

11.0 Regional Summaries

Summary of Panhandle Region

The Planning Group identified water supply needs for 44 out of 128 water user groups in the region. The total needs by 2050 are about 777,400 AFY. There are 23 urban and rural municipalities that have needs in the planning area in 2050.

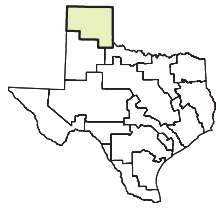
Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are \$390.4 million, including \$307 million for municipal strategies. Irrigation strategies include precipitation enhancement, the North Plains evapotranspiration (NPET) network for scheduling irrigation, installation of low energy precision application (LEPA) equipment, changes in crop variety, implementation of conservation tillage methods, and conversion from irrigated agriculture to dry-land agriculture at a cost of \$29.2 million. Livestock user groups propose to develop additional groundwater and to enhance precipitation to meet their needs at a cost of about \$33.1 million. Manufacturing proposes to use additional Ogallala groundwater and the Palo Duro Reservoir at a total cost of \$10.1 million. Mining will draw from the Dockum aquifer at a cost of about \$1.4 million. Power generation proposes to use groundwater and effluent reuse at a cost of about \$10 million.

The plan proposes that all municipal needs occurring by 2050 will be met. The cities of Cactus, Dumas, and Sunray will share in building a transmission system from Palo Duro Reservoir to meet their future needs. All remaining municipal water user groups will depend on the Ogallala aquifer as a supply source for future water needs. Amarillo has selected a strategy to augment its supplies with Roberts County groundwater by 2025. Five of the water user groups will have unmet needs in 2050 of about 488,200 AFY for irrigation.

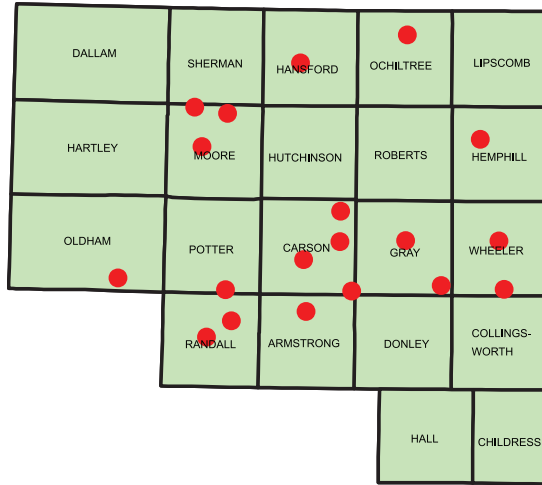
No new reservoirs are proposed for meeting future water needs in the planning area. The Planning Group has included a recommendation that a previously identified potential reservoir, Sweetwater Creek Reservoir, be eligible to receive funding to conduct feasibility studies for evaluating the potential yield.

A groundwater conservation goal (that 50 percent of the 1998 saturated thickness of the Ogallala aquifer would be remaining in 50 years) was adopted for the region. The Planning Group was firmly committed to ensuring that its activities were open and accessible to all interested parties. Several public information meetings featured the use of an interactive video-teleconferencing system that allowed interested parties to participate from their choice of as many as four locations.

The Planning Group received preliminary ideas on several water-transfer concepts. None of these transfer concepts was included in the regional plan because none was considered a preferred water management strategy. The Planning Group expects to study and evaluate several water-transfer concepts during the next planning cycle.



(A) Panhandle Region

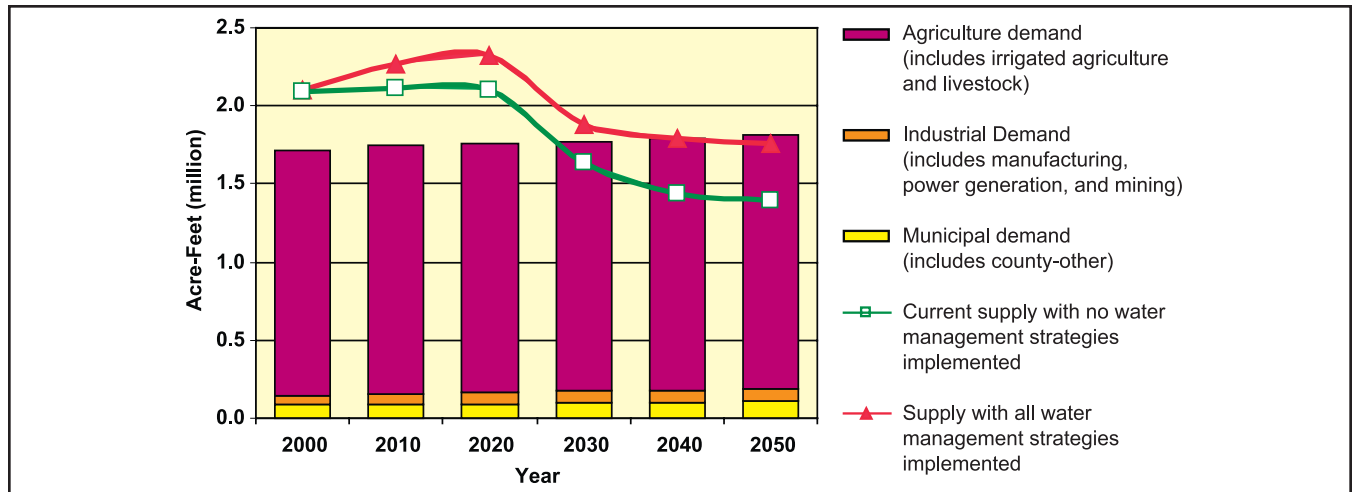


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

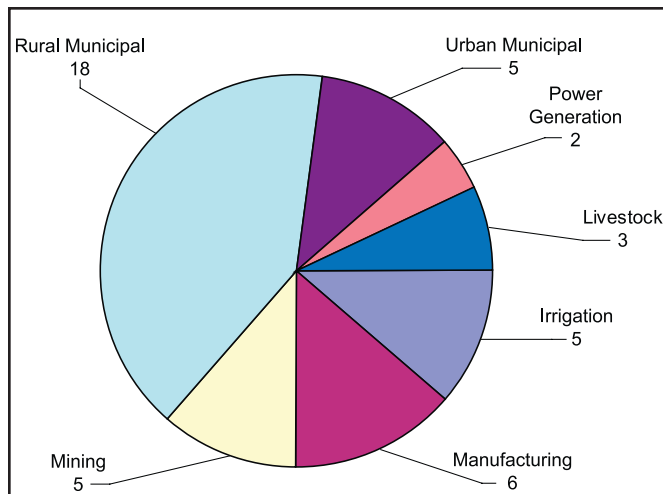
Key Points

- Total capital cost: \$390 million
- No new reservoirs
- Strategies to meet all municipal needs occurring by 2050
- 44 water user groups with projected water needs by 2050
- Has goal of 50 percent of current groundwater supplies remaining in 50 years
- Significant public participation in planning process
- Potential water-transfer projects to be evaluated on individual basis as presented to the Planning Group

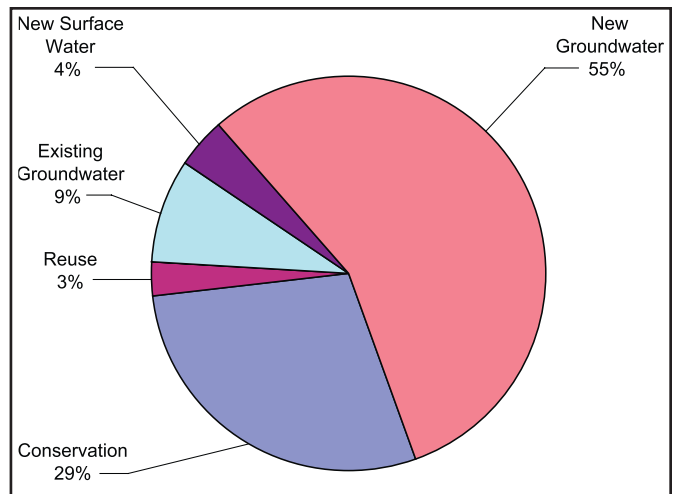
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Region B

The Planning Group identified water supply needs for 4 out of 68 water user groups in the region. The total needs by 2050 are about 20,669 AFY. There are 2 urban and rural municipalities with needs in 2050.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are \$145.3 million. Major projects consist of treatment of water from Lake Kemp/ Diversion Reservoirs (\$60.6 million) for the City of Wichita Falls, groundwater from Round Timber Ranch Well Field (\$3.8 million) for the City of Vernon and entities served by Vernon, the Hinds-Wildcat Pipeline (\$648,000), an ion-exchange system for Lockett (\$510,000), and the River Well Field for the City of Electra (\$2.4 million). Although not used as a strategy to meet a specific need, the Chloride Control Project (\$77.5 million) to improve water quality in Pease and Wichita Rivers before they reach Red River is recommended as a regional water supply management strategy.

Unless water quality standards prevent use of some currently available supplies, all municipal water user groups are expected to have water supplies sufficient to meet drought-of-record conditions if one or a combination of recommended strategies is implemented. There are no unmet needs in 2050.

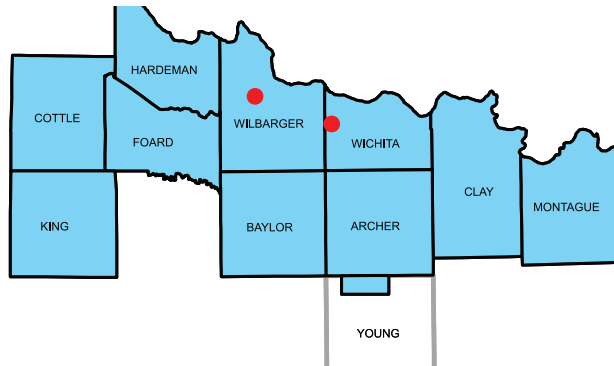
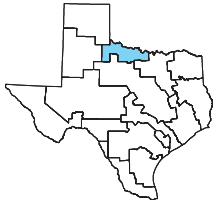
The City of Electra is projected to have a need of 51 to 65 AFY during the 2000 to 2050 period. The recommended strategy is to reopen River Well Field existing wells and install a reverse-osmosis treatment unit at the River plant. Round Timber Ranch Well Field is the recommended strategy for supplying the projected needs (91 AFY in 2050) of the City of Vernon and several small systems served by the City of Vernon. The water need for manufacturing in Wilbarger County is projected to be 521 AFY in 2050. Because the City of Vernon provides almost all of this water, the strategy for this need is included in Vernon's use of Round Timber Ranch Well Field.

Although the firm yields of Kickapoo and Arrowhead Lakes are sufficient to meet the demands of the City of Wichita Falls, the city developed a safe yield estimate showing that the city could need about 20,000 AFY. To meet this potential need, the City of Wichita Falls has selected a preferred strategy of treating poor-quality water from Lake Kemp.

In the early 1980's the City of Wichita Falls identified a potential reservoir site near the Town of Ringgold. The Planning Group evaluated this strategy, which has a projected capital cost of \$287 million; however, neither this strategy nor any other new reservoir was included as a recommended strategy.

Three major concerns that need to be addressed are (1) 13 groundwater-supplied water systems in Region B are not compliant with Primary Drinking Water Quality Standards, (2) Lake Arrowhead may contain arsenic levels above the allowed limit, and (3) salinity in Lake Kemp and Diversion Lake.

