CBO TESTIMONY

Statement of
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Future Investment in Drinking Water Infrastructure

before the
Subcommittee on Environment and Hazardous Materials
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SUMMARY

In this testimony, the Congressional Budget Office (CBO) draws on the findings of a forthcoming study to provide two estimates of 20-year costs for investment in drinking water infrastructure. Annual costs from 2000 through 2019 are projected to average $11.6 billion under a low-cost case and $20.1 billion under a high-cost case. That range of estimates spans the most likely outcomes within the full set of possibilities, CBO believes, and illustrates the uncertainty surrounding attempts to predict future water investment costs.

CBO's estimates are in constant 2001 dollars and measure costs "as financed." That approach takes into account the use of bonds and loans to spread the burden of investment costs over time. The divergent estimates for CBO's low- and high-cost cases reflect differences in six assumptions, the most important of which is the replacement rate for drinking water pipes during the 20-year period.

Relative to investment in 1999, CBO's projection of average annual costs for 2000 to 2019 under the high-cost case is about 70 percent higher. No increase would be required under the low-cost case—a possibility that contradicts conventional wisdom but that CBO considers reasonable, given the potential for savings in both the amount of investment required and the costs of financing it.

Similarly, the share of average household income claimed by the average water bill (covering both drinking water and wastewater) would be little affected under CBO's low-cost case, rising from 0.5 percent in the late 1990s to just 0.6 percent by 2019. Under the high-cost case, the share of income claimed in 2019 would be 0.9 percent.

Earlier estimates of investment needs from the Water Infrastructure Network (WIN) do not measure costs as financed and include some debt service that water systems will pay in the two decades after 2019. When WIN's estimate is expressed in costs as financed, it is close to that of CBO's high-cost case. That similarity is not surprising, given that CBO used the basic approach developed by WIN and that the specific assumptions of the high-cost case are broadly similar to WIN's.

Society as a whole will pay 100 percent of future investment costs for water infrastructure, whether through ratepayers' bills or taxes. Economists note that efforts to subsidize those investment costs may distort prices and reduce incentives for efficiency, thus raising total national costs for water services.

Mr. Chairman and Members of the Subcommittee, I am pleased to be here today to discuss future investment in drinking water infrastructure. My testimony draws on findings from a forthcoming Congressional Budget Office (CBO) study that was requested by this Subcommittee and by your colleagues on the Transportation and Infrastructure Committee.

CBO's testimony before the Subcommittee last year emphasized that estimates of investment spending through 2019 are very uncertain—in part because many important data are not readily available—and existing estimates may be too large. Today, I can make those points more concretely by presenting CBO's estimates of a low-cost and a high-cost case, which are intended to span the most likely outcomes within the full set of possibilities.

I will begin by presenting estimates of average annual investment costs under the two cases and then discuss how CBO derived the estimates and how they differ. I will also compare those projections with an estimate of the current burden of investment in drinking water infrastructure and examine how future investment might affect household budgets. Finally, I will compare CBO's estimates with the much-publicized figures from the Water Infrastructure Network (the WIN coalition). My testimony focuses on capital investment in drinking water systems, but it also presents estimates of future operations and maintenance (O&M) costs under both a low-cost and high-cost scenario.

Before discussing specific dollar figures, I would like to emphasize that society as a whole pays 100 percent of the costs of water systems, either through ratepayers' bills or taxes. Thus, the goal of many water-industry advocates to make water services more "affordable" can be met only by reducing the total costs of providing such services or by using taxes and government subsidies to redistribute their costs from some people to others. Depending on the method used, the net effect of such redistributive efforts may be to shift costs from low-income to high-income households, from large to small users of water, or from ratepayers served by high-cost systems to those served by low-cost systems. Taxes and subsidies may also distort prices and reduce the incentives for efficient choices by system managers and consumers, resulting in the unwanted side effect of higher total national costs for water services.

CBO'S 20-YEAR ESTIMATES

CBO projects that annual capital costs for drinking water infrastructure will average $11.6 billion from 2000 to 2019 under the low-cost case and $20.1 billion under the high-cost case. (Unless otherwise specified, all costs are in 2001 dollars.) Annual

O&M costs over the same period are projected to average $25.7 billion under the low-cost case and $31.8 billion under the high-cost case. CBO chose the 2000-2019 period for its analysis to make it easier to compare its estimates with those of the WIN coalition. Data on actual investment spending in 2000 and 2001, which are provided by the Census Bureau's Survey of State and Local Government Finances, are not yet available.

