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DRINKING WATER

Some Households Rely on Untreated Water From Irrigation Systems

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Resources, Community, and
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Ranking Minority Member
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United States Senate

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Most Americans obtain their residential drinking water from public water systems regulated under the Safe Drinking Water Act. However, in some instances, American households have not had access to public water systems and have relied instead on untreated water from irrigation systems or other "special purpose" water systems. This practice has occurred primarily in the arid western states where irrigation is needed for agricultural purposes and the water is transported through open canals and ditches. To help ensure that these people obtain safe drinking water, the Congress amended the Safe Drinking Water Act in 1996 and moved to regulate these water suppliers as public water systems unless they meet certain exclusion criteria. The Environmental Protection Agency has developed guidance to implement these new requirements, which took effect on August 6, 1998.

In response to a provision in the amendments and discussions with your staff, we agreed to provide information on (1) the location and number of households that rely on irrigation systems or other special purpose water systems for some or all of their residential water needs (including drinking, cooking, and bathing); (2) the cost of the water used by such households and the cost and feasibility of alternative sources; and (3) the implementation issues that are likely to affect the states' and special purpose water systems' ability to meet the new requirements. As agreed, we focused our work on specific areas within the United States that the Environmental Protection Agency's officials identified as likely to have the most households using water from special purpose systems.

Results in Brief

According to officials of the Environmental Protection Agency, California and Texas are likely to contain the largest concentrations of people relying on water from irrigation systems in the United States. Preliminary estimates by irrigation system managers indicate that in California, in the counties where residential use of irrigation water is believed to be most prevalent, several thousand households are relying on such water for some or all of their residential water needs. In Texas, a state agency has estimated that in the counties where residential use of irrigation water is believed to be most prevalent, about 11,250 people—or about 2,600 households—have no access to public water systems (or have systems characterized as deficient) and, therefore, may be relying on irrigation water to meet at least some of their water needs. Several factors make it difficult to obtain precise data on the extent of usage, particularly the uncertainty about whether and how water from irrigation and other special purpose systems is being used inside the home. However, given the extensive availability of irrigation water within these Texas counties and the lack of alternative sources, state and local officials believe that a significant number of these households are probably using irrigation water for at least some residential water needs. The vast majority of the households relying on such water in both California and Texas are believed by state, local, and irrigation system officials to be purchasing bottled or hauled water[1] for drinking and cooking and using the water from irrigation and other special purpose systems for other uses, such as bathing and washing dishes.

Residential users of irrigation systems currently pay from $100 to about $700 per year for untreated water that is supposed to be used only for nondomestic purposes such as watering lawns and livestock. We found that the cost of buying bottled or hauled water currently ranges from about $120 to $650 per year. Other alternatives, such as connecting residential users to existing community water systems, installing new community systems, or installing point-of-entry treatment devices[2] in individual households, can be considerably more expensive and may not be affordable without financial assistance. For example, within the counties we selected for review, the cost of installing central treatment ranged from $2,100 to $18,000 per household in recently completed projects. Several factors affect the cost of treatment, including the quality of the source water, the terrain, the distance between residential

[1]Hauled water refers to bulk, treated water that is delivered to homes in trucks by commercial operations. Generally, the water is stored in a tank located on or adjacent to the home.

[2]Point-of-entry treatment devices treat all the water that enters a household, thus providing treated water at every tap.

customers, and the proximity of existing community water systems. Most residential users of special purpose water systems are located in areas with relatively low median incomes, but federal and state funding is available to help offset the cost of some alternatives.

Both the difficulty of identifying residential users and the costs and technical issues associated with finding alternatives to irrigation water are likely to present major challenges to states and special purpose water systems when implementing the new requirements established in the 1996 amendments to the Safe Drinking Water Act. For example, water suppliers will have to identify their residential users to implement the new requirements, but state program administrators from both California and Texas expressed concern about whether people will be forthcoming about the sources and uses of their residential water, particularly if they may be required to pay for costly alternatives. In addition, representatives of irrigation districts raised concerns about the timing and content of the Environmental Protection Agency's draft guidance (e.g., that the implementing guidance was not issued until just before the effective date of the new requirements), some of which were addressed in the final guidance. Finally, state officials also indicated that their ability to implement the new requirements would be affected by competing demands for the limited resources of the states' drinking water programs.

Background

The Safe Drinking Water Act (SDWA) regulates public water systems, which, until 1996, were defined as systems that provide piped water for human consumption and have at least 15 service connections or regularly serve at least 25 individuals. The Environmental Protection Agency (EPA) has interpreted "human consumption" to include drinking, cooking, bathing, showering, dish washing, and maintaining oral hygiene, an interpretation that has been upheld by the courts.[3]

In 1996, the Congress changed the definition of public water system after learning that (1) some U.S. households were relying on untreated water from irrigation canals for some or all of their residential water needs and (2) a federal appellate court had held that such canals were not public water systems within the meaning of SDWA because they do not constitute a system of "piped water" for human consumption.[4] Specifically, the Congress expanded the definition of a public water system to include

[3]See United States v. Midway Heights County Water District, 695 F. Supp. 1072, 1074 (E.D. Cal. 1988).

[4]Imperial Irrigation District v. United States Environmental Protection Agency, 4 F.3d 774 (9th Cir. 1993).

systems that provide water for human consumption through "constructed conveyances" other than pipes. For the most part, this change affects water suppliers, such as irrigation systems, that provide water through constructed conveyances such as man-made ditches and canals.[5]

Under the 1996 amendments, a water supplier must still serve at least 25 people or have at least 15 service connections to be considered a public water system. But in some cases, a connection will not be considered as a "service connection" for the purpose of determining how many connections or users are being served. Thus, systems that provide water through constructed conveyances other than pipes may avoid regulation as public water systems if, for some or all of their connections,

- the water is used exclusively for purposes other than drinking, bathing, and cooking, or other similar uses;
- the EPA Administrator or state primacy agency[6] has determined that alternative water (e.g., bottled or hauled water) is provided for drinking and cooking and that this water achieves a level of public health protection equivalent to that provided by the applicable national primary drinking water regulations; or
- the EPA Administrator or state primacy agency has determined that the water provided for drinking, cooking, and bathing is treated centrally or at the point of entry by the provider, a pass-through entity,[7] or the user to achieve a level of public health protection equivalent to that provided by the applicable national primary drinking water regulations.

The 1996 amendments also exclude from regulation certain irrigation districts that were in existence prior to May 18, 1994, if (1) the districts provide primarily agricultural water through piped water systems with only incidental residential or similar use and (2) the systems or their users meet the exclusion criteria, described previously, for alternative water or treatment.