(B) Region B

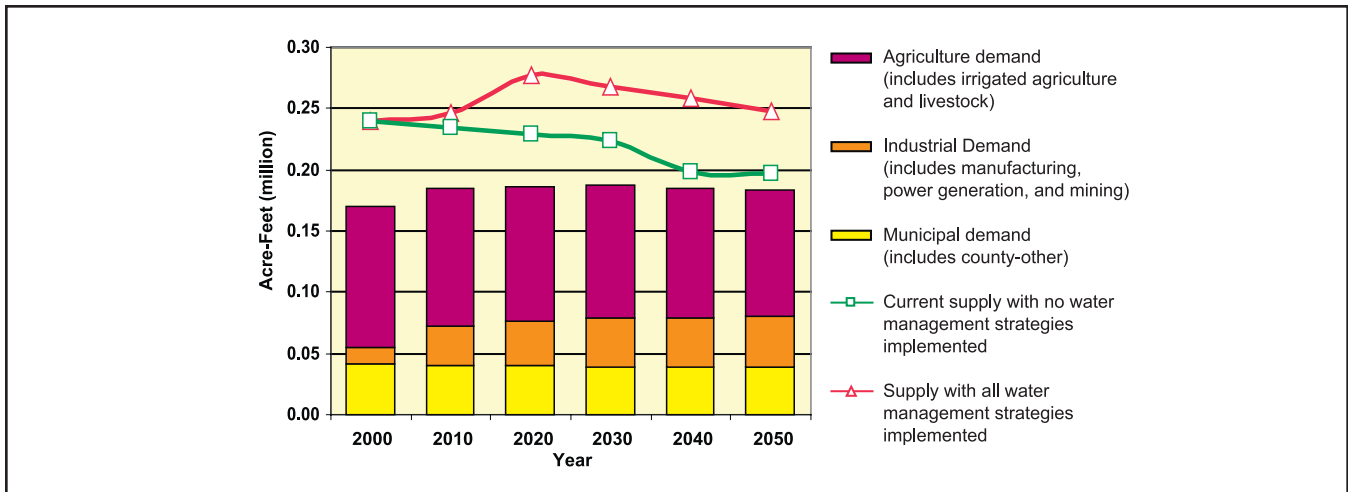


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

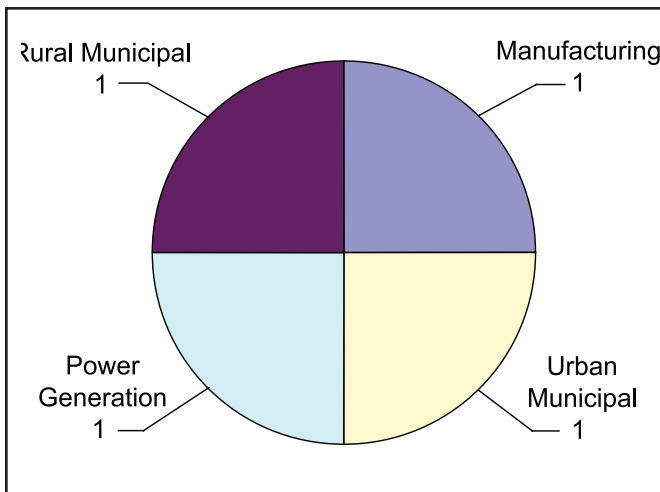
Key Points

- **Total capital cost: \$145 million**
- No new reservoirs
- Strategies to meet all municipal needs occurring by 2050
- Four water user groups with projected water needs by 2050
- Chloride Control Project on the Wichita River is a regional priority
- Concern about cost of current and proposed requirements for mandatory treatment of water supplies, specifically nitrates

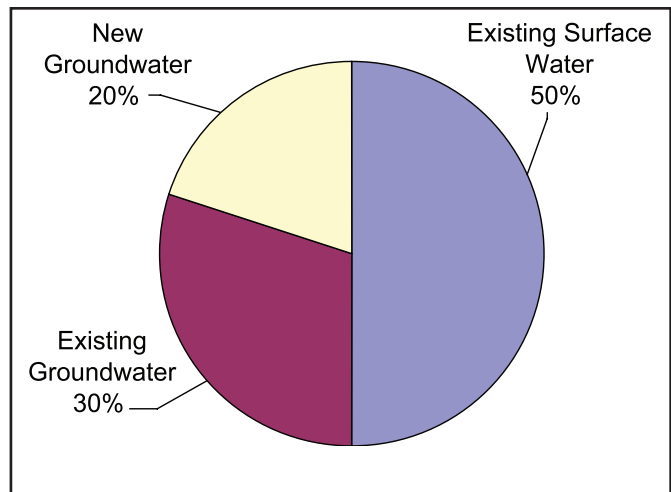
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Region C

The Planning Group identified water supply needs for 195 out of 270 water user groups in the region. The total needs by 2050 are about 1,203,947 AFY. There are 165 urban and rural municipalities and 4 irrigation and livestock user groups with needs in 2050.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are \$6.16 billion. Selected examples of costs include Marvin Nichols I Reservoir (\$1,625,190,000), Lake Fork Connection (\$288,000,000), Trinity River reuse (\$75,168,000), Lower Bois d'Arc Creek Lake/transmission system for North Texas Municipal Water District (\$167,324,000), Ellis County water project (\$65,945,000), Cooke County water supply project (\$26,785,000), Denton County Water Treatment Plant expansions and related costs for Upper Trinity Regional Water District (\$479,157,000), Fannin County water system (\$52,358,000), Grayson County surface water supply system (\$94,316,000), reuse of Garland wastewater in Kaufman County (\$18,497,000), treated water delivery lines from Weatherford (\$7,164,000), and new groundwater wells in Wise County (\$544,000).

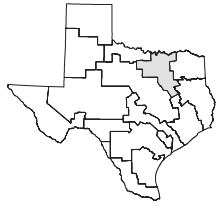
Most water supplied in Region C is provided by five major water providers in the region: Dallas Water Utilities, Tarrant Regional Water District, North Texas Municipal Water District, Fort Worth Utilities, and Trinity River Authority. Consequently, most municipal needs will be met by one of these providers. The only unmet needs in 2050 are about 6,300 AFY for municipal.

Within Region C, Lower Bois d'Arc Creek Reservoir is proposed in Fannin County, with an estimated yield of 123,000 AFY. Additionally, Muenster Reservoir is proposed in Cooke County. This proposal would be an impoundment of 4,700 AFY, with a diversion of 500 AFY.

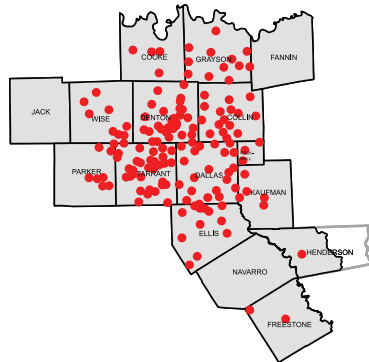
Significant regional needs result primarily from a large and expanding population base. In 1998, the region included 38 communities having 20,000 or more in population. The region has 12 of the 20 fastest growing communities in Texas. Judging from census figures released after plan adoption, regional population appears to be growing even more rapidly than anticipated.

Although some expansion of supply can occur within the region, the Planning Group also considered other areas for future supplies. Region C and the North East Texas Region formed the Sulphur River Task Group to address issues of importance to both regions. The Marvin Nichols I Reservoir was proposed, which will be located on the Sulphur River primarily in Red River and Titus Counties in the North East Texas Region. Eighty percent of the estimated yield of this reservoir would be conveyed to Region C.

Oklahoma water is recommended as a water management strategy for the North Texas Municipal Water District and Tarrant Regional Water District. Several entities in the region have been engaged in negotiations to purchase water from Oklahoma.



(C) Region C

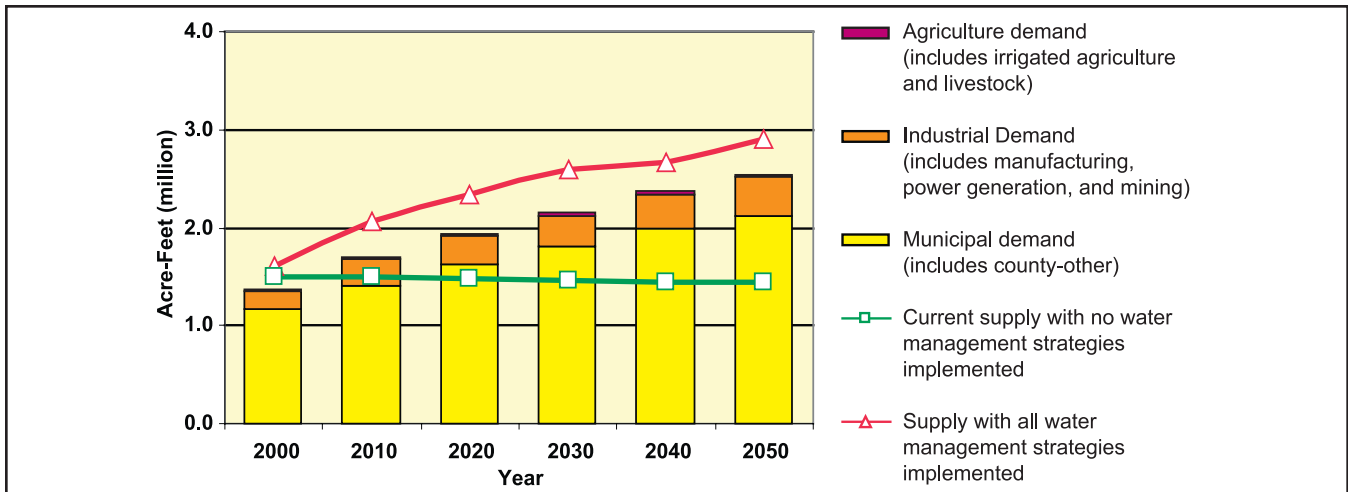


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

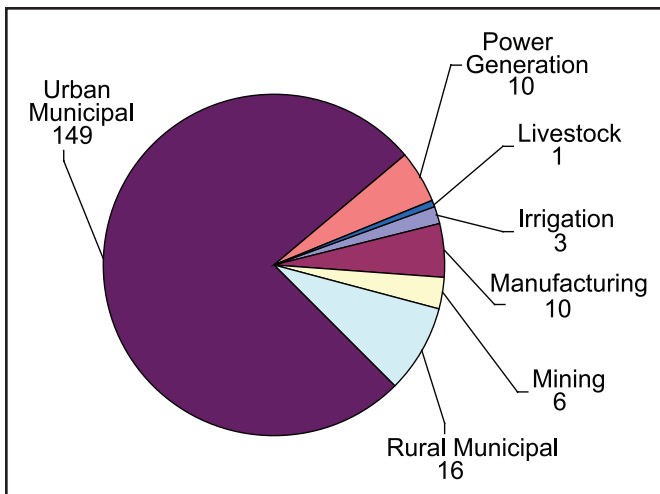
Key Points

- **Total capital cost: \$6,161 million**
- One new major reservoir to meet needs
- 195 water user groups with projected water needs by 2050
- Includes 12 of the 20 fastest-growing communities in Texas
- Significant cooperation to obtain additional Region D water

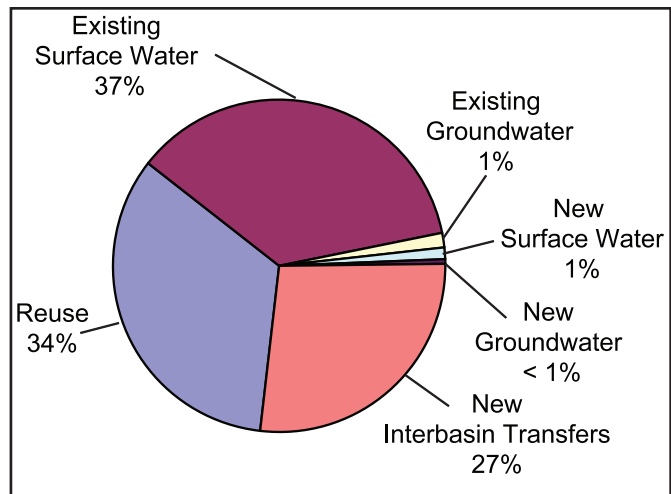
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of North East Texas Region

The Planning Group identified water supply needs for 66 out of 167 water user groups in the region. The total needs by 2050 are about 122,009 AFY. There are 59 urban and rural municipalities with needs in 2050.

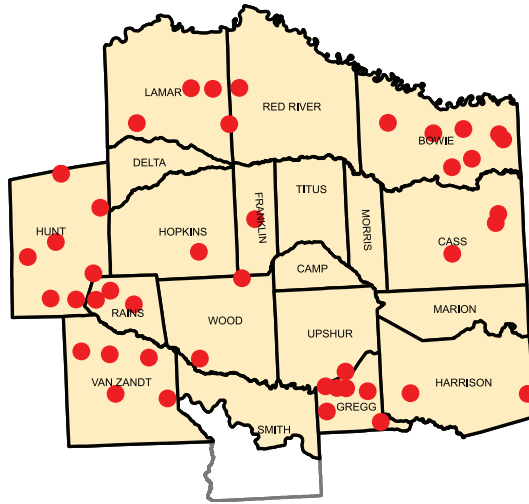
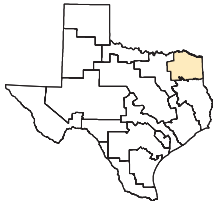
The North East Texas Planning Group recommended that the Marvin Nichols I Reservoir site be developed to provide future water supply for water users within both the North East Texas Region and Region C. The Planning Group also recommended Prairie Creek Reservoir as a water management strategy, consistent with a recommendation, contained in the *Comprehensive Sabine Watershed Management Plan*, that the Sabine River Authority develop the reservoir. Prairie Creek Reservoir, as recommended, would yield an estimated 17,215 AFY. However, plans call for increasing the project yield by diversions from the Sabine River and/or a pipeline from Toledo Bend Reservoir.

Estimated capital costs of recommended water management strategies to meet needs over the 50-year planning horizon are \$55.0 million. Selected projects and costs include Prairie Creek Reservoir (\$29,032,200), West Gregg Water Supply Corporation wells (\$1,337,993), Harleton Water Supply Corporation surface water supply (\$2,890,805), Star Mountain Water Supply Corporation wells (\$2,192,735), and Lake Fork Water Supply Corporation wells (\$1,504,665). To address many of the needs identified in the plan, no additional capital improvements will be required. Renewal of water supply contracts will be sufficient to ensure an adequate supply during the planning period. There are unmet needs in 2050 of about 26,100 AFY for manufacturing, 7,500 for steam-electric power, and 22,900 AFY for municipal.