Three more points will help clarify the nature of CBO's estimates. First, they are intended to represent the minimum amount required to achieve the goals of maintaining desired levels of service to water customers, meeting federal standards for drinking water quality, and maintaining and replacing assets cost-effectively.[1] They exclude investments whose sole purpose is to serve future growth; that is because much of the data underlying them come from the Environmental Protection Agency's (EPA's) Drinking Water Infrastructure Needs Survey, which focuses only on investments eligible for assistance from the state revolving funds, or SRFs.[2] Because of a lack of data, CBO's estimates also exclude investments to increase the security of drinking water systems. Preliminary indications suggest, however, that security costs will be small relative to the estimates presented here.

Second, the estimates measure costs "as financed" and thus take into account the use of borrowing to spread the investments' financial burden over time. In particular, for each year of the 20-year period, CBO's estimate includes two things: the costs of that year's new investments that are paid for out of funds on hand—that is, on a pay-as-you-go basis; and the debt service (principal and interest) paid that year on previous investments financed through loans and bonds. Economists usually measure investments in terms of their current resource cost—which covers the capital cost of all current investments, regardless of how they are paid for, and excludes payments on

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1. That scope is similar to the one used in the needs survey of the Environmental Protection Agency (see text). Although the survey is restricted to investments "required to protect the public health," most of those public health needs simply reflect "the inherent costs of being a water system which involves the nearly continual need to install, upgrade, and replace the basic infrastructure that is required to deliver safe drinking water to customers" (Environmental Protection Agency, *Drinking Water Infrastructure Needs Survey: Second Report to Congress*, February 2001, p. 12). CBO's formulation explicitly recognizes that a water system's investment requirements depend on the standards of service that it chooses. The formulation also targets the minimum amount of spending necessary to achieve the identified goals.

2. Investments to serve new or future customers are eligible for SRF assistance only if they respond to a public health problem (for example, a project to hook up users of contaminated wells) or are components of projects triggered by the needs of existing customers (for example, replacing a deteriorated water main with a larger-sized one to allow for expected growth). As discussed later, the other source of data underlying CBO's estimates is an analysis by Stratus Consulting that focused on the costs of replacing existing water pipes and thus also excludes investments relating to future growth.

past investments. The current resource cost is preferred over other measures of investment volume for analyzing the efficient use of society's resources, such as the costs and benefits of water-quality regulations. But CBO's present analysis takes the water-quality and service goals as a given and focuses on the costs of meeting those goals. For that purpose, measuring costs as financed is more useful because it better indicates the burden facing water systems and their ratepayers at a given point in time.[3]

Third, the relatively large difference between CBO's estimates of 20-year investment requirements under the low-cost and high-cost cases—the former is 42 percent below the latter—reflects the limitations of the available data. Indeed, although the two cases are intended to bracket the most likely outcomes, CBO does not rule out the possibility that the actual level of investment needed could lie outside that range.

HOW CBO DERIVED ITS ESTIMATES

As CBO's previous testimony emphasized, some key data for estimating future investment, such as the average age and condition of the nation's existing water infrastructure, are not readily available. Since CBO could not fill that gap by collecting new data from the nation's 45,000 community water systems, its strategy in developing its low-cost and high-cost cases was to take maximum advantage of existing data and analyses.

In particular, CBO analysts used the basic approach developed by the WIN coalition, working from a study of pipe replacement needs by Stratus Consulting for the American Water Works Association and from estimated requirements for other investment categories derived from EPA's Needs Survey. CBO chose not to rely on the Needs Survey alone; even though the survey strives to include all relevant investments over a 20-year period for drinking water systems nationwide, EPA reports that its results do not fully cover the whole period. (According to EPA, planning documents used by many systems as the basis for their responses to the survey often cover just one to five years.) The Stratus study used a different approach than the survey uses to estimate pipe replacement needs: it combined some national-level data and various assumptions to estimate the number of drinking water systems nationwide (classified by size and region), the miles of pipe per system, the distribution of pipe mileage by pipe size, the replacement cost of pipes of each size, and the rate of pipe replacement.