[5]Other types of systems that may be included by the expanded definition include mining and industrial water systems. According to EPA, state, and industry officials, however, virtually all of the special purpose water systems likely to be affected by the new definition provide irrigation water. Thus, in this report, we will use the term irrigation system to denote any special purpose water system.

[6]Under SDWA, EPA has authority to delegate the primary responsibility for enforcing drinking water program requirements—commonly referred to as "primacy"—to states that meet certain requirements. Today, all states except Wyoming have assumed primacy for managing their drinking water programs.

[7]According to the manager of EPA's work group on the new definition of a public water system, "pass-through entity" refers to a third-party contractor that operates and maintains centralized or individual treatment systems and monitors water quality.

Although the requirements for irrigation districts that provide piped water took effect immediately, irrigation systems that provide water through constructed conveyances were given 2 years, or until August 6, 1998, to comply. During the 2-year period, EPA developed guidance to assist state primacy agencies and water suppliers in implementing the new requirements. EPA published its guidance in the Federal Register on August 5, 1998.

The potential health effects from consuming untreated water from open canals or ditches can be serious because the water frequently is contaminated with bacteria, including fecal and other disease-causing bacteria. In addition, open canals and ditches are subject to runoff of pesticides and fertilizers from agricultural fields, and aquatic herbicides are used in the water to treat for algae and to control vegetation. Gastrointestinal illness, or diarrhea, is the most common illness caused by bacteriological contamination, but certain pathogens cause hepatitis A infections that may lead to jaundice and liver damage.

Households Using Water From Irrigation Systems Are Limited in Location and Number

According to EPA officials, California and Texas are likely to contain the largest concentrations of people relying on water from irrigation systems in the United States. Estimates derived from preliminary user surveys and other information indicate that in California, several thousand households obtain water for human consumption from irrigation systems within the four counties we selected for detailed review. In Texas, a state agency has estimated that about 2,600 households in the two counties we selected for detailed review live in areas that either do not have public water systems or have systems characterized as deficient. Given the wide availability of irrigation water within these two counties and the lack of alternative sources, state and local officials believe that a significant number of these households are likely to be using irrigation water for at least some of the purposes defined as human consumption, such as bathing or washing dishes. Several factors, such as better enforcement of the requirements for safe drinking water in residential developments, indicate that households' reliance on irrigation water may be on the decline in these counties.

Residential Use of Irrigation Water Is Limited to Certain Areas and Circumstances

In California, the residential use of untreated canal water occurs throughout remote areas in the foothills of the Sierra Nevada and also in Imperial County in the arid southeastern corner of the state, where an extensive system of irrigation canals supports what has become one of the most important agricultural counties in the nation. EPA and state officials

indicated that of the foothill counties, Nevada, Placer, and Tuolumne counties are likely to have the greatest number of residential users of untreated canal water. In Texas, state officials believe that the residential use of untreated canal water is concentrated in the lower Rio Grande valley, particularly in Cameron and Hidalgo counties. We included these key counties—Imperial, Nevada, Placer, and Tuolumne in California (see fig. 1) and Cameron and Hidalgo in Texas (see fig. 2)—in our review.

Figure 1: California Counties Included in GAO's Review

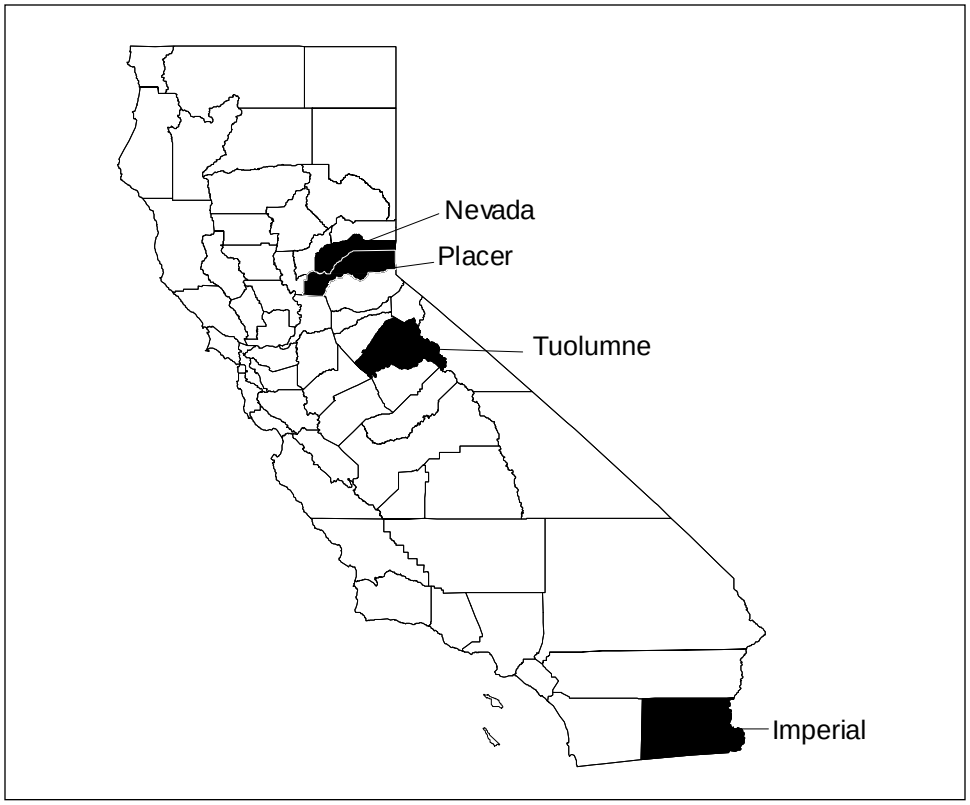
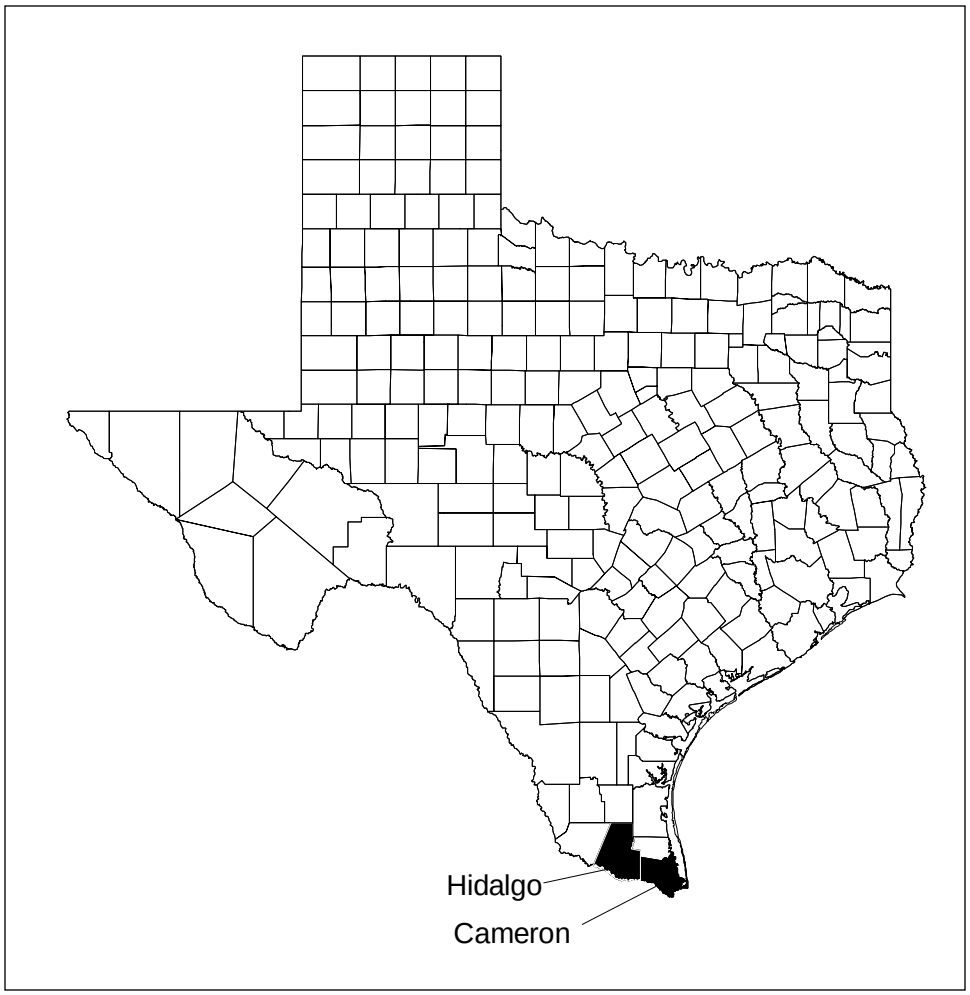