The North East Texas Planning Group examined needs of smaller communities in detail because much of the regional population is rural. Within the region there are eight cities with populations of more than 10,000, whereas total regional population is about 687,000. The regional water plan addresses water supply needs of many districts, water supply corporations, and other communities that were too small to be defined as water user groups. One challenge now faced by the region is how to finance the improvements necessary to meet the needs of the rural population.

Region C and the North East Texas Region formed the Sulphur River Task Group to address issues of importance to both regions. The Task Group included representatives from each region.

(D) North East Texas Region

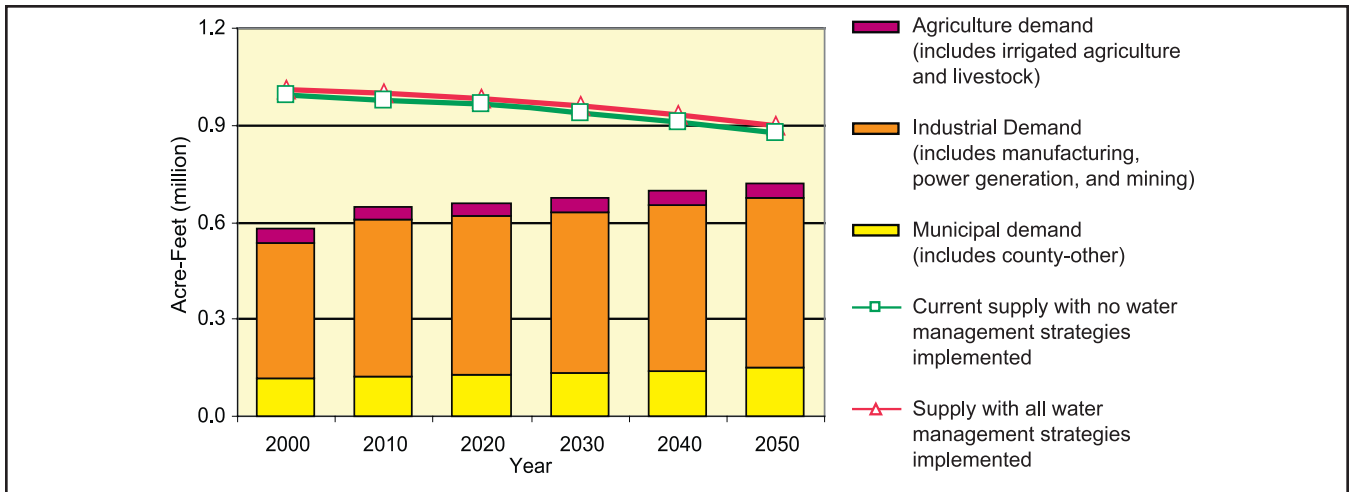


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

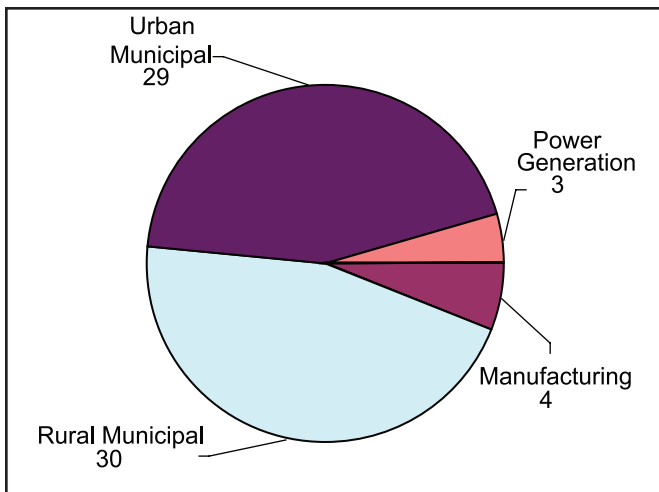
Key Points

- **Total capital cost: \$55 million**
- Two new major reservoirs
- 66 water user groups with projected water needs by 2050
- Largely rural, creating a challenge to provide affordable water to many small communities
- Cooperating with and exporting water to Region C

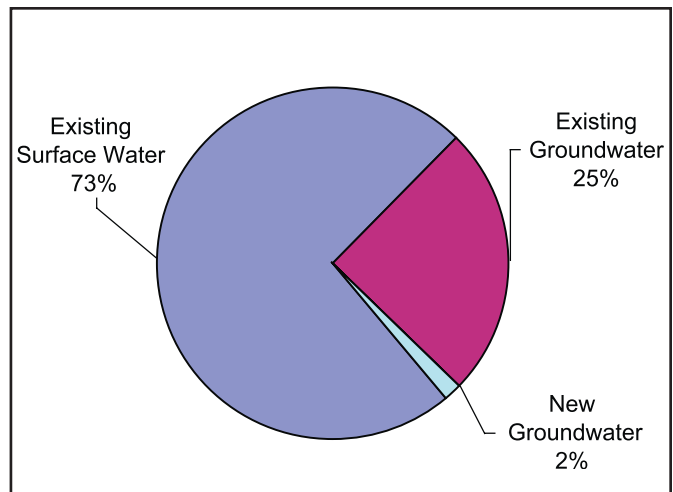
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Far West Texas Region

The Planning Group identified water supply needs for 23 out of 51 water user groups in the region. The total needs by 2050 are about 417,260 AFY. There are 16 urban and rural municipalities and 3 irrigation and livestock user groups with needs in 2050. The City of El Paso and entities supplied by El Paso are projected to have unmet needs after 2030.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are \$941.5 million. Major projects include \$22 million for additional wells or increased use of groundwater, \$83 million for wastewater reuse, \$52 million for desalination, and \$716 million for the long distance transport of groundwater from rural counties to El Paso.

County-other unmet needs (27,911 AFY in 2050) are projected for all counties except Culberson. Irrigation unmet needs of 146,361 AFY in 2050 arise from the limited availability of water in the Rio Grande during drought conditions. In El Paso County, unmet needs of 2,000 AFY in 2050 for steam-electric power generation, 20,332 AFY in 2050 for manufacturing, and 3 AFY in 2030 for mining are recommended to be met by purchases from the City of El Paso. Livestock unmet needs of 78 AFY in 2050 are projected in El Paso and Jeff Davis Counties.

The Planning Group recommended a combination of strategies, including additional surface water obtained from conservation savings in irrigation, purchase of irrigation rights, reuse, desalination, and purchase and use of groundwater from outside El Paso County. Expanded use of local groundwater is intended as a drought contingency supply. Even with these strategies, there is a projected total unmet need for municipal supplies of about 66,393 AFY in 2050. It is important to note that the Planning Group continues to evaluate water management strategies for the El Paso County area in an effort to meet all needs throughout the 50-year planning horizon.

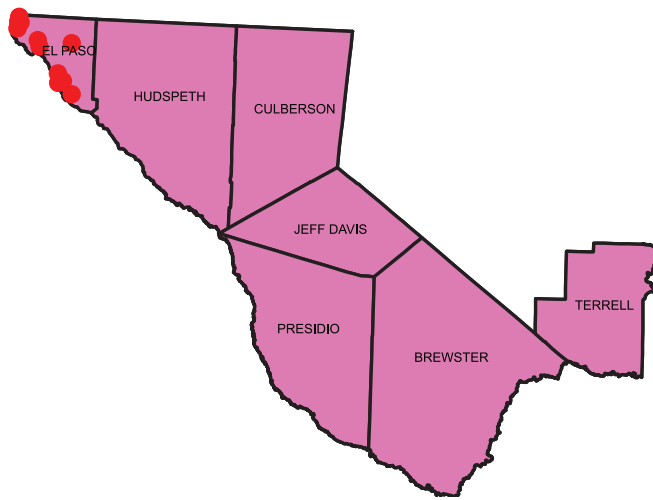
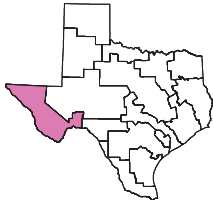
The Planning Group proposed no new reservoirs. The only potential location for a new reservoir would be on the Rio Grande, but the river's yield is fully committed and regulated by interstate and international treaties.

In El Paso County, reliance on local groundwater could cause the Hueco-Mesilla Bolson aquifer to become depleted of freshwater by 2030. If possible, the City of El Paso would like to reserve use of this aquifer to times of drought, when surface water is unavailable. In El Paso County during drought-of-record conditions, the Rio Grande is expected to have insufficient flow for demands.

Desalination of significant reserves of brackish groundwater was evaluated and is a potential future source of water supply if current technology issues are resolved.

Groundwater transfer from rural counties to El Paso is a potential strategy; however, the costs and impacts on local groundwater supplies will need to be examined in more detail.

(E) Far West Texas Region

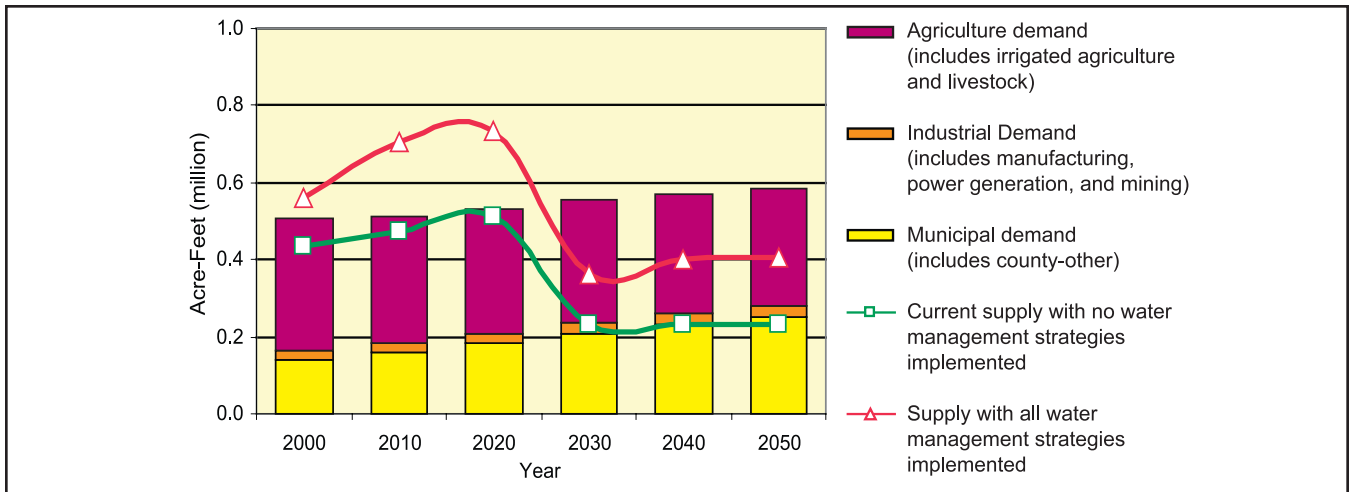


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

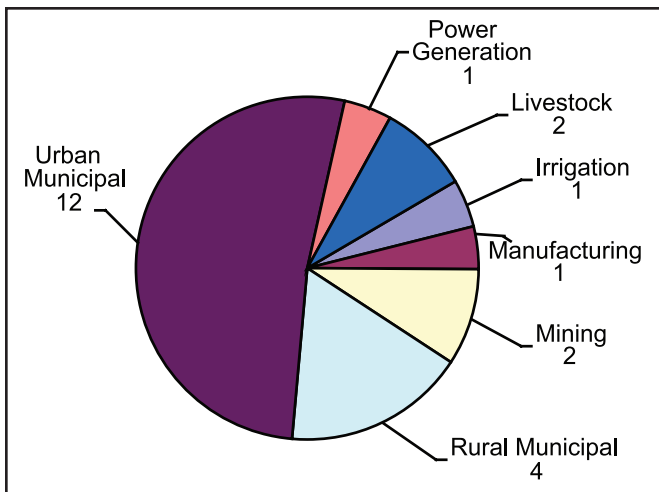
Key Points

- **Total capital cost: \$942 million**
- No new reservoirs
- Eight cities with unmet needs by 2050
- 23 water user groups with projected water needs by 2050
- Fresh groundwater supplies available to El Paso probably depleted by 2030
- Rio Grande water unavailable during drought-of-record
- Desalination of groundwater increasingly important to El Paso
- Impacts of groundwater transfers from rural counties to be examined in more detail

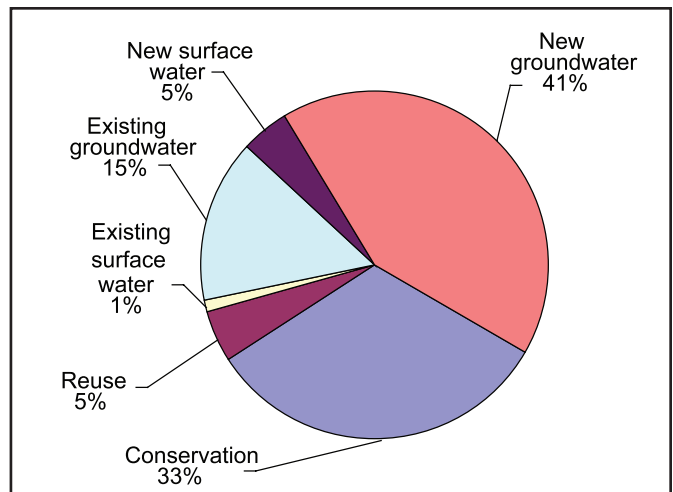
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Region F

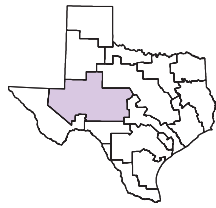
The Planning Group identified water supply needs for 51 out of 201 water user groups in the region. The total needs by 2050 are about 241,518 AFY. There are 19 urban and rural municipalities and 15 irrigation and livestock user groups with needs in 2050. There are unmet needs for irrigation in Glasscock, Midland, and Reeves Counties.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are \$326.0 million. Costs ranged from a low of \$20 per acre-foot for advanced irrigation technologies to more than \$1,700 per acre-foot for some municipal strategies. Estimated capital costs of municipal water management strategies total \$195 million. Municipal needs include the cities of Midland and San Angelo and cities that rely on the Hickory aquifer. Recommended water management strategies for San Angelo and Midland include \$65.8 million for development of groundwater supplies from T-Bar Well Field in Winkler and Loving Counties and \$44.4 million to build a pipeline from McCulloch Well Field to Ivie Reservoir and improve deliveries from the Colorado River Municipal Water District. No new reservoirs are planned.