3. Because O&M costs are generally paid for without borrowing, resource costs and costs as financed are the same in that case.

Although CBO's low-cost and high-cost cases draw on the same sources of data, they differ in the assumptions for six factors: three concern the capital costs estimated by Stratus and EPA, and three involve the costs of financing the investments (see Table 1). The most critical assumption is the rate at which drinking water pipes will be replaced over the 20-year period: the low-cost case assumes an average annual rate of 0.6 percent, and the high-cost case assumes a rate of 1 percent. That factor alone accounts for most of the difference—$8.5 billion annually—between the two sets of estimates. Using a rate of 0.6 percent in the high-cost scenario would narrow the difference to $3.4 billion, a reduction of 60 percent.

The lack of data on the condition of existing water pipes is the basis for CBO's view that plausible estimates of the annual replacement rate could be as far apart as 0.6 percent and 1 percent. Both rates have their genesis in the Stratus study. The study's primary analysis assumed an average annual replacement rate of 1 percent, apparently as a compromise between the rates implied by standard rules of thumb about pipe service lifetimes and the rates actually reported in studies from the mid-1990s. However, the Stratus study also presented another approach: analysts estimated when

TABLE 1. FACTORS DISTINGUISHING CBO'S LOW-COST AND HIGH-COST CASES

	Low-Cost Case	High-Cost Case
Capital Factors		
Annual Rate of Pipe Replacement (Percent)	0.6	1.0
Savings from Improved Efficiency (Percent)	15	5
Annual Costs for Regulations Not Yet Proposed (Billions of 2001 dollars)	0	0.53
Financing Factors		
Real (Inflation-Adjusted) Interest Rate (Percent)	3.0	4.0
Borrowing Term (Years)	30	25
Pay-as-You-Go Share (Percent)	15	30

SOURCE: Congressional Budget Office.

pipes would reach the end of their useful lifetimes on the basis of the assumption that the rate at which pipe miles were installed over time was proportional to the rate of population growth. According to that analysis, the bulk of the replacement cost will not occur until some time after 2020, and the average replacement rate required from 2000 through 2019 will be on the order of 0.6 percent.[4]

Similar uncertainties underlie the rest of the differing assumptions that CBO used in the low-cost and high-cost cases. Examples of improved management methods and new technologies here and abroad, plus conversations with industry experts, lead CBO to believe that efficiency gains will reduce future investment needs—but whether the savings will be on the order of 5 percent or 15 percent is hard to predict with any confidence. CBO also cannot precisely determine the costs associated with future drinking water rules, the share of investments that will be financed through borrowing, the average borrowing term, or the real (inflation-adjusted) interest rate.

CBO's analysis of future O&M spending used simpler methods, and only one factor distinguishes the estimates under the two cost scenarios. For the high-cost case, CBO merely extrapolated a linear trend from real 1980-1998 spending on O&M; for the low-cost case, CBO started with the same linear trend but phased in savings of 20 percent, resulting from improved efficiency, over the period from 1995 through 2004.[5] Those simpler methods probably do not capture as much of the true uncertainty surrounding future O&M costs as do CBO's more-detailed models of capital investment, but again, O&M was less central to the analysis—in part because it is not eligible for aid under current federal programs.

COMPARING FUTURE COSTS AND CURRENT SPENDING

One useful way to view estimates of future investment costs is by comparing them with a baseline of current spending. For the present purpose, however, the available data on current spending are inadequate because they do not measure spending in terms of costs as financed. Specifically, the data include the capital costs of all investments made in a given year—whether the burden of those projects falls on rate-

4. More precisely, the study reported separate average annual replacement rates for three pipe lifetimes (50 years, 75 years, and 100 years) and two decades (2000 to 2009 and 2010 to 2019). The average of the six individual rates was 0.58 percent. In contrast, the implied long-run rates for the three lifetimes are 2.0 percent, 1.33 percent, and 1.0 percent, respectively, for an average of 1.44 percent.

5. The WIN coalition's analysis also assumed savings of 20 percent.

payers in that year or is being deferred through borrowing—and exclude the principal being repaid on previous borrowing.

For 1999, the latest year for which the necessary information is available, CBO's best estimate of investment spending is $11.8 billion, measured in terms of costs as financed. However, developing that baseline required CBO to make many assumptions—for example, about the extent to which drinking water systems borrowed to finance investments over the previous 20 years. Alternative assumptions could have changed the result, perhaps by 20 percent.