Figure 2: Texas Counties Included in GAO's Review



The irrigation canals found throughout the foothills of the Sierra Nevada were originally hand-dug earthen ditches constructed in the 19th century for use in gold mining, according to irrigation system managers. Later, these canals began to be used for agricultural irrigation or for the logging industry, and more recently, the canals have also served as a source of residential water for pockets of homeowners living in remote areas of the foothills. Until the past few years, according to state, county, and irrigation system officials, some counties permitted homes to be built in areas that lacked public drinking water systems but had access to untreated irrigation water. The counties generally required that a homeowner relying on irrigation water install a point-of-entry system to treat the water.

In both Imperial County, California, and the lower Rio Grande valley of Texas, an extensive network of agricultural irrigation canals has existed since the early 20th century, predating much of the current residential development. Imperial County and Cameron and Hidalgo counties in Texas have many hundreds of miles of irrigation canals and ditches and thousands of residents whose homes are not connected to public water systems. Residential use of untreated canal water is found both in isolated rural areas where the nearest public water system may be miles away and in very low-income communities, often called colonias,[8] that were initially constructed without basic water and sewer infrastructure.[9]

Although colonias developed all along the U.S.-Mexican border, they are particularly common in Texas, where, until recently, there has been little regulation of residential development in the unincorporated areas outside municipalities. Thus, the development and sale of parcels of land without access to public services such as adequate water and sewage were permitted under state law. This lack of regulation, coupled with the need for affordable housing in the border region, facilitated the growth of colonias over the last 40 to 50 years. All of the organizations we contacted that work with colonia residents were aware of households in these communities that use irrigation water in their homes. Although much progress has been made in bringing water and sewer services to these communities, some still lack basic services, and even after water service has been installed, some residents cannot afford the cost of connecting to the system.

Difficulties Exist in Determining Precise Extent of Reliance on Water From Irrigation Systems

Although precise data are not available, our review suggests that in both California and Texas, several thousand households are probably using untreated water from irrigation systems for one or more of the purposes EPA defines as human consumption, including drinking, cooking, bathing, showering, dish washing, and maintaining oral hygiene. Little is known about exactly how untreated water is being used inside the home, but state and local officials believe that few people are directly ingesting such water through drinking and cooking. According to these officials, most

[8]Although there is no generally agreed-upon definition, "colonia" generally refers to a rural unincorporated subdivision along the U.S.-Mexican border in which one or more of the following conditions exist: substandard housing, inadequate roads and drainage, and substandard or no water and sewer facilities. Available data, although limited, indicate that residents of colonias are mostly Mexican-American; many work as seasonal farm laborers and have incomes below the poverty level. See Rural Development: Problems and Progress of Colonia Subdivisions Near Mexico Border (GAO/RCED-91-37, Nov. 5, 1990).

[9]According to EPA, residential use of canal water is also widespread among suburban homes located near the 11 towns in central Imperial County.

households buy bottled or hauled water for the latter purposes and may be using the untreated water for purposes such as bathing and washing dishes.

In California, within the counties we selected for detailed review, several major water suppliers have made preliminary efforts to determine how many of their residential customers are using irrigation water for human consumption. For example, a 1993 customer survey conducted by the Imperial Irrigation District in Imperial County identified approximately 2,800 households with piped connections to the irrigation canals. Since that time, several communities have extended their water lines to provide treated water to nearby colonias, and the district now estimates that it has about 2,200 residential connections. Likewise, the Tuolumne Utility District in Tuolumne County conducted a preliminary survey of its customers; on the basis of this effort, the district's officials believe that at most, 230 of their 625 customers may use the irrigation water for human consumption.

Farther north, in Placer and Nevada counties, other water suppliers estimated the number of households that may be consuming untreated water on the basis of whether the households are receiving irrigation water year-round. Since in the Sierra Nevada foothills agricultural customers do not usually need irrigation water during the rainy winter months, EPA and state officials maintain that year-round use of canal water may indicate that the water is used for human consumption. The Placer County Water Agency reported that it has about 3,700 residential accounts, of which one-half to one-third receive water throughout the year. The Nevada Irrigation District, based in Nevada County, has 4,680 residential customers, including 770 that receive water all year, according to a district official. Managers from these districts were quick to mention that the year-round purchase of irrigation water does not necessarily mean that the water is used for human consumption; some customers may be using the water only for fire protection or flushing toilets.