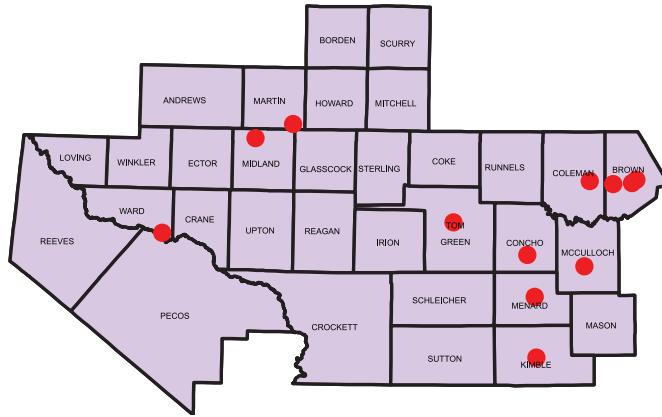
For many of the water user groups, existing supplies in the region could be developed further to meet needs. However, most of the municipal users of the Hickory aquifer have no alternative source of water. In addition, irrigation (the largest water user in the region) also lacks a readily expandable supply source to meet future needs. The largest unmet need in 2050 is about 82,000 AFY required for irrigation. This unmet need accounts for about 9 percent of the region's total demand in 2050. There are additional unmet needs in 2050 of 9 AFY for manufacturing and 40 AFY for livestock.

Remaining municipal demands rely on the Hickory aquifer, with no alternative. Additional concerns are the high cost of meeting current and proposed mandatory treatment standards for drinking water and for disposal of naturally occurring radionuclides, both of which may effectively eliminate the use of the Hickory aquifer as a primary drinking water source. Therefore, four different water management strategies are recommended: \$17.4 and \$13.8 million for building two water-treatment plants (Brady Creek and Lake Ivie, respectively) and \$10 and \$15.2 million for developing two well fields (New Ellenburger and New Hickory, respectively).

Estimated capital costs of irrigation water management strategies totaled \$81 million. For most counties with irrigation needs, the development of additional supplies is not an option. Therefore, advanced water conservation irrigation technologies to reduce demands are recommended. These technologies include converting furrow irrigation to sprinkler or drip irrigation. Assuming 100-percent adoption of these technologies by 2020, the region could realize a 40- to 50-percent reduction in irrigation needs between 2020 and 2050. However, after full utilization of advanced irrigation technologies and available wastewater reuse, irrigation needs of Glasscock, Midland, and Reeves Counties are still unmet.



(F) Region F

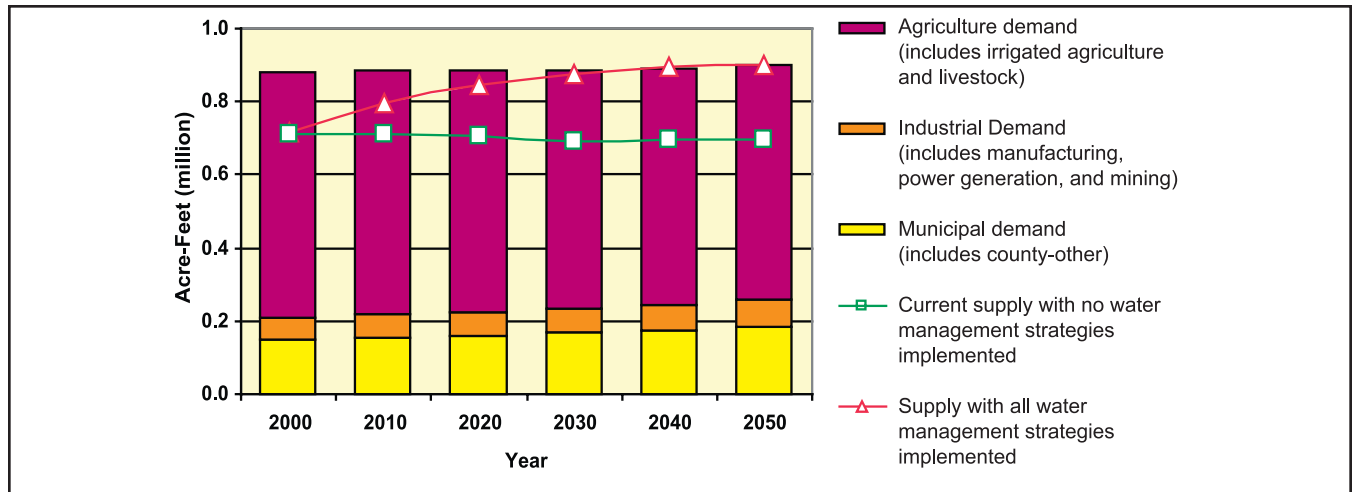


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

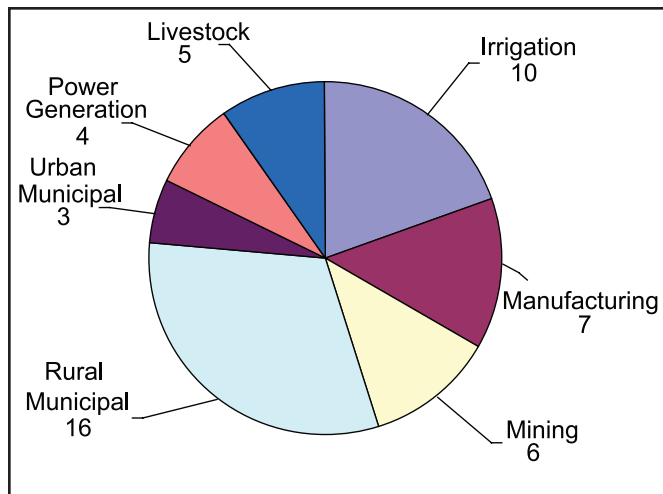
Key Points

- **Total capital cost: \$326 million**
- No new reservoirs
- Strategies to meet all municipal needs occurring by 2050
- 51 water user groups with projected water needs by 2050
- Concern about high cost/low benefit of current mandatory treatment standards for drinking water
- Permit requirements for Spence and Ivie Reservoirs require constant releases regardless of inflow

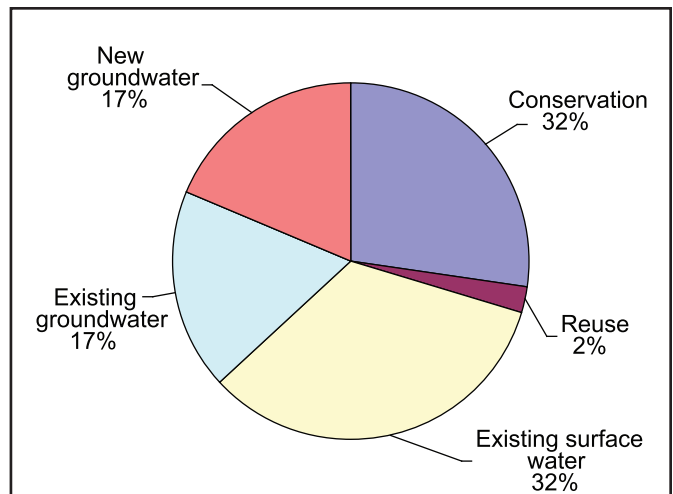
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Brazos G Region

The Planning Group identified water supply needs for 101 out of 319 water user groups in the region. The total needs by 2050 are about 216,357 AFY. There are 67 urban and rural municipalities and 7 irrigation user groups with needs in 2050.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are \$523.5 million. This estimate includes about \$80 million for the City of Abilene, \$200 million for projects in Williamson County, and the remainder for funding strategies in the rest of the region.

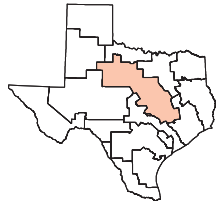
The Little River Reservoir site is the only major reservoir recommended. The yield and costs of this reservoir would be shared with Region H, with an estimated total capital cost of \$361 million. Five minor reservoirs, New Throckmorton, Brushy Creek, Meridian Off-Channel, Somervell Off-Channel, and Groesbeck Off-Channel, were also included as strategies to meet needs at a total cost of about \$48 million. There are unmet needs in 2050 of about 18,600 AFY for irrigation, 100 AFY for manufacturing, 1,700 AFY for mining, 3,300 AFY for steam-electric power generation, and 11,200 AFY for municipal.

In addition to the one major and five minor reservoirs recommended to meet needs, the region also recognized Breckenridge Reservoir, South Bend Reservoir, Paluxy Reservoir, Lake Bosque, and Millican Reservoir as potential reservoirs. However, these reservoirs were not recommended to meet identified needs in the region. Currently, the Planning Group and local interests are also involved in discussions related to the Double Mountain Fork reservoir site in Stonewall County, with the possible goal of inclusion in the next round of regional water planning. Also, pending the availability of additional information, the Legislature may want to evaluate this site as it considers designating unique reservoir sites.

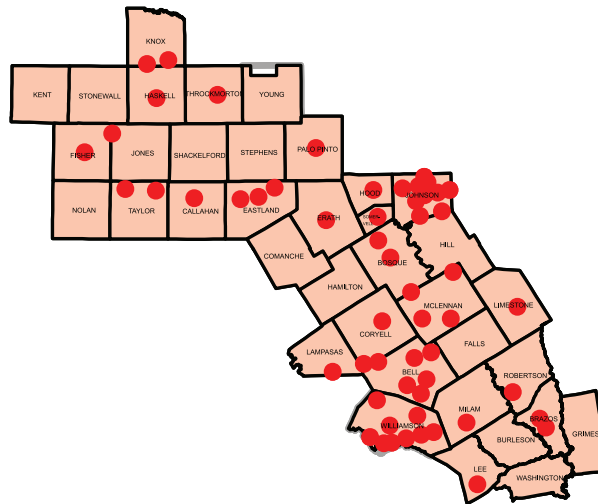
Historically every reservoir project built has had some measure of opposition from local landowners, especially those that have had to sell land that is in the impoundment area. The proposed Little River Reservoir is no exception, and many of the affected individuals have voiced their opposition at every opportunity. Much less opposition is involved with the minor reservoirs proposed in several areas of the planning region.

The largest water use in the Brazos G Region is municipal, accounting for 40 percent of the total demand. Municipal demand is projected to nearly double by 2050, and increases in steam-electric power generation, mining, and manufacturing demands are also expected. The demand for irrigated agriculture is projected to decline slightly over the planning horizon.

The development of groundwater in the Carrizo-Wilcox aquifer in areas such as Lee and Burleson Counties for use in Williamson County has met with opposition from landowners in the counties of origin. However, development of groundwater in these counties for export out of the region has met with even more opposition.



