	5.1	13.8	9.5	15.9	48.7	18.8	42.6	7.4
Seasonal rate	0.0	0.0	0.0	2.8	0.0	0.0	4.3	14.7	0.2
Unmetered charges:									
Separate flat fee for water	16.8	19.2	10.0	15.3	23.8	28.6	25.5	14.7	16.3
Combined flat fee for water and other services	19.0	8.7	0.0	2.8	4.3	12.1	3.4	0.0	9.3
Other billing methods	1.7	0.4	1.8	2.8	2.1	3.0	1.1	0a.0	1.4
Average number of employees	1.3	1.6	2.8	5.7	15.2	42.1	64.6	374.7	4.6
Average annual labor costs ($000)	5	12	38	190	636	1755	2616	17,669	115
Average total capital investment in the past 5 years ($000)	35	97	309	923	3392	7001	17,656	160,507	624
Type of capital expenses in the past 5 years (% of systems reporting each type of expense):									
Land	1.1	2.5	5.0	26.5	27.7	13.6	28.9	34.0	7.0
Water source	30.6	48.7	31.0	49.6	47.8	64.6	47.6	83.0	40.0
Distribution and transmission	40.7	61.7	73.2	70.6	84.9	96.4	100.0	100.0	61.5
Treatment	27.6	32.3	34.0	39.5	59.7	61.9	42.0	66.0	34.0
Storage	30.4	35.1	40.0	43.1	47.9	60.1	80.2	49.1	37.0
Other	11.9	19.8	17.5	28.7	41.7	65.6	45.9	83.0	19.8

Source: Environmental Protection Agency, Community Water System Survey 2000, EPA 815-R-02-005B, December 2002
[1]Except where indicated by footnote
[2]Includes all ground- and surface water-supplied community water systems surveyed
[3]Systems that are primarily surface water-supplied have an average of 5.4 wells per system; those that primarily purchase water from other systems have an average of 3.9 wells per system.

owned, with 87% of these serving populations of 500 or fewer persons.

Average Daily Production

Average daily production ranges from 0.003 million gallons per day (mgd) for systems serving 100 or fewer persons to nearly 145 mgd for the largest ground water systems. Medium-size systems appear to have the largest percentages of water losses (average unaccounted for water as a percent of water produced) as compared to smaller and larger ground water systems.

Average Number of Wells

Small systems serving 100 or fewer persons have an average of 1.4 wells per system. The largest systems, serving more than 500,000 persons, average 132.2 wells per system. Overall, the average per system is 2.5 wells, but systems that are primarily surface water–supplied (and tend to be larger) have an average of 5.4 wells per system, while systems that primarily purchase water from other systems have an average of 3.9 wells.

Treatment

Because ground water is typically considered a clean water source, some systems have not treated it before delivering it to consumers at the time of the survey. Of systems surveyed serving 100 or fewer persons, 35% did not treat ground water before use by consumers. However, for the largest systems in the survey, all provided treatment.

Pipeline in Place

The smallest systems averaged one mile of pipeline to deliver ground water. The largest systems averaged 2414 miles of pipeline. The average distance of pipeline in place was 39 miles per system, with a mean of 55 connections per mile. Most pipe was less than 40 years old for all system sizes. While the largest systems replaced an average of 64 miles per system in the prior five years, the smallest systems in the survey did not replace any pipeline during that time. Notably, the cost per mile of pipeline replacement increased from small systems to larger systems serving urban areas. Average annual pipeline replacement cost ranged from $45,000 per mile over the five years prior to 2000 for the smallest systems to $1,719,000 per mile for systems serving more than 500,000 persons.

Revenues

Average annual revenue for the smallest systems was $5000, while the largest systems averaged more than $75 million. Most systems (including ground and surface water systems) used a uniform rate or declining block rate residential charge structure. Increasing block rates are in greater use by some of the larger systems. Nearly 26% of the systems on average relied on a flat fee for water charges.

Expenses

The survey found that expenses for ground water systems ranged on average from $7000 per year for the smallest to more than $62 million for the largest. Examining expenses on a water unit basis indicates significant economies of scale for ground water systems—$4.16 per thousand gallons produced for systems serving 100 or fewer people down to $1.36 for systems serving more than 500,000 people, a factor of just over three. Average labor cost per employee shows a different relationship—$3846 for the smallest systems compared to $47,155 for the largest systems.

Capital Investment

Capital investment in ground water systems appears to exhibit a significant economy of scale. Dividing the average total capital investment in the past five years (1995 through 1999 in the case of this survey) by the average daily production indicates that the smallest systems invested at a rate of approximately $3 to $12 million per mgd, whereas the largest ground water systems invested from $1107 to $1277 per mgd. The four major types of capital expenses across most system size categories were distribution and transmission systems, water source, treatment, and storage.

This article was compiled by Charles Job, Infrastructure Branch (4606M), Office of Ground Water and Drinking Water, EPA, Washington, DC 20460, from data summarized in the EPA's 2000 Community Water System Survey (reported in December 2002), and does not represent a statement of policy by the EPA.

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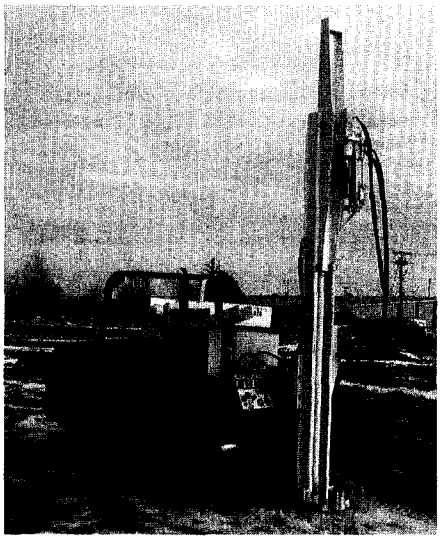

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