While our review showed that thousands of households may have connections to irrigation canals, the irrigation managers in California we interviewed believed that few people are drinking the untreated water. Rather, such customers are, for the most part, believed to be buying bottled or hauled water for drinking and cooking or to be relying on point-of-entry water treatment units to process all of the water entering the home.

In Texas, little or no data have been gathered yet by state agencies or irrigation districts on the number of households relying on untreated irrigation water. However, some efforts have been made to identify the number of people who do not have access to safe drinking water, some of whom are likely to be dependent on irrigation water. For example, the Texas Water Development Board (TWDB) estimated that as of December 1996, the most recent date for which data are available, 45,965 people—or roughly 11,000 households—in the state's border region were without adequate water service.[10] These individuals were in areas not served by public water systems or had systems determined to be deficient.[11] According to TWDB, about 11,250 of these people—or about 2,600 households—were in Cameron and Hidalgo counties, where residential reliance on irrigation water is believed to be most prevalent. In addition, new colonias continue to develop in these counties, some of which may not yet have been counted by TWDB.

While it is not known how many of the households identified by TWDB were relying on canal water, state and water agency officials have told us that using canal water is often the most feasible option available for households without treated water, given the lack of suitable groundwater and the lack of state-regulated water haulers. For example, an investigator from the state attorney general's office who works in Cameron and Hidalgo counties told us that untreated irrigation water is used "quite extensively" there and that its use is "normal practice" in homes without access to drinking water. He estimated that people were using untreated water in 8 of the 10 colonias in which he has conducted investigations during the last 4 years.

Several officials familiar with conditions in the lower Rio Grande valley told us that even where centralized treatment systems are available, significant numbers of colonia households may not be able to afford the cost of connecting to the systems and, thus, may be using irrigation water. Connection fees, including the cost of the water lines from the street into the home, the water meter, meter box, and other fees, range from several hundred dollars to several thousand, according to state officials.

[10]The border region is defined as the 33 Texas counties within 100 kilometers of the U.S.-Mexican border. The Texas Water Development Board, among other responsibilities, provides grants and loans from state and federal sources for the water and sewer needs of the state's economically distressed areas and administers the drinking water state revolving fund.

[11]In addition to the water needs identified, TWDB and the Texas Natural Resource Conservation Commission (TNRCC) estimated that nearly 335,000 people living in Texas along the Mexican border did not have wastewater service from a centralized system. These agencies estimated that the Texas border region needs $2.5 billion (in 1995 dollars) for improvements to water and wastewater systems. (Texas Border Region Environmental Infrastructure Needs Assessment, TWDB/TNRCC, Apr. 1997.)

In addition to the colonia residents who are likely to be using irrigation water, irrigation canals are the only source of water for some households in remote areas, according to officials from the Lower Rio Grande Valley Water District Managers Association. Many of these households contract with the districts to pay for "yard water" for watering yards and livestock, and some may be using the water inside the home.[12] To varying degrees, the irrigation districts also have some unauthorized users who set up a connection from an existing customer's line or find some other means to obtain water. The managers could not estimate how many households obtain water without authorization nor whether this water is used for human consumption. The officials generally believe that most of their thousands of paying, nonfarm customers have access to treated water from public systems.

As in California, Texas officials do not believe that many households routinely use the untreated canal water for drinking or cooking. They indicated that some households purchase water for such purposes from vending machines that have become prevalent in recent years. Others get treated water for drinking and cooking from the home of a friend or relative who has a connection to a public water system. Hence, the officials believe that the household use of irrigation water in the lower Rio Grande valley is generally confined to bathing, showering, and washing dishes.

Reliance on Water From Irrigation Systems May Be Declining

There are indications that the number of households relying on water from irrigation systems has declined in recent years and will continue to decline in California and, to some extent, in Texas as well. In California, several factors have been at work to decrease the reliance on irrigation systems for residential use. Among these have been the increasing suburbanization of areas north and east of Sacramento, such as Placer County. What were once isolated areas with few homes are now more densely populated with middle- and upper-income communities that have begun to demand the same services, such as centralized water treatment, available in the city. As more people move into these areas, the per household cost of installing a central water treatment system declines, which can also make it more feasible to install such a system.

[12]Because of the severe drought conditions in the lower Rio Grande valley during the summer of 1998, some irrigation districts have had to cut off the water supplied to these users. According to the president of the association, the districts have recently been receiving complaints from customers who say that they have no other source of household water.

Also, both local and state governmental efforts have been helping to decrease the reliance on untreated water from irrigation systems for residential uses. For example, some county departments, such as Placer County's Division of Environmental Health, no longer allow the construction of homes that are not connected to an approved water system. For several years, the California Department of Health Services has had a program in place to establish public water systems that supply treated water to clusters of homes served by irrigation systems. As a result of this program, some irrigation systems, including the Nevada Irrigation District and the Placer County Water Agency, also operate public water systems that are subject to SDWA requirements.

Moreover, irrigation system managers in California cited the unwillingness of financial institutions to loan money to homebuyers for residences not connected to a centralized water treatment system as a factor contributing to the decline in the reliance on irrigation water. The managers believe that the financial institutions' policies have already forced, and will continue to force, the remaining residential users of untreated irrigation water to pay for connections to the nearest public water system. A manager from the Nevada Irrigation District said that largely because of these policies, his district sees 75 to 80 conversions of residences from irrigation water to public water systems each year.

Texas has also been experiencing a decline in the number of households relying on water from irrigation systems, according to several officials who work in the lower Rio Grande valley. These officials attribute the decline to the many governmental and private efforts made to bring drinking water to these areas.

Despite such efforts, household consumption of irrigation water may continue to occur in Texas well into the future. For example, TWDB and TNRCC have predicted that the populations of the four most populous counties along the border with Mexico—including Cameron and Hidalgo—will double, on average, their 1990 levels by the year 2020. Officials working in this area confirmed that small clusters of homes in areas not served by public water systems are continuing to be built, even as older colonias are finally receiving such services. If, in addition to the expected population increases, these counties' high poverty and unemployment rates continue, the issues of water access and affordability could persist. Much will depend on how successful Texas officials are in enforcing new laws intended to prevent substandard developments.

The Cost of Irrigation Water and Its Alternatives Vary Widely

As states and irrigation systems begin to implement the new definition of a public water system, residential users of irrigation systems could face significantly higher water costs, depending on the nature of their alternative water source. While several types of financial assistance are available to offset the cost of some alternatives, in most instances these programs serve multiple purposes, and water suppliers will have to compete with other types of projects to obtain the funding needed to meet the new requirements.