(G) Brazos G Region

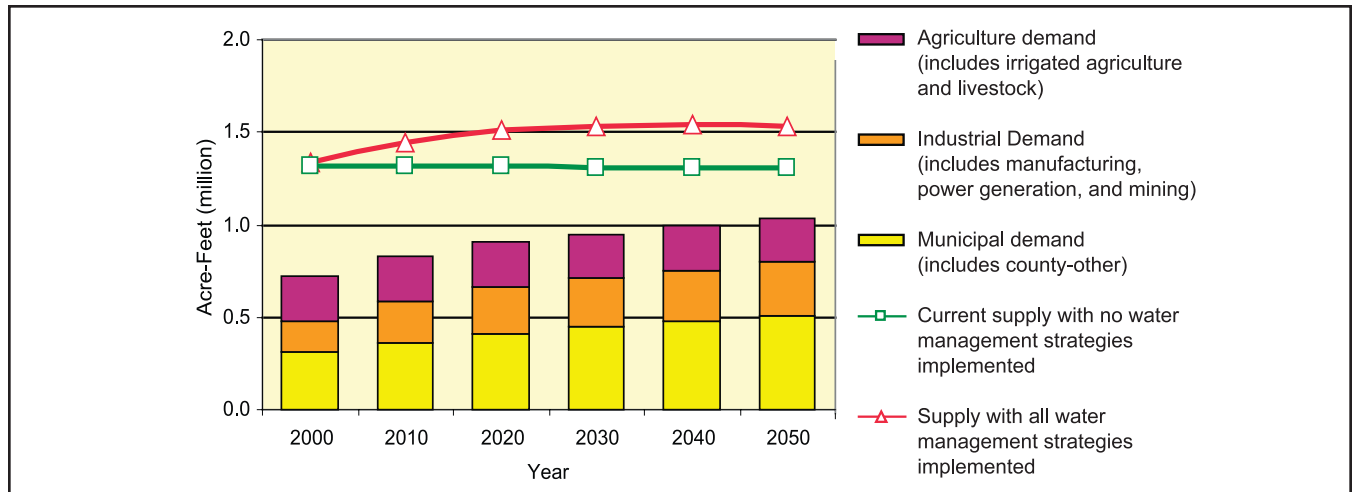


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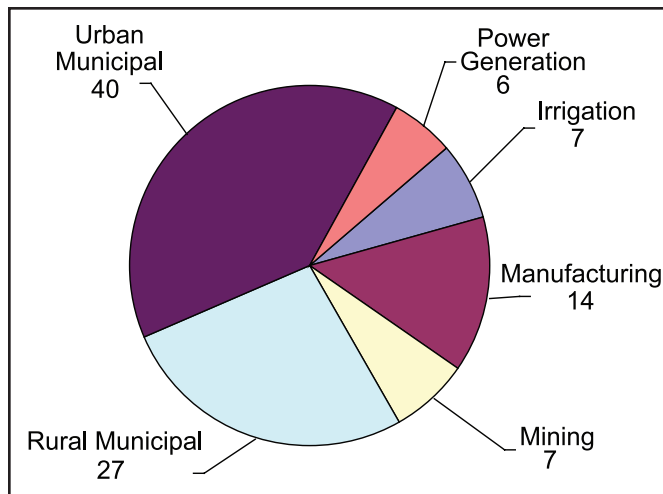
Key Points

- **Total capital cost: \$524 million**
- One new major reservoir and five new minor reservoirs to meet needs
- Four cities with unmet needs by 2050
- 101 water user groups with projected water needs by 2050
- Opposition to groundwater exports
- Landowner opposition to reservoir development

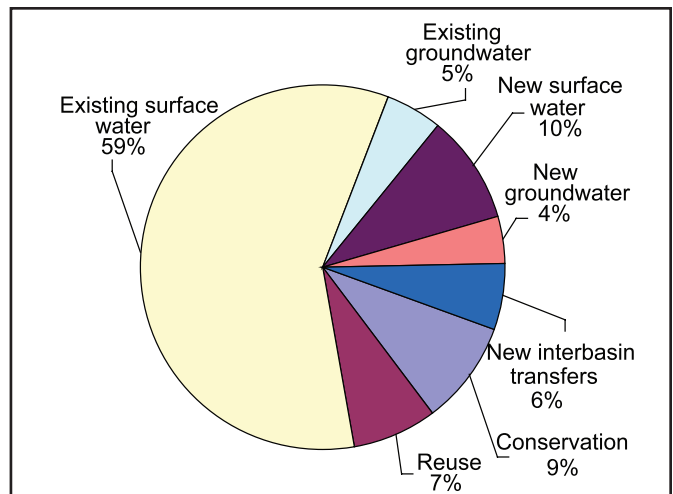
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Region H

The Planning Group identified water supply needs for 94 out of 202 water user groups in the region. The total needs by 2050 are about 1,375,455 AFY. There are 79 urban and rural municipalities and 3 irrigation user groups with needs in 2050.

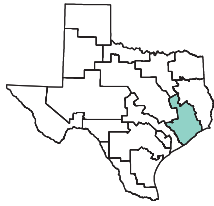
Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are \$2.423 billion.

Region H designated five major water providers: the City of Houston, San Jacinto River Authority, Brazos River Authority, Trinity River Authority, and Gulf Coast Water Authority. These major water providers are responsible for the additional supply needed by most of the water user groups. There are no unmet needs for any water user groups in 2050.

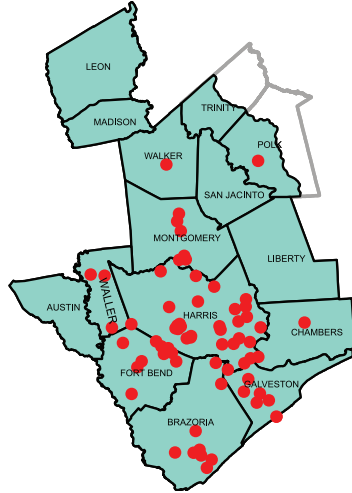
The Trinity River Authority will have a water supply surplus throughout the planning horizon, whereas the other major water providers must develop additional supply. To meet these needs, the Planning Group recommended three new reservoirs: Allens Creek Reservoir, Little River Reservoir, and Bedia Reservoir. The Allens Creek Reservoir would create 99,650 AFY of firm supplies for the City of Houston and for the Brazos River Authority. The Little River Reservoir would create 101,000 AFY for the Brazos River Authority, which includes 30,000 AFY for the Brazos G Region, and 28,000 AFY for the Gulf Coast Water Authority. Bedia Reservoir would create 90,700 AFY for the San Jacinto River Authority and the Trinity River Authority. Other significant water management strategies include a wastewater reclamation facility capable of treating 90,700 AFY, two water conveyances, two contractual transfers, and a voluntary redistribution of water supply. Some of the conveyances and transfers involve interbasin transfers. Region H cannot satisfy its future water needs without interbasin transfers.

Region H is second to Region C in population but it is anticipated that it will surpass Region C by 2050. Although the overall projected population growth is about 100 percent, certain counties adjacent to Harris County, such as Fort Bend, Waller and Montgomery Counties, are predicted to increase in population by as much as 400 percent by 2050. Present water use is second to that of the Llano Estacado Region, but by 2050, Region H is projected to have the greatest water demand of any region.

The Region H Planning Group adopted a regional water plan that includes aggressive municipal and irrigation conservation as water management strategies for all affected water user groups with needs. It was the only region to designate ecologically unique stream segments. It worked with the Galveston Bay Freshwater Inflows Group to adopt criteria, as part of its plan, for sustaining freshwater inflows to the Galveston Bay system.



(H) Region H

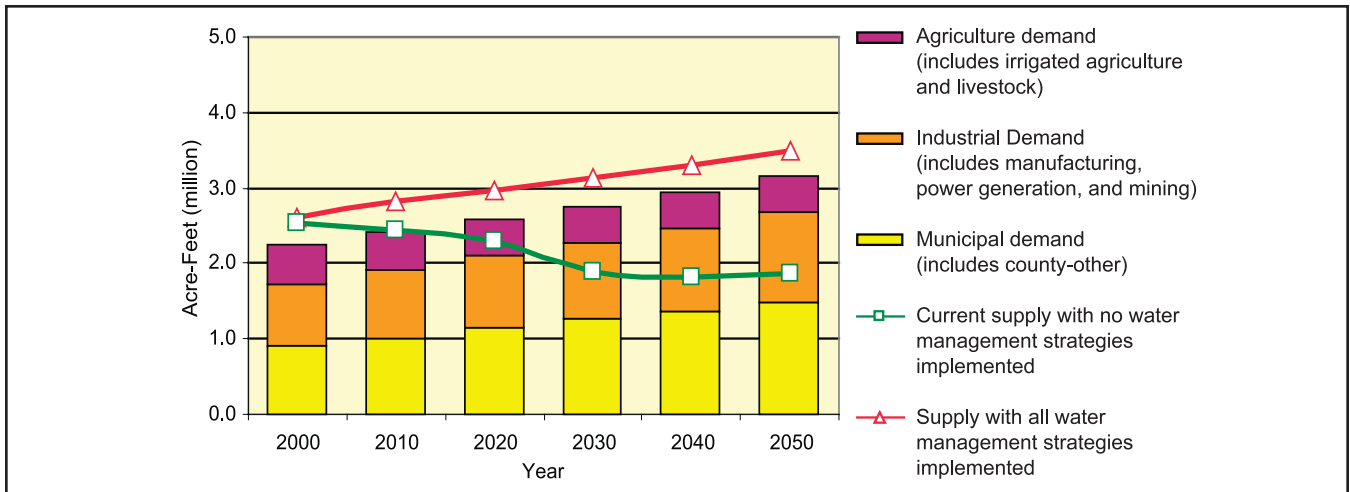


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

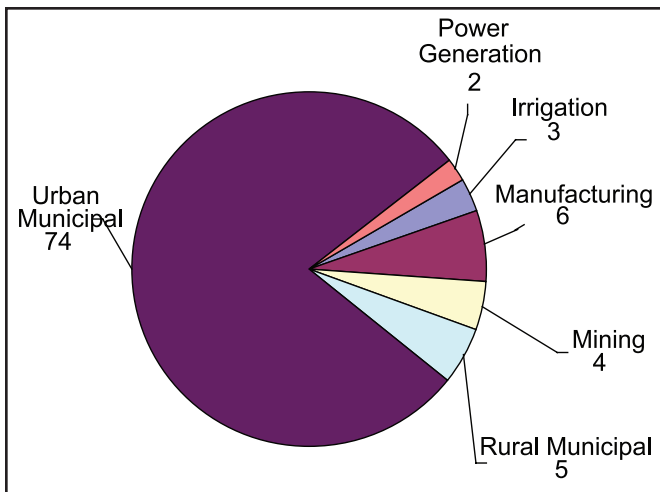
Key Points

- **Total capital cost: \$2,423 million**
- Two new major reservoirs to meet needs
- Strategies to meet all municipal needs occurring by 2050
- 94 water user groups with projected water needs by 2050
- Greatest projected water use by any region by 2050
- Two-thirds of U.S. petrochemical production

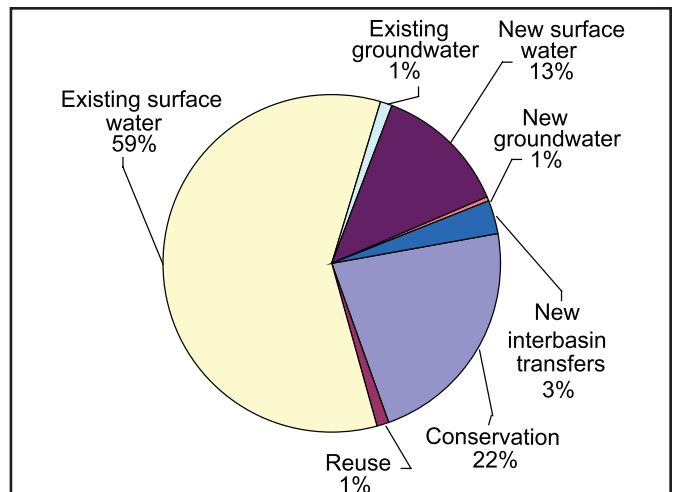
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of East Texas Region

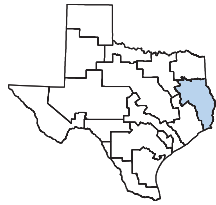
The Planning Group identified water supply needs for 92 out of 165 water user groups in the region. The total needs by 2050 are about 763,567 AFY. There are 47 urban and rural municipalities and 18 irrigation and livestock user groups with needs in 2050.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are about \$517 million. This includes approximately \$200 million for new reservoirs, about \$50 million for the City of Lufkin, and the remainder for funding strategies in the rest of the region. The one new reservoir recommended in the region is Lake Eastex, located on Mud Creek in Cherokee County. This reservoir has been permitted by the TNRCC and is in the process of obtaining Federal permits from the U.S. Army Corps of Engineers.

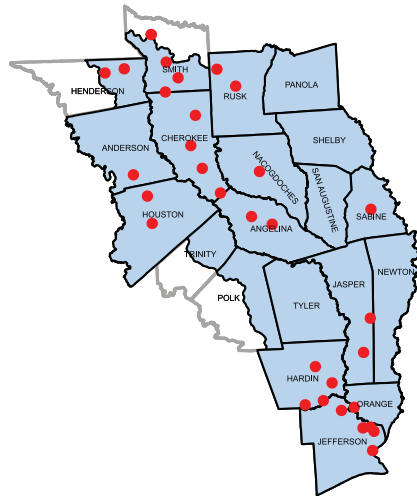
The largest water user in the East Texas Region is manufacturing, which accounts for 39 percent of the total demand of about 1.17 million AFY in 2050. Increases in steam-electric power generation, mining, and irrigation demands are also expected. Municipal water use for the region is projected to increase between 2000 and 2050, from about 171,000 AFY to 219,000 AFY. Five counties—Angelina, Jefferson, Nacogdoches, Orange, and Smith—account for most of the total municipal use for the region in 2050. The cities of Lufkin, Beaumont, Port Arthur, Nacogdoches, Orange, and Tyler are included in these counties. These cities will rely on increased groundwater and surface water production to meet their needs. The only unmet needs in 2050 are 3 AFY for mining and 17 AFY for municipal.