The difference between that estimate of 1999 investment spending (as financed) and CBO's estimates of average annual investment from 2000 through 2019—sometimes dubbed the funding gap—is essentially zero in the low-cost case and $8.3 billion in the high-cost case. The possibility reflected in CBO's low-cost scenario—that the average yearly burden of investment in drinking water infrastructure through 2019 might not exceed the 1999 level—contradicts conventional wisdom; however, CBO considers that scenario reasonable, given the uncertainty about how soon pipes will need to be replaced, the prospects for increased efficiency, and the potential for water systems to fund more of their investments through borrowing and to borrow for longer terms. Of course, the estimate of future needs under the high-cost case—representing an increase of about 70 percent over estimated spending in 1999—is also considered reasonable, if less optimistic.

THE POTENTIAL IMPACT OF HIGHER COSTS ON HOUSEHOLD RATEPAYERS

Supporters of increased federal aid for investment in water infrastructure often argue that rising costs will make households' water bills "unaffordable." Under CBO's high-cost case, bills for drinking water and wastewater combined would still represent less than 1 percent of income for the average household, although that share would be larger for many households that have low income or that are served by high-cost systems.

CBO estimates that in the late 1990s, average bills for drinking water and wastewater services combined represented 0.5 percent of average household income. To derive that estimate, CBO used data from the Consumer Expenditure Interview Survey (conducted by the Census Bureau under contract with the Bureau of Labor Statistics), which analysts supplemented by imputing bills for the 39 percent of survey respondents who did not report their own. That imputation, which was based on the water

bills of respondents with comparable income, may bias the estimate upward, because many respondents without separate water bills are apartment-dwellers, who use less water for lawns and gardens than do residents of single-family homes.[6]

To analyze the impact on households of future investment and O&M spending by drinking water and wastewater systems, CBO first estimated the rates that would be required by 2019 to pay for that spending, holding support from all levels of government constant. It then compared the result with incomes in that year, taking into account projections of real income growth. The share of average household income going to water bills in 2019, CBO estimates, would be 0.6 percent and 0.9 percent under the low- and high-cost scenarios, respectively.

Of course, averages can mask important differences in individual cases (see Figure 1). For example, half of all households spent 1 percent or less of their income on water bills in the late 1990s while others spent significantly more.

COMPARING CBO'S AND WIN'S ESTIMATES

The WIN coalition's estimates of future investments in drinking water and wastewater infrastructure do not measure costs either as financed or in terms of resource costs. When its estimates for the 2000-2019 period are expressed in terms of costs as financed, they are close to CBO's for the high-cost case.