Households Currently Served by Irrigation Systems Often Have Multiple Sources of Water

According to state and irrigation district officials, most of the households that obtain water from irrigation canals also use bottled or hauled water for drinking and cooking. Although, in some districts, residential users have historically had the right to use irrigation water at no cost, we found that most irrigation districts currently charge users from $100 to about $700 per year. Bottled water is sold at a variety of retail outlets, such as supermarkets and gas stations, as well as at stand-alone facilities at a cost of 20 to 25 cents per gallon. The cost of hauled water is 35 to 40 cents per gallon and may include the cost of renting the tank used to store the water. Overall, we found that the cost of buying bottled or hauled water for drinking and cooking ranges from about $120 to $650 per year.[13]

Both California and Texas regulate water haulers, and these purveyors are widely used in California. However, Texas officials told us that there are no state-regulated water haulers in the lower Rio Grande valley, so residents do not have access to water from this source. State and local officials in Texas told us that residents not served by public water systems sometimes obtain treated water through informal arrangements such as trucking in barrels of water obtained from relatives or friends with access to a public water supply.

In addition to bottled and hauled water, some households in California and Texas obtain water for residential purposes from private wells. However, neither state maintains accurate records on the number and location of such wells or whether they are actively used. Moreover, concerns about the quality and reliability of the groundwater resources in the areas we selected for detailed review also raise questions about the extent to which

[13]To estimate these costs, we obtained cost data from local water purveyors and irrigation districts. When the only information available was the price per gallon, we relied on EPA for assumptions about the average number of people per household and water usage in order to estimate annual costs of bottled or hauled water. According to EPA, the average number of people per household is three and each individual consumes an average of 2 liters of water per day for drinking and cooking. In a three-person household, this equates to 1.6 gallons per household per day or a total average consumption of 584 gallons per household per year.

people are relying on private wells. For example, in both the lower Rio Grande valley and the southeastern desert area of California, the groundwater is not considered drinkable because of the high levels of dissolved solids. Although the groundwater quality is much better in the foothills of the Sierra Nevada, state and local officials told us that drilling a well into bedrock is very costly and that finding a reliable supply is hit or miss. These officials also told us that some people have obtained connections to irrigation canals because their wells have run dry.

The Cost and Feasibility of Alternative Water Sources Vary

Under the 1996 amendments to SDWA, irrigation systems may be excluded from coverage under the act and therefore avoid regulation as public water systems if (1) bottled or hauled water is provided for drinking and cooking or (2) water for drinking, cooking, and bathing is treated centrally or at point of entry by the provider, a pass-through entity, or the user.[14] In each case, the alternative water must achieve the equivalent level of protection provided by the applicable national primary drinking water standards. In addition, according to EPA's guidance, irrigation systems may pass the costs of providing alternative water on to their customers.

As noted earlier, we found that households that supplement the water obtained from irrigation systems with bottled or hauled water for drinking and cooking are spending roughly $120 to $650 per year. If an irrigation district assumes responsibility for providing the bottled or hauled water, as contemplated in EPA's guidance, the cost of administering this effort could increase costs to users.[15] For example, the Tuolumne Utilities District in Tuolumne County, California, estimated that the cost of providing bottled water to about 60 isolated households would be $82,000 per year if the residents were to pick up the water at a central location and $343,000 per year if the water were delivered to individual households by the district. This amounts to $1,367 or $5,717 per household per year depending on whether the water is delivered.[16] In contrast, the Imperial

[14]Irrigation systems may also avoid regulation as public water systems if the water is used exclusively for purposes other than drinking, bathing, and cooking, or other similar uses.

[15]The bulk purchase of water by irrigation districts may offset at least some of these increased costs.

[16]The lower estimate does not consider the costs incurred by individuals if they were required to pick up the water from a central location. Such costs would increase the costs to households above the $1,367 estimate cited here. The higher estimate includes the cost of delivery trucks that would be purchased and operated by the Tuolumne Utilities District. However, EPA's guidance does not state that irrigation systems must deliver alternative water to their residential customers. Instead, the guidance states that the supplier must provide the water to the users at a reasonable location, not merely make it available. According to the guidance, whether the alternative water is being provided at a reasonable location, such as the user's doorstep or property line, will be determined by the state primacy agency on a case-by-case basis.

Irrigation District in Imperial County, California, recently estimated that having water delivered by a water hauler would cost each household $50 to $55 per month, or $600 to $660 per year.

Point-of-entry treatment units that are capable of treating raw water from irrigation canals so that it meets the applicable quality standards currently cost $4,000 to $5,000 each, according to California officials.[17] Some households are already using point-of-entry treatment, but state officials questioned the effectiveness of some types of devices. For example, we were told that the swimming pool filters used by some households do not provide sufficient treatment. California officials told us that effective units are relatively expensive because they must treat raw water that is of poor quality, removing bacteriological contamination and periodically high levels of turbidity.[18] In addition, regular maintenance and water quality monitoring are required to ensure that the units continue to perform effectively, and the officials have no assurance that this will be done. As a result of these concerns, California has only once approved the use of point-of-entry treatment as part of a public water system[19] and Texas has never done so.

Additional costs may be incurred in some situations where point-of-entry treatment is the alternative selected for compliance. According to irrigation district officials, in some instances, the units may have to be installed at the property line—rather than inside the home—to provide maintenance personnel with easy access. This approach would require the construction of a meter box and a shed to protect the unit from the elements, particularly in areas where freezing occurs in the winter months.

The cost of installing a central water treatment system can also vary significantly, depending primarily on the distance between residential customers and the proximity of existing water lines or treatment plants. For example, in the case of projects sponsored by TWDB to bring treated water to colonias in Cameron and Hidalgo counties, the cost per

[17]EPA officials maintain that although costlier units may be necessary in some situations, units ranging from $2,000 to $2,500 will generally provide adequate treatment.

[18]Turbidity is a cloudiness in water caused by minute suspended particles, such as clay, silt, and microscopic organisms. High levels of turbidity may reduce the efficiency of disinfection treatment and mask the presence of microbiological contaminants.