The region is very concerned about the environmental needs of instream flows and the bays and estuaries in the coastal area. Additional studies will be conducted in the next planning cycle to ensure that these needs are met.

The growing of houseplants in containers and the raising of poultry in large, confined growing houses are emerging as water use industries in the region. Tens of millions of gallons of water is needed each day in the region to supply these industries, and these demands are projected to continue increasing.



(I) East Texas Region

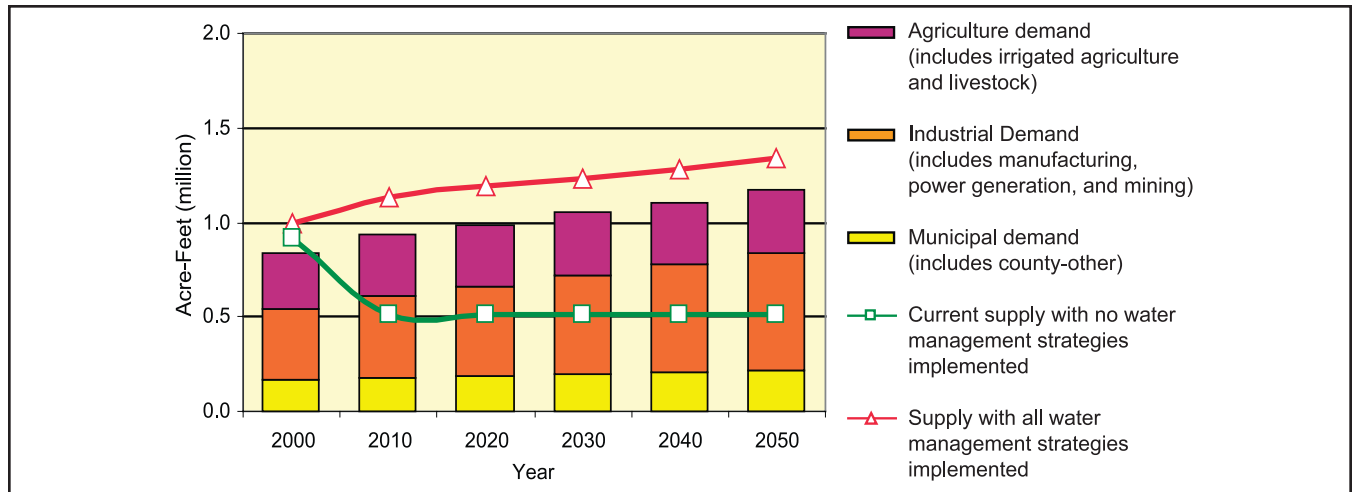


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

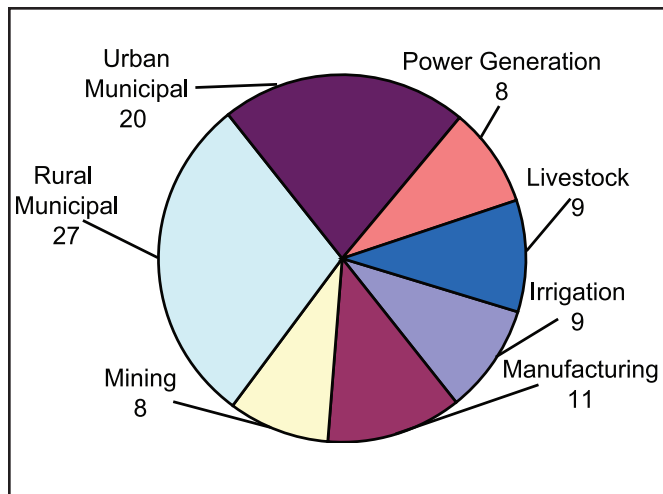
Key Points

- **Total capital cost: \$517 million**
- One new major reservoir to meet needs
- 92 water user groups with projected water needs by 2050
- Concern about potential environmental impacts from water transfers on bays and estuaries
- Growing water-use industries, including poultry and plant nursery

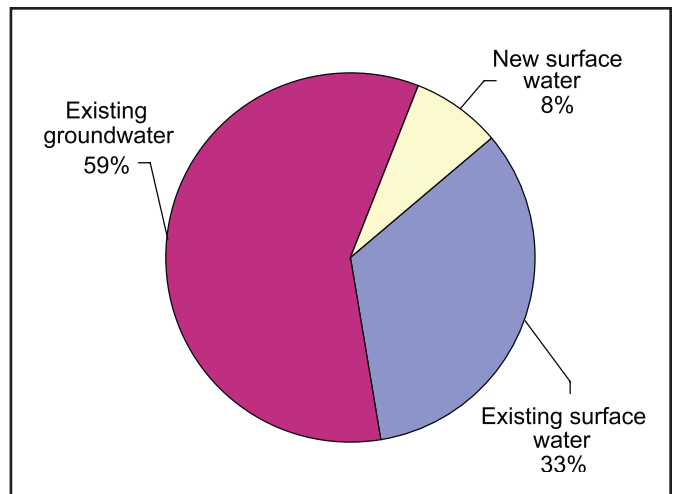
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Plateau Region

The Planning Group identified water supply needs for 12 out of 34 water user groups in the region. The total needs by 2050 are about 10,824 AFY. There are 4 rural municipalities and 6 irrigation and livestock user groups with needs in 2050.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are about \$65.8 million. Major projects include \$34.0 million for new wells or expanded use of existing wells and \$23.5 million for increased water-treatment-plant capacity.

The Planning Group projects that the Cities of Kerrville and Leakey will have needs under drought-of-record conditions. Kerrville has a need of 1,547 AFY that began in 2000. The Planning Group recommended a combination of strategies for Kerrville, including obtaining additional surface water rights, purchasing raw water from the Upper Guadalupe River Authority or Guadalupe-Blanco River Authority, developing additional groundwater supplies from a new remote well field, and expanding the current Aquifer Storage and Recovery System by adding two additional wells to provide a maximum of 5,450 AFY in 2050. The Planning Group projected that Leakey will have a need beginning in 2020 and recommended drilling wells to supply an additional 63 AFY by 2050. Beginning in 2000, rural needs are projected for Bandera and Kinney Counties. The Planning Group recommended that needs be met by drilling additional private wells to supply 4,528 AFY in 2050. The only unmet needs in 2050 are 72 AFY for municipal.

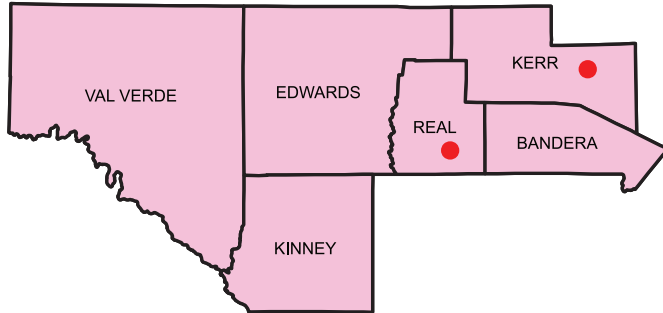
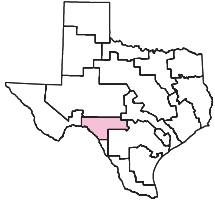
Irrigation needs are projected for Edwards and Kerr Counties beginning in 2000 and are 337 AFY in 2050. Expanded use of groundwater is recommended as the main supply source, with advanced conservation providing only minimal effects after implementation in 2030. Beginning in 2000, livestock needs of 342 AFY are projected by the Planning Group. These needs could be met by expanding use of existing groundwater. Water needs for mining are minimal at 179 AFY in 2050 and could be met by drilling of additional wells.

The Planning Group chose to evaluate the purchase of existing rights or water supply from entities having surface water supplies instead of proposing any new reservoir projects, even though construction of reservoirs in suitable areas may increase the amount of available surface water.

The Planning Group commented that environmental impacts on endangered and threatened species could limit future water development if that development were to affect springflows or streamflows critical to the existence of these species.

The Planning Group also commented that its members strongly believe that current knowledge of groundwater resources in the region is insufficient for them to recommend definitive quantitative strategies.

(J) Plateau Region

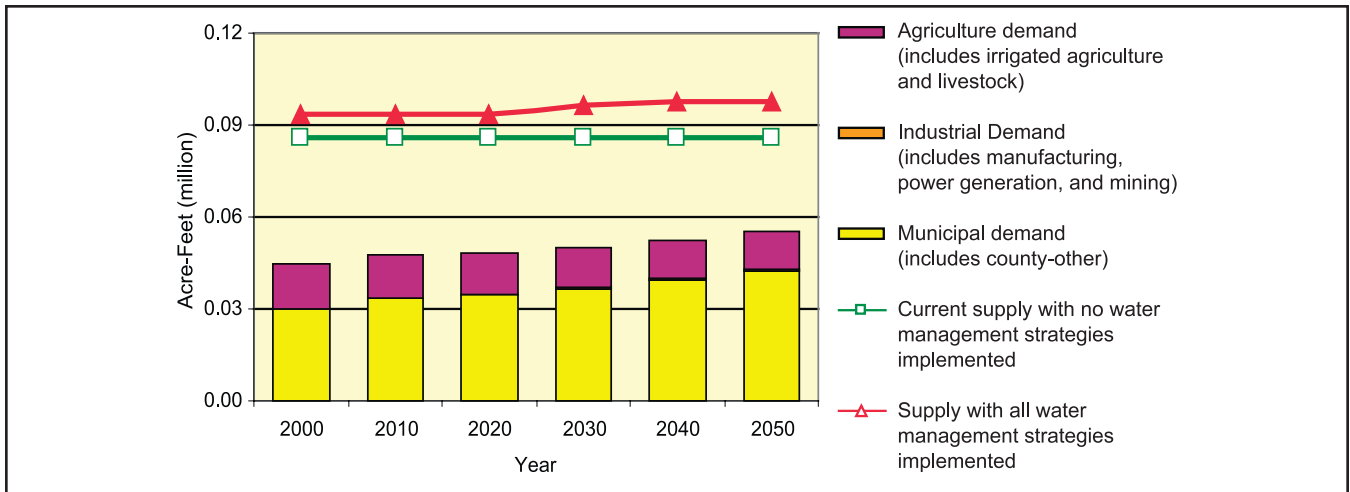


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

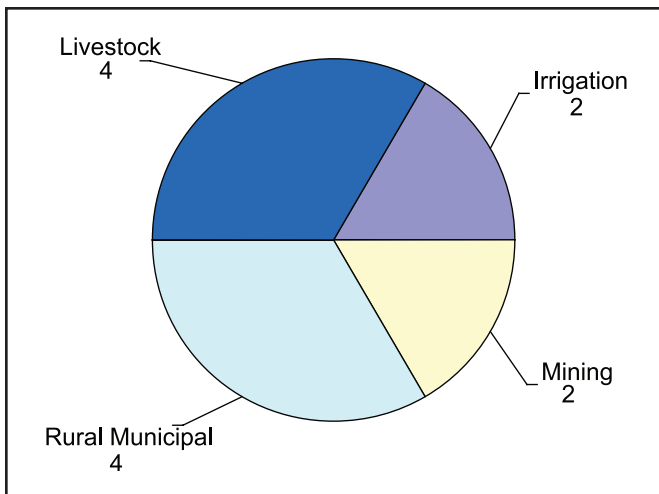
Key Points

- **Total capital cost: \$66 million**
- No new reservoirs
- 12 water user groups with projected water needs by 2050
- Endangered and threatened species could limit future water development options
- Historical groundwater data insufficient for planning purposes

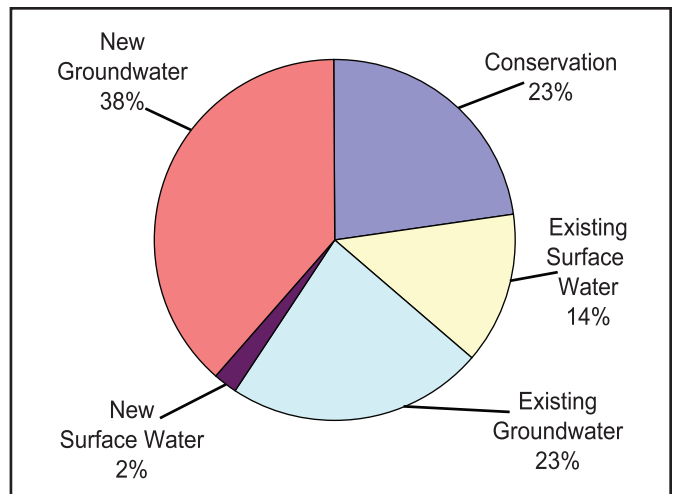
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



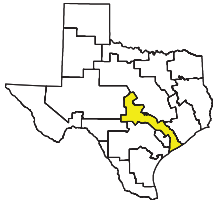
Summary of Lower Colorado Region

The Planning Group identified water supply needs for 30 out of 111 water user groups in the region. The total needs by 2050 are about 391,575 AFY. There are 24 urban and rural municipalities and 3 irrigation user groups with needs in 2050.