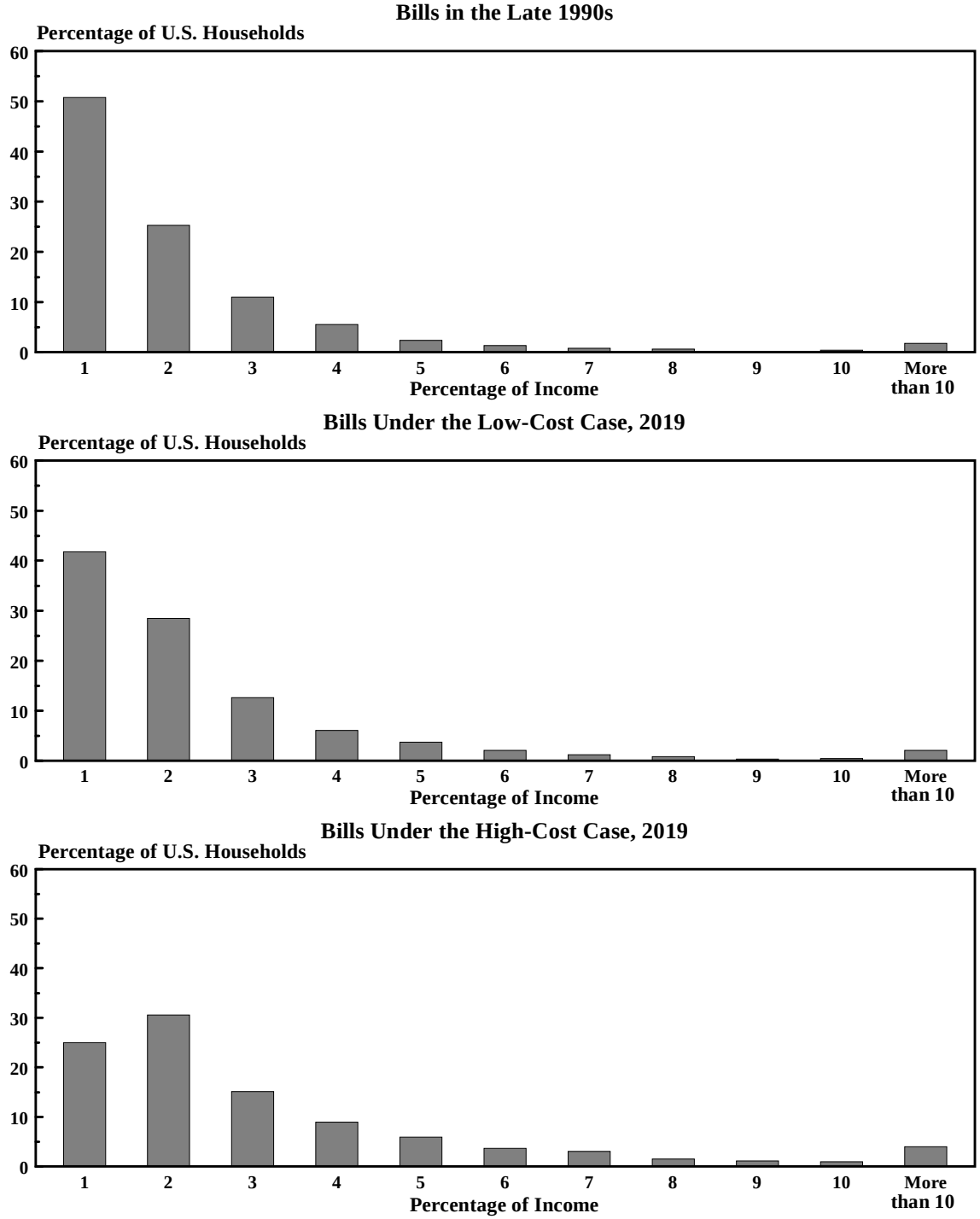
For each year of the period, WIN's estimates add the cost of that year's pay-as-you-go investments to the total debt service (principal plus interest, in constant dollars) to be paid in later years for newly financed investment.[7] Thus, where a costs-as-financed estimate includes the current debt service paid on past investment, WIN's estimates include future debt service on current investment—much of which will be paid after 2019.

The impact of that difference is substantial (see Table 2). WIN's published estimate of average annual drinking water investment needs from 2000 to 2019 is $26 billion (in 2001 dollars); using costs as financed reduces the estimate by about 18 percent,

6. CBO's estimate may also overstate the percentage of income devoted to water bills by accepting at face value all incomes reported in the survey. (Some analysts believe that many incomes at the very low end of the distribution are understated.)

7. Equivalently, WIN's annual estimate combines the current resource costs for all of that year's investments and the sum (in real dollars) of all future interest costs for the portion of the investments financed by borrowing.

FIGURE 1. WATER BILLS AS A SHARE OF HOUSEHOLD INCOME



SOURCE: Congressional Budget Office.

TABLE 2. CBO'S AND WIN'S ESTIMATES OF INVESTMENT NEEDS FOR DRINKING WATER, 2000-2019 (In billions of 2001 dollars)

	CBO		Water Infrastructure Network	
	Low-Cost Case	High-Cost Case	Published Estimate	Costs-as-Financed Estimate
Average Annual Investment Need	11.6	20.1	26	21.4
Increase Above Recent "Baseline" Investment	-0.2[a]	8.3[a]	13[b]	9.4[a,c]

SOURCES: Congressional Budget Office; Water Infrastructure Network.

a. Relative to a 1999 baseline.

b. Relative to a 1996 baseline.

c. CBO's approximation of WIN's results.

to $21.4 billion.[8] The reason for the decrease is that the cohorts of investment financed yearly from 1980 through 1999, and still being paid off from 2000 through 2019, are smaller than the new cohorts that are projected to be financed during the latter period. When expressed in comparable terms, WIN's estimate is roughly 6 percent and 84 percent higher, respectively, than the estimates for CBO's high- and low-cost cases.