[19]Several years ago, California approved the use of point-of-entry treatment in the Gibson Canyon area of the Solano Irrigation District after the district did a feasibility study to examine the possibility of installing these treatment devices at individual households instead of providing central treatment. The annual cost per household for these devices was estimated to be $1,133 over 20 years. Eventually, Gibson Canyon residents opted for central treatment.

connection ranged from about $2,200 to $3,700. The median cost of a connection was about $2,600 in these projects. For isolated households or very small communities located far from existing water lines, the cost per connection can be much higher. For example, according to a TWDB official, in another project at a colonia located outside the lower Rio Grande valley, water lines had to be extended nearly 10 miles to an existing water treatment plant. The cost per connection for each of the 31 households in this small colonia was nearly $17,000 when the funding commitment was made in 1996.[20]

The manager of a rural water supply corporation that provides treated water in the lower Rio Grande valley agreed that the cost of connecting isolated households can be substantial. He estimated that in 1998, the cost of installing pipelines from public main water lines to homes ranges from $2.25 to $3.00 per foot. Thus, a customer who lives 3 miles from the nearest public water main would have to pay more than $35,000 for the pipeline alone. The manager told us that he periodically gets inquiries about hooking up to his system, but people often become discouraged after learning how much it would cost.

Similarly, in California, an official with the Placer County Water Agency agreed that location can greatly affect the cost of providing treated water. While the cost of connecting a household to one of this agency's treated water systems is, on average, about $6,000, the cost can be much higher, depending on the location of the household. For example, in 1996, the agency constructed a small water system to serve 97 households at a total cost of $1.5 million. The average cost per household, including the cost of pipelines from the water main to individual homes, the connection fees, and interest, was $15,000 to $18,000. According to the official, the high cost was attributable to the small number of households served by the system, the distance between customers, and the hilly terrain.

Considering the relatively low median income in some areas, some alternative water sources may not be feasible without financial assistance. In Cameron and Hidalgo counties in Texas, the median household incomes were $17,336 and $16,703, respectively.[21] Within California, some areas had

[20]In addition to the cost of installing water lines in a community, individual households must pay connection fees to extend the lines from the street into the home. TWDB officials told us that their funding may not be used to pay for any installation on private property. As noted earlier, these connection or hookup fees range from several hundred dollars to several thousand, according to state and local officials.

[21]Data on median household income were extracted from the 1990 U.S. Census database and represent 1989 income levels, the most recent data available on a countywide basis. The national median household income for the same period was $30,056.

significantly higher income levels. Median household income ranged from $22,442 in Imperial County to $37,601 in Placer County.

Funding Is Available to Help Offset the Cost of Some Alternative Water Sources

Several sources of funding are available to finance drinking water projects in rural or disadvantaged communities, including projects that will provide treated water to households that rely on irrigation systems. For example, financial assistance is available from the U.S. Department of Agriculture's (USDA) Water and Waste Disposal programs, the Department of Housing and Urban Development's (HUD) Community Development Block Grant program, the North American Development Bank, and EPA and state funds earmarked for water and wastewater projects in colonias. In some instances, eligibility for financial assistance is determined by the project's location, the median household income of local residents, or both.

More recently, the Congress authorized a new state revolving loan fund for drinking water projects under the 1996 amendments to SDWA. Under this program, local communities can obtain low-interest loans for constructing or upgrading drinking water systems; states must use a minimum of 15 percent of all dollars credited to the revolving loan fund for assistance to small systems that serve fewer than 10,000 people. States also have the option of providing additional loan subsidies, such as principal forgiveness or below market interest rate loans, to disadvantaged communities. In California, several irrigation districts have submitted "preapplications" to get projects on the state's priority list for funding to provide treated water to households that currently rely on irrigation canals. In Texas, state officials had not identified such households at the time of the state's needs assessment and, thus, did not include irrigation systems on the state's priority list.

In addition to the programs that provide funding for basic water infrastructure, some programs, including HUD's Community Development Block Grant program and USDA's Water and Waste Disposal programs, may be used to pay for residential plumbing connections. In Texas, EPA has also made about $15 million available for this purpose. Such assistance is important because connection fees can be substantial, depending on the nature of the connection and the types of fees charged by the water authority. In addition, many residences in the colonias need to be upgraded; some water authorities will not approve a connection unless a residence has an enclosed bathroom, which some colonia residences lack.

A Number of Issues May Affect States' and Water Suppliers' Ability to Meet New Requirements

State and irrigation system officials identified a number of potential obstacles to the effective implementation of the new definition of a public water system. The issues range from practical problems, such as identifying the customers that are relying on untreated water and finding affordable alternatives, to questions about EPA's interpretation of the 1996 amendments and the impact of implementing the new SDWA requirements on irrigation systems' ability to comply with existing state laws.

Difficulties Exist in Identifying Residential Users of Irrigation Water

According to EPA's guidance, the state is responsible for making a determination about whether individual water suppliers, such as irrigation districts, meet the new definition of a public water system, and this determination rests on two key elements: (1) whether the supplier is "providing" water within the meaning of the statute and (2) whether the water is being used for human consumption. EPA's guidance states that for the supplier to be providing water to users, an explicit or implied arrangement or agreement of some kind must exist between a supplier and individuals using water. In the absence of an explicit arrangement or agreement, the state should decide whether an implicit arrangement or agreement exists on the basis of (1) whether the supplier knows or should know that water is being taken and (2) whether the supplier has consented to its being taken. Similarly, the determination of whether the water is being used for human consumption is to be based on whether the supplier knows or should know that such use is occurring. The guidance suggests that water suppliers undertake "reasonable" actions within their authority, such as conducting user surveys, to determine whether and how water obtained from irrigation systems is being used for human consumption, as defined by EPA.

In both California and Texas, circumstances make it difficult to identify households that are relying on irrigation systems for domestic water. For example, state program managers expect that people will be untruthful about the source and uses of their residential water, particularly if they may be required to pay for costly alternatives. Representatives of irrigation districts also expressed concern about whether people will be forthcoming about their water use. District officials believe that they will not be able to determine whether irrigation water is actually being used inside the home without trespassing on private property or digging up residents' lawns to locate pipes. They note that even when the connections into a home are obvious, some residents are likely to report incorrectly that the irrigation water is only being used to flush toilets or for some other purpose that does not fall within EPA's definition of human consumption.

Identifying residential users will be difficult in Texas because, according to state officials, most users are unauthorized and are taking irrigation water surreptitiously. Some irrigation districts have contracts with residential users for "yard water" to water lawns and livestock and could use these customer lists as a starting point to identify households that could be using the water for bathing or other categories of human consumption. Identifying unauthorized users may be problematic, however. Irrigation district officials told us that patrolling hundreds of ditches and canals to detect unauthorized connections would place a huge burden on the districts, some of which have only one or two employees. However, according to EPA's guidance, a supplier would not be expected to go beyond its normal inspections or operation of water conveyances to discover unauthorized diversions, and a supplier that takes actions that a property owner would ordinarily take to maintain his or her property rights should be able to demonstrate that there is no implied arrangement to "provide" water.