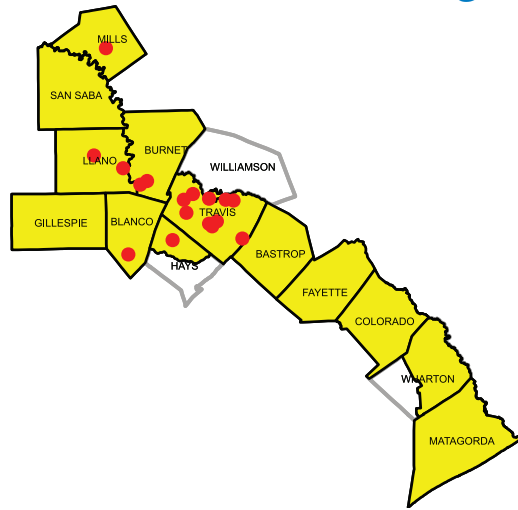
Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are about \$256 million. The recommended water management strategies for the Lower Colorado Planning Region consist primarily of a series of off-channel reservoirs or “ring dikes,” proposed in the lower part of the region combined with the implementation of major irrigation conservation practices to meet irrigation needs. This project would also free water stored in upstream reservoirs currently used for irrigation to meet municipal needs in upper region counties. During drought, groundwater would be used as necessary to supplement surface water from the project. Highland lake levels would remain higher on average, owing to less-frequent irrigation demands from reservoir storage. Additional water from this project would be made available to entities outside the region (in the South Central Texas Region) to meet some of their projected municipal and industrial needs. Conceptually these entities would be responsible for project funding; however, such funding, as well as the assignment of new water generated by this project, will be determined through ongoing contractual negotiations between entities in the Lower Colorado Region and the South Central Texas Region. The off-channel reservoir project is expected to provide 300,000 to 330,000 AFY of additional water supply. The total capital cost is \$800 million to \$1 billion, with the portion of the cost to meet in-region needs estimated at \$157 million.

Development of new wells adjacent to existing irrigation canals is needed to provide as much as 68,000 AFY during drought to supplement surface water produced by the off-channel reservoir project. New lines are recommended to transport 5,806 AFY of water to Dripping Springs, Buda, rural Hays County, and Blanco County and the City of Blanco at a capital cost of \$52.3 million. Dredging existing reservoirs and building new channel dams in Llano and Goldthwaite are estimated to cost \$7.8 million for the new storage portion only. New groundwater development and an aquifer storage and recovery project for Gillespie County are estimated to cost \$8.3 million for a yield of 1,120 AFY. Advanced on-farm conservation, canal lining, and crop research are recommended to reduce irrigation demand by 118,000 AFY at a capital cost of \$31.8 million.

Groundwater availability throughout the region is defined on the basis of local aquifer characteristics. In general, availability is defined on a sustainable basis (estimated aquifer recharge) instead of on the basis of the total volume of water in aquifer storage.



(K) Lower Colorado Region

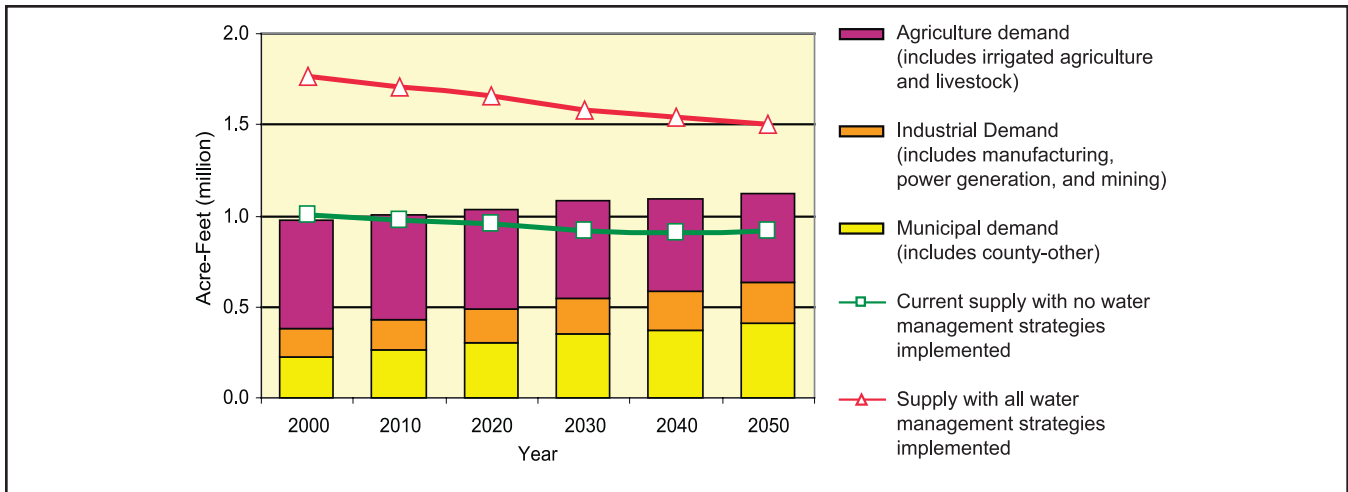


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

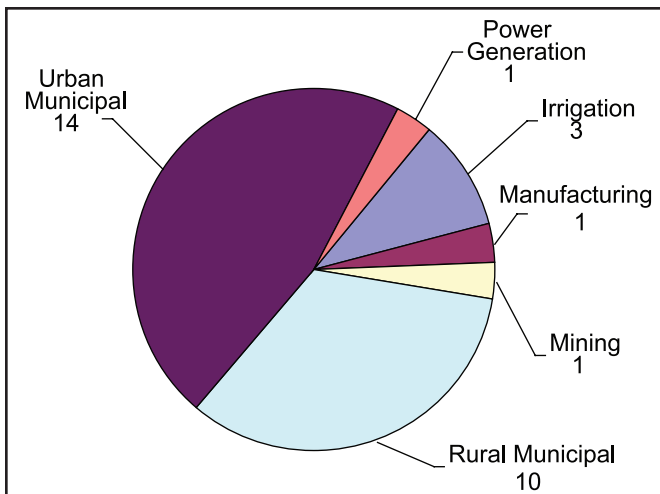
Key Points

- **Total capital cost: \$256 million**
- Four minor reservoirs and four “ring dike” structures to meet needs
- 30 water user groups with projected water needs by 2050
- Groundwater availability defined on a sustainable basis rather than on a storage basis
- All irrigation shortages proposed to be met by sale of water to the South Central Texas Region and conservation

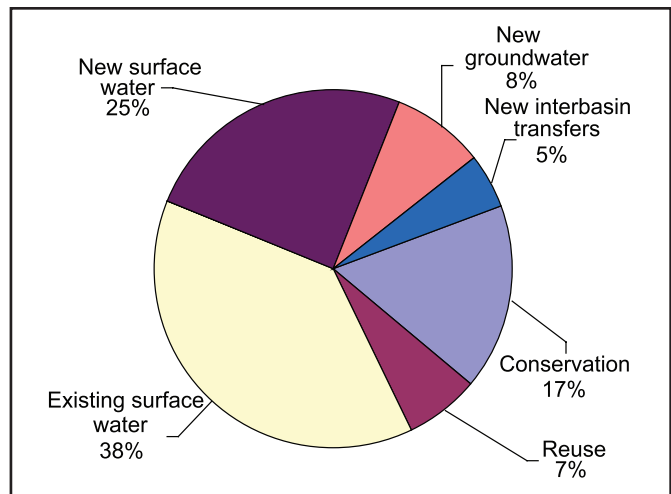
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of South Central Texas Region

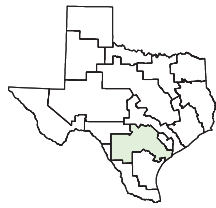
The Planning Group identified water supply needs for 70 out of 191 water user groups in the region. The total needs by 2050 are about 785,728 AFY. There are 50 urban and rural municipalities and 7 irrigation user groups with needs in 2050.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are about \$4.72 billion. The Planning Group adopted advanced water conservation as the basis for the projection of water demands in the region. The Planning Group estimated water supply needs for drought-of-record conditions of about 495,000 AFY in 2000 and 786,000 AFY by 2050. The projected needs in 2050 are estimated to be 505,000 AFY for municipal, industrial, steam electric, and mining and 280,000 AFY for irrigation. The plan shows 12 counties with municipal water user groups that have projected needs, 4 counties with projected industrial water needs, 2 counties with projected steam-electric power generation water needs, 7 counties with projected irrigation water needs, and 7 counties with projected mining water needs during the 50-year planning period.

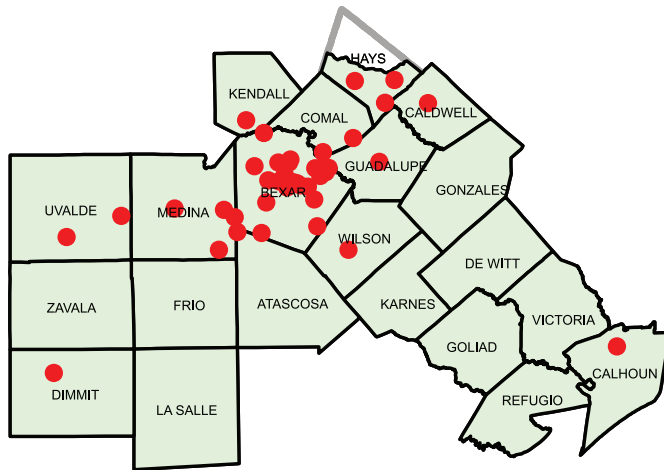
The plan includes water management strategies that could produce new supplies of as much as 744,053 AFY in 2050. These strategies include (1) municipal and irrigation water conservation; (2) water reuse; (3) purchase/lease and transfer of irrigation rights for municipal use; (4) aquifer storage and recovery; (5) increased use of Canyon Reservoir; (6) Lower Guadalupe River diversions (including 50,000 acre-feet of off-channel storage); (7) Colorado river diversion; (8) groundwater imports from the Simsboro aquifer in Bastrop, Lee, and Milam Counties; (9) desalination of seawater; (10) recharge of the Edwards aquifer; (11) enhanced use of the Carrizo-Wilcox aquifer from Wilson, Gonzales, and Bastrop Counties; and (12) expansion of existing well fields. The plan also includes brush management, weather modification, rainwater harvesting, and additional municipal water reuse. The Planning Group evaluated and then excluded large-scale development of new reservoirs and focused on smaller, off-channel balancing reservoirs for efficient operations and meeting peak seasonal water needs. The unmet needs in 2050 are 251,550 AFY for irrigation, 3 AFY for mining, and 98 AFY for municipal.

The South Central Texas Region is a complex area. It includes parts of six major river basins and overlies portions of four major and two minor aquifers. The water resources of the region include the Comal and San Marcos springs, which are reported to have the highest flow dependability and environmental stability of any spring system in the southwestern United States.

During the next decade, implementation of a number of water management strategies on an expedited basis will be necessary to avoid significant hardship, water rationing, and/or cessation of discharge from Comal Springs in the event of severe drought. Substantial water supply needs or shortages are also projected for irrigation use in the South Central Texas Region on the basis of present economic conditions for agriculture and there being no low-cost water supplies to be developed.