Similar contrasts emerge in comparing average future investment with baseline spending. Again, WIN's estimate of the difference between the two levels of investment drops significantly—from $13 billion per year to $9.4 billion—when it is expressed in terms of costs as financed. And again, the latter figure is roughly $1 billion higher than the estimate for CBO's high-cost case and $10 billion above the estimate for its low-cost scenario.[9]

8. As originally published, WIN's estimate was expressed in 1997 dollars and was $24 billion. Note that the revised costs-as-financed estimate of future investment needs merely reframes results from WIN's own analysis and does not change any modeling assumptions.

9. CBO did not have enough information to directly calculate WIN's own estimate of 1999 debt service, a key component of baseline spending in costs-as-financed terms. Instead, CBO approximated it by multiplying WIN's estimate of average 2000-2019 costs for annual debt service on pre-2000 investments by a scaling factor that it obtained from a mock re-creation of WIN's model. The resulting estimate of baseline spending as it would have been calculated in WIN's analysis is $12.0 billion, which is very close to the estimate of $11.8 billion used in CBO's scenarios.

The fact that WIN's estimates are close to those of CBO's high-cost case when both are expressed in comparable terms should not be interpreted as independent support for estimates of that magnitude. CBO and WIN used the same modeling approach, and CBO's high-cost scenario used specific assumptions that are broadly similar to WIN's.[10] Thus, it is not surprising that the resulting estimates are also similar. The lesson that CBO draws from comparing the three estimates is that under the basic framework of the modeling approach, fairly pessimistic assumptions are required to obtain estimates as high as WIN's.

Given WIN's estimates, it is also not surprising that the coalition sees water bills as accounting for a larger share of future household budgets than CBO does. In particular, WIN projects that 22 percent of households will be paying more than 4 percent of their income for water services by 2009 (halfway through the study period) and talks more generally about "a third or more of the population" reaching that level as rates continue to adjust. (The fraction of households paying more than 4 percent of their income is simply one of many summary measures that can be derived from the distribution of water bills. There is no economic or scientific significance to 4 percent as the threshold at which water bills become "unaffordable.")[11] In contrast, CBO's estimates for the end of the study period in 2019 show 11 percent of households paying above 4 percent in the low-cost case and 21 percent doing so in the high-cost case.

Part of the difference between CBO's and WIN's projections lies not in the different estimates of future levels of investment but simply in different conclusions about current spending. CBO estimates that 7 percent of households paid more than 4 percent of their income for water services in the late 1990s; using other data sources, WIN estimates that 18 percent paid that much. WIN's approach is more limited, in two respects. First, the approach uses data only from the state of Ohio, which WIN finds to be representative of the nation as a whole in its costs for drinking water relative to household income. Second, the approach relies on system-level data (specifically, data from 1997 on drinking water and wastewater charges for using the

10. CBO's high-cost case differs from WIN's scenario not only in its easier borrowing terms and savings from increased efficiency but also in its higher costs for complying with federal standards for drinking water quality and somewhat greater reliance on pay-as-you-go funding.

11. WIN chose 4 percent on the basis that EPA has, at various times, used 2 percent of median household income as a benchmark in evaluating the "affordability" of average rates charged by both drinking water and wastewater systems. But in a community whose water systems charged rates that together collected 4 percent of median household income, many households with income below the median would probably be paying more than 4 percent. Thus, there is no logical connection between the EPA and WIN benchmarks.

equivalent of 250 gallons per day) rather than on the actual bills paid by individual households based on their own use. WIN's method may bias its results if low-income households tend to use less than 250 gallons of water per day.

In conclusion, CBO agrees with the consensus of industry experts that the nation's drinking water systems will require additional investment in the decades to come. But CBO's estimates make clear that the timing of the increase is not at all certain, nor is its ultimate size predictable, once savings from improved management and new technology are taken into account. Similarly, CBO agrees that higher rates for drinking water and wastewater services over the next 20 years may lead households to pay a larger share of their income for them. However, CBO's estimates of the potential impact higher rates would have on households are much smaller than those reported by the WIN coalition. Moreover, economists would argue that such considerations should be addressed through policies that redistribute income—not those that manipulate the price of water.