A related issue is whether irrigation systems "should know" that households located in areas that are not served by public water systems—and where the quality or quantity of the groundwater is not suitable for private wells—are likely to be relying on untreated water from irrigation canals for human consumption. EPA officials told us that the determination of which households constitute service connections will have to be made on a case-by-case basis considering all relevant circumstances.

In California, state officials say that it will be some time before they are even able to identify the universe of water suppliers that provide water through constructed conveyances and have enough residential users to meet the new definition of a public water system. According to one estimate, California has about 900 governmentally chartered districts that perform some type of water-related function. In addition to irrigation districts, a variety of other entities may provide water for agricultural purposes and, thus, could be subject to the new requirements. These include county and state water districts, water conservation districts, flood control districts, water reclamation districts, and special act districts.[22]

Another problem in both California and Texas, according to state and irrigation district officials, is that in an unknown number of cases, more

[22]Special act districts were created by legislation or by "special acts" that pertained specifically to them. For example, the Placer County Water Agency was created in 1957 by the Placer County Water Agency Act passed by the California legislature.

than one household may be obtaining irrigation water from a single authorized connection. Since such accounts are billed to a single household, irrigation district officials cannot readily determine how many households are actually receiving the irrigation water.

Alternative Water Sources Raise Cost and Technical Issues

The cost of alternative water sources can be significant, particularly in the case of centralized or point-of-entry treatment. Although bottled or hauled water can be considerably less expensive than some of the treatment alternatives, Texas officials have reservations about allowing this option because it may not protect public health sufficiently. Allowing the use of bottled or hauled water for drinking and cooking would mean that people could continue to use untreated water for bathing and other domestic purposes. According to Texas officials, this raises concerns about potential health effects from exposure to untreated irrigation water.

Texas officials also have reservations about allowing the use of point-of-entry treatment as a compliance option because, as we noted earlier, they are skeptical about finding an effective device, given the likelihood of bacteriological contamination and periodically high levels of turbidity in irrigation water.[23] The officials also have concerns about the amount of maintenance and monitoring required to ensure that these devices are continuously providing safe drinking water.

California officials told us that while connecting households to centralized treatment systems is the most protective and desirable alternative, they believe that the costs of implementing this option are formidable. In some areas, the median household income is too high for the residents to be eligible for some types of financial assistance. In addition, they told us that the state's Proposition 218 will make it difficult to gain the support of existing customers of water districts to help pay the costs of hooking up additional households. Proposition 218 prohibits any local government in California, including special districts, from imposing or increasing any special tax unless at least two-thirds of the voters approve. Thus, according to these officials, Proposition 218 would have the effect of making it more difficult for water districts to issue bonds to finance capital improvements.[24]

[23]According to EPA regulations, turbidity, which is measured in nephelometric turbidity units (NTU), should not exceed 5 NTU at any time; however, California and Texas officials told us that turbidity in irrigation canals can range as high as 150 or 200 NTU.

[24]EPA officials point out, however, that it may not prove necessary to issue bonds where funding is provided under the state revolving loan fund.

Concerns Exist About Timing and Content of EPA's Implementing Guidance

In commenting on EPA's draft guidance on implementing the new definition of a public water system, irrigation districts and other water suppliers raised several concerns about the timing and content of the guidance. Among other things, they argued that in its efforts to develop implementing guidance, EPA consumed nearly all of the 2-year grace period that was intended to give water suppliers time to achieve compliance by the August 6, 1998, effective date of the new requirements. In addition, because the guidance is not legally binding and does not impose legal requirements as a regulation would, water suppliers say that they are left with uncertainty about what they need to do to comply with the new provisions of federal law. Furthermore, the guidance recommends, in several instances, that the states establish requirements or make case-by-case determinations.[25] Thus, even though EPA issued its final guidance by the effective date of the requirements, these water suppliers believe that they will not have time to meet the compliance deadline because of the responsibilities that EPA has delegated to the states.

According to EPA, the requirements in the law itself constitute the legally binding obligations for water suppliers. EPA officials told us that the guidance is only intended to facilitate implementation and provide clarification on some issues.

State officials in both California and Texas told us that they, too, had been awaiting EPA's final guidance so that it could be used as a basis for their own implementation strategies. However, they said that as a practical matter, implementing the new definition of a public water system will be an iterative process; as they learn of irrigation systems that may be subject to the new requirements, they will work with the systems, make the necessary determinations, and ensure compliance.

Some irrigation districts, citing legislative history, commented that EPA went beyond the intent of the Congress when, in its guidance, the agency said that states should determine whether a water supplier qualifies as a public water system on the basis of whether the supplier "knows or should know" that residential connections exist or that the individuals are using the water for human consumption. According to the Association of California Water Agencies, there is no reason that irrigation districts "should know" whether or how people are using irrigation water inside their homes when the supplier (1) is not in the business of selling or

[25]For example, the guidance says that state primacy agencies should (1) determine what form of records they will need from water suppliers regarding their efforts to identify households using the water for human consumption and (2) make case-by-case determinations on whether particular water suppliers meet the new definition of a public water system.

distributing treated water and (2) does not issue permits for private wells or permits for home occupancy. In addition, many water suppliers require their residential users to sign some type of waiver stating that they must not use or are not using irrigation water for human consumption. The Imperial Irrigation District commented that such waivers should be considered as evidence of whether or not the supplier knows or consents to such use.

In responding to these comments, EPA modified its draft guidance to clarify how the "knows or should know" standard will be applied. For example, instead of expecting water suppliers to take "any necessary actions" to determine whether people are using irrigation water for human consumption, the revised guidance states that water suppliers should make "reasonable" efforts "within their authority" to determine the nature of their customers' water use. Also, EPA agreed that waivers could be used as evidence of a lack of consent by the supplier, but should not be determinative on this issue. In addition, as noted earlier, EPA officials expect that these determinations will be made on a case-by-case basis considering all relevant circumstances.

The Association of California Water Agencies also commented that EPA ventured beyond the intent of the law when the agency decided that alternative water must be "provided" by the irrigation districts. They argued that the law is silent on who is to be responsible for providing the bottled or hauled water. Moreover, they pointed out that it makes no difference who the provider is—as long as the water quality meets the applicable standards. However, EPA officials told us that on the basis of the legislative history, their view is that the Congress clearly intended that alternative water would be provided by the water suppliers.

Implementation of the New SDWA Requirements May Affect Compliance With Existing State Laws

In both California and Texas, implementing the new SDWA requirements could affect irrigation systems' ability to comply with existing state laws. For example, under the 1996 amendments to SDWA, irrigation districts and other special purpose systems that also have residential users must be regulated as public water systems unless they can meet certain exclusion criteria. However, by state law, irrigation districts in Texas are not authorized to provide drinking water. Texas officials say that amending the state drinking water statute to incorporate the new definition of a public water system does not resolve the problem; additional statutory changes will be required to amend the state law governing irrigation districts.

Under the applicable state laws, the California and Texas irrigation districts cannot refuse to supply irrigation water to any taxpaying member of a district who requests a connection. However, if these households use the irrigation water inside their homes, under EPA's guidance, the district may be subject to liability under SDWA if it knew or should have known that the water was being used for human consumption—even if the district provides the water only on the condition that it will not be used for human consumption.[26] Irrigation district representatives expressed concern that until recently, county planning authorities were approving new development without evidence of a safe drinking water source. Residents who turned to the irrigation canals for domestic water may now be counted as "service connections," and the irrigation districts could be subject to regulation as public water systems if they cannot use the exclusion provisions within the statute to avoid regulation.

Another implementation issue, cited by Texas officials, was the potential infringement by irrigation districts on the designated service areas granted to rural water supply corporations. Regulated under the state's Public Utilities Regulatory Act, these corporations are nonprofit organizations, run by boards of directors, that receive franchise rights to provide drinking water in a specific geographic area. Within its certified area, a water supply corporation has the responsibility to provide drinking water as well as the exclusive right to do so—that is, no one else is allowed to provide drinking water to residents within that area. Texas officials expressed concern that if irrigation districts are regulated as public water systems and must supply treated water to residential users, the districts would be impinging on the exclusive rights of water supply corporations to supply these users. They estimated that 50 to 80 percent of the people who are currently getting water for residential uses from the irrigation canals are within the service areas of water supply corporations.

Higher Priorities and Limited Resources May Hamper States' Implementation of the New Requirements

As a result of the 1996 amendments to SDWA, states gained significant new responsibilities, including the implementation of the new state revolving loan fund for drinking water projects, source water assessment and protection programs, capacity development programs for small water systems, expanded operator certification programs, and several new contaminant regulations that are expected to have a major impact on public water systems. According to state officials in both California and

[26]As noted earlier, EPA believes that waivers are ineffective in protecting a supplier against SDWA liability in instances in which the supplier knows or should know that the water it supplies to a user is being used for human consumption. However, that does not mean that waivers or warnings to customers have no evidentiary role in an enforcement proceeding.

Texas, the bulk of their attention and resources will be devoted to these higher-priority activities rather than implementing the new definition of a public water system. Nevertheless, each state has begun to develop an implementation strategy. EPA officials also acknowledged that implementing these new requirements is a relatively low priority compared with the agency's other responsibilities under the 1996 amendments.

Agency Comments

We provided a draft of this report to EPA, the California Department of Health Services, and the Texas Natural Resource Conservation Commission. We obtained comments from EPA officials, including the Director of the Implementation and Assistance Division of the Office of Ground Water and Drinking Water, and state officials responsible for overseeing drinking water quality. EPA agreed with the report, noting that it accurately captures the issues pertaining to the domestic use of untreated irrigation water, and state officials also agreed with the facts in the report. The EPA and state officials also provided updated information and technical comments, which we incorporated throughout the report as appropriate.

The scope and methodology we used for our work are discussed in appendix I. We performed our work from September 1997 through September 1998 in accordance with generally accepted government auditing standards.

We will send copies of this report to the EPA Administrator and other interested parties. We will also make copies available to others on request. Please call me at (202) 512-6111 if you or your staff have any questions. Major contributors to this report are listed in appendix II.

Peter F. Guerrero
Director, Environmental
Protection Issues

Contents

Abbreviations

EPA	Environmental Protection Agency
HUD	Department of Housing and Urban Development
NTU	nephelometric turbidity unit
SDWA	Safe Drinking Water Act
TNRCC	Texas Natural Resource Conservation Commission
TWDB	Texas Water Development Board
USDA	U.S. Department of Agriculture

Scope and Methodology

In conducting our review, we collected data from a wide variety of sources, including the Environmental Protection Agency's (EPA) Office of Ground Water and Drinking Water and Office of Enforcement and Compliance Assurance, the U.S. Department of Agriculture's (USDA) Rural Utilities Service, the National Rural Water Association, the National Water Resources Association, the National Mining Association, the Association of State Drinking Water Administrators, and selected states. We chose California and Texas for detailed review because they (1) were identified by EPA officials as the states likely to be the most affected by the new definition of a public water system, (2) are agricultural states with many irrigation districts, and (3) have colonias with inadequate water and wastewater infrastructure along the U.S.-Mexican border.

Within these states, we focused on selected counties where reliance on irrigation systems is most common according to federal and state officials. In Texas, residential use of these systems is concentrated in the lower Rio Grande valley in Cameron and Hidalgo counties. In California, residential use is most prevalent in the southern desert area (Imperial County) and the foothill areas of the Sierra Nevada (Nevada, Placer, and Tuolumne counties).

To determine the number and location of households that rely on irrigation systems for some or all of their residential water needs, we gathered data using a case study approach in California and Texas. Within each state, we interviewed officials responsible for managing the public drinking water program and financing water infrastructure improvements, including the California Department of Health Services, the California Department of Water Resources, the Texas Natural Resource Conservation Commission, the Texas Water Development Board, the Texas Office of the State Attorney General, and the local offices of USDA's Rural Utilities Service. In addition, we met with representatives of irrigation districts from each of the selected counties, including the Association of California Water Agencies and the Lower Rio Grande Valley Water District Managers Association, and other knowledgeable officials. To supplement the testimonial evidence, we obtained and analyzed relevant reports and other supporting documentation.

The state and local officials we interviewed in California and Texas also provided information on the sources and costs of the water used by households relying on irrigation systems and the cost and feasibility of alternative sources. Where residential customers contracted for irrigation water, we collected data on the average cost per household. In addition,

we obtained cost data from purveyors of bottled and hauled water in the selected counties. To the extent possible, we obtained actual cost data on completed projects involving the connection of clusters of households to existing public water systems or the construction of new small systems in previously unserved areas. In addition, within EPA's Office of Ground Water and Drinking Water, we obtained cost data from the Treatment Technology Team, which is responsible for developing information on affordable and effective compliance technologies for small water systems. Unless otherwise stated, all costs included in our report are stated in current year dollars.

To identify implementation issues that are likely to affect the states' and irrigation systems' ability to comply with the new definition of a public water system, we interviewed EPA officials responsible for developing guidance on the new requirements as well as state and irrigation district officials responsible for implementing the new requirements. We also reviewed EPA's draft and final guidance as well as the comments received on the draft guidance.

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