(L) South Central Texas Region

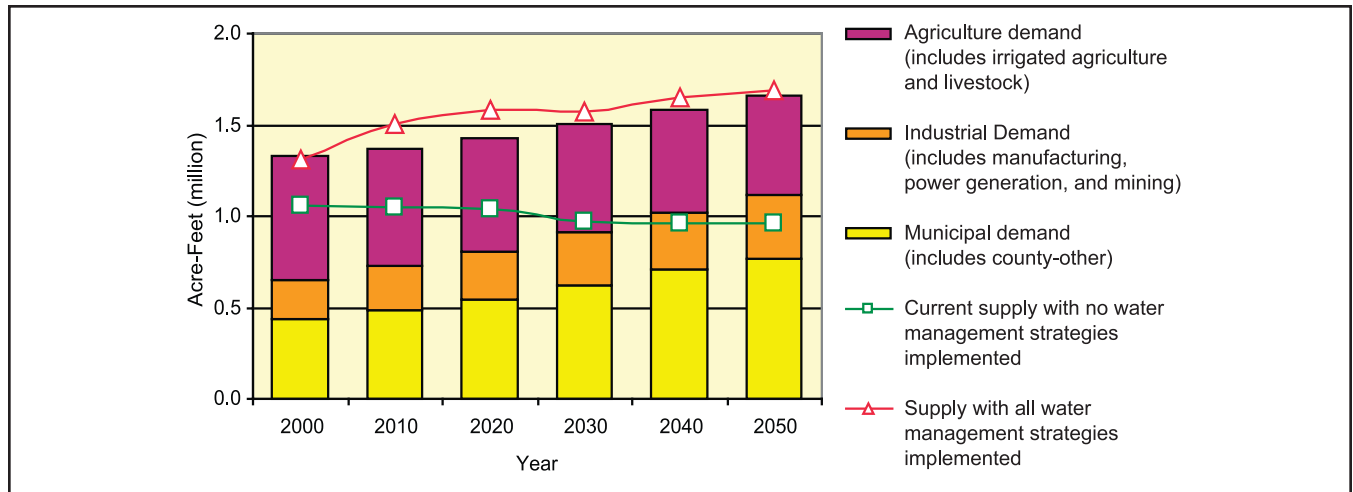


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

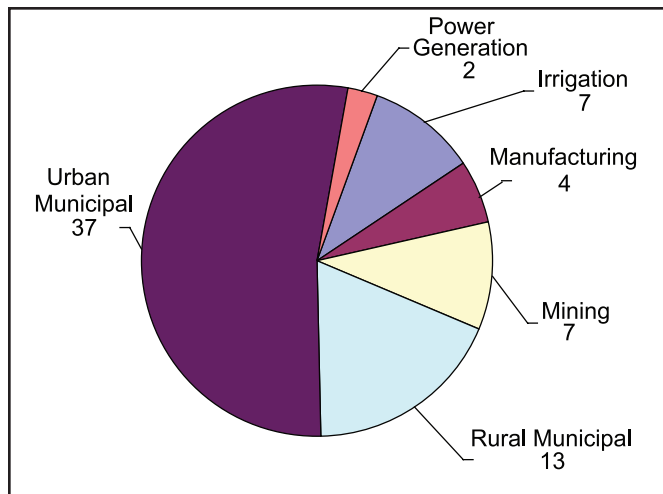
Key Points

- **Total capital cost: \$4,720 million**
- No new major reservoirs
- 70 water user groups with projected water needs by 2050
- Development of new supply sources proposed, reducing reliance on Edwards aquifer
- Increased reliance on conservation, water imports, and transfer of groundwater irrigation rights to municipal use
- Advanced conservation

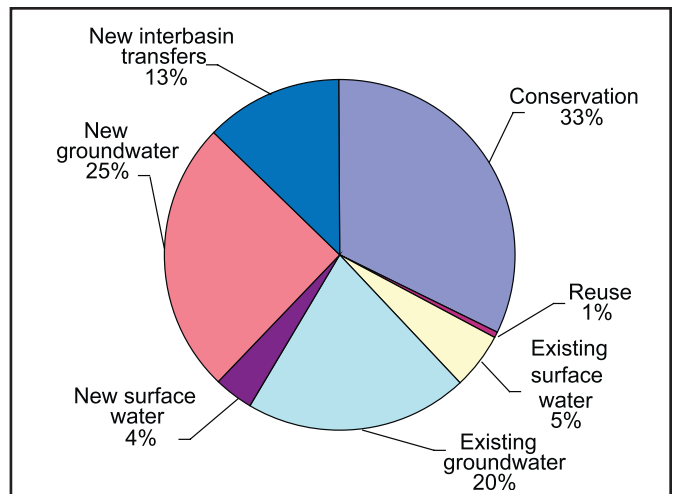
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Rio Grande Region

The Planning Group identified water supply needs for 48 out of 83 water user groups in the region. The total needs by 2050 are about 832,583 AFY. There are 39 urban and rural municipalities and 6 irrigation user groups with needs in 2050.

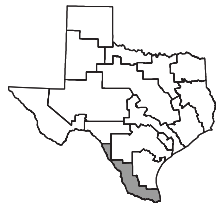
Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are about \$930 million. Nonspecific strategies recommended to meet all municipal needs include additional or advanced conservation measures (\$18 million), nonpotable water reuse (\$140 million), and acquisition of additional Rio Grande water (\$455 million). The third strategy refers to redistribution, by sale and purchase, of existing river supplies. The Planning Group also recommended local groundwater development (\$32 million) and the construction of a weir and channel dam (\$81 million) as specific strategies to meet the needs of Laredo and Brownsville, respectively. The weir would capture excess flows that currently go past Brownsville and discharge into the Gulf of Mexico; it would impound 6,000 acre-feet while diverting 40,000 acre-feet of water.

To address irrigation needs, the Planning Group recommended agricultural water conservation involving improvement of the conveyance and distribution system (\$98 million); improving on-farm water use efficiency by metering, volumetric pricing and pipes (\$106 million); and modification of TNRCC rules for operation of the reservoir system (no cost). The third recommendation was implemented by TNRCC in the spring of 2001. The only unmet needs in 2050 are about 346,000 AFY for irrigation and 9,000 AFY for municipal.

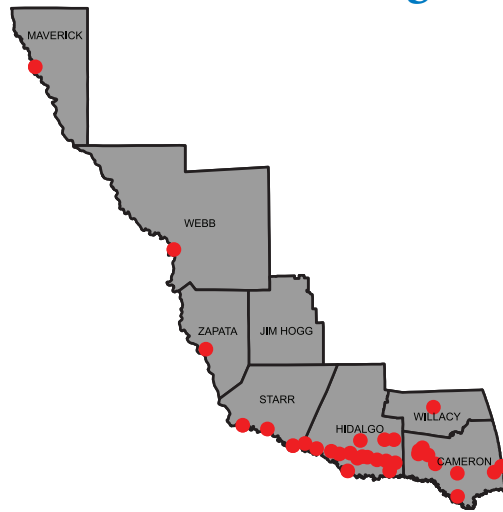
The Planning Group further recommended that the water supply from the Rio Grande be optimized by:

- improving real-time monitoring of the river and its major tributaries in order to minimize the conveyance losses and to maximize use of those waters not accounted for by treaty between the U.S. and Mexico (\$1 million),
- controlling noxious weed vegetation on the Rio Grande (no costs available), and
- restoring the river's historic channel (rechanneling) between Fort Quitman and the City of Presidio to increase the flows reaching this planning area and thus firm up existing water rights (\$10 million).

The Planning Group also suggested that a surface water model be made available for the Rio Grande to help determine impacts of environmental flow needs, and it strongly recommended that the U.S. Government take all necessary and appropriate actions to ensure Mexico's full compliance with the terms of the treaty allocating and governing water on the river.



(M) Rio Grande Region

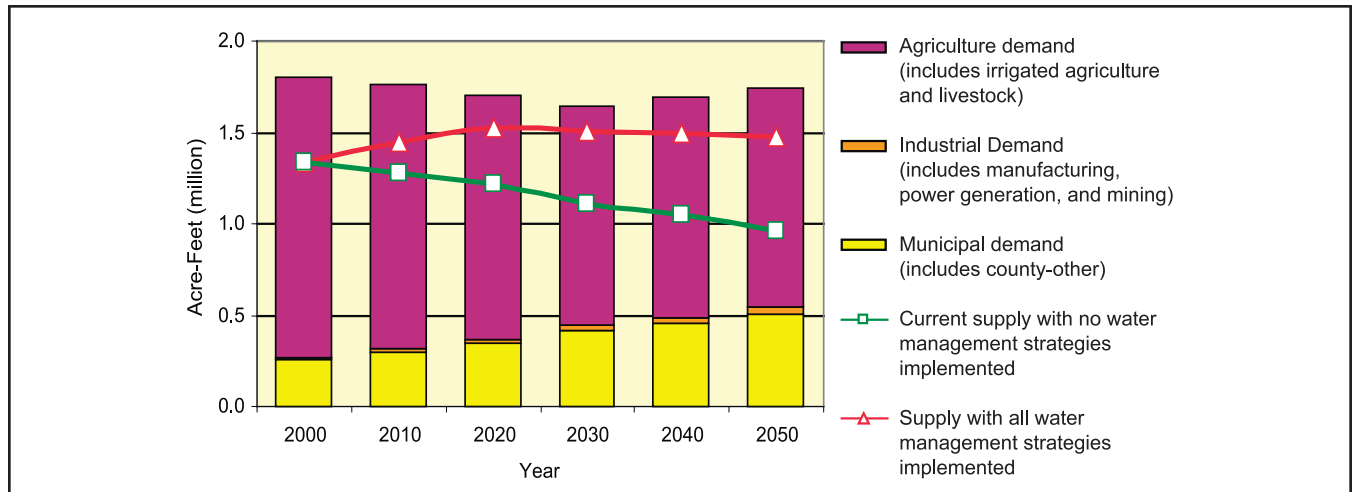


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

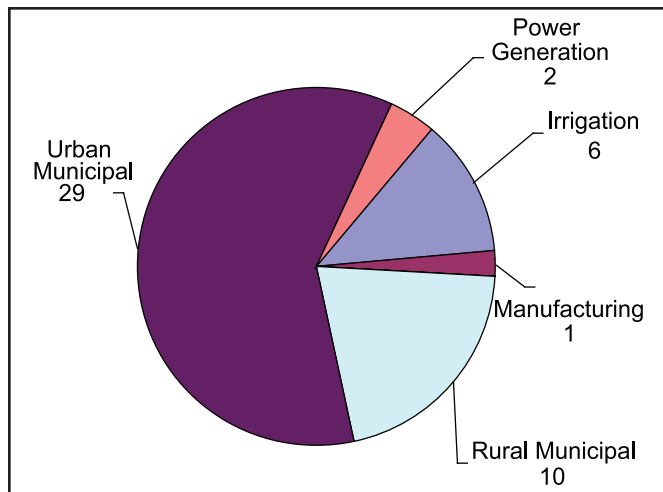
Key Points

- **Total capital cost: \$930 million**
- One new major reservoir to meet needs
- 48 water user groups with projected water needs by 2050
- Water availability model needed for the Rio Grande to help determine impacts of environmental-flow needs
- Mexico's compliance with water apportionment treaty essential

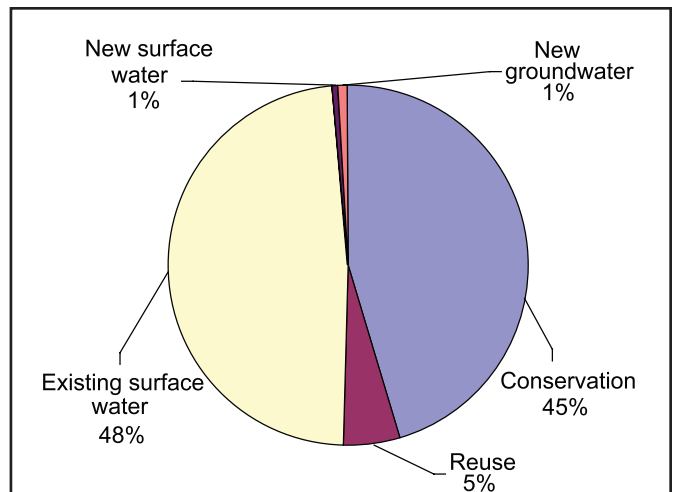
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Coastal Bend Region

The Planning Group identified water supply needs for 15 out of 78 water user groups in the region. The total needs by 2050 are about 99,220 AFY. There are 10 urban and rural municipalities and 2 irrigation user groups with needs in 2050.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are about \$107 million.

Twelve strategies were recommended that involve both surface and groundwater supplies. None of the strategies involves the construction of any new reservoirs. Larger municipalities have recommended strategies to help fill their own needs, as well as those of interconnected communities:

- system interconnects involving a surface source (\$3,364,000),
- additional (interruptible) Lake Texana water (no cost available),
- reallocation of surface water (no cost available),
- conservation from the manufacturing segment (\$2,073,000),
- aquifer storage and recovery (\$14,118,000), and
- use of surface water rights via the Garwood Pipeline (\$83,250,000).

For smaller municipalities, which tend to be located in the groundwater-dependent western part of the region, the planning group recommended

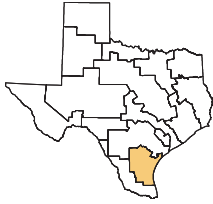
- short-term overdrafting of groundwater (no cost),
- voluntary reallocation of groundwater (\$303,000), and
- utilizing of small desalination plants (\$3,350,000).

The small municipal strategies also benefit local mining users. Mining strategies include both the use of nonpotable groundwater and the recycling/reuse of groundwater. Neither strategy has costs associated with it. Unmet needs in 2050 include about 1,200 AFY for manufacturing, 800 AFY for mining, and 3,400 AFY for municipal.

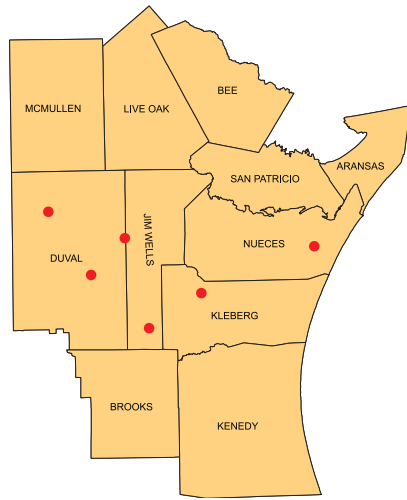
Irrigation needs are generally met through conservation. Those costs are estimated at \$729,000. The Planning Group recognized that there will be some unmet irrigation needs.

The Planning Group will also continue to study the feasibility of large-scale desalination projects. A desalination project has the potential to meet needs in several regions. The Planning Group is exploring interregional cooperation on interbasin transfers and the exchange of surface water rights.

Finally, the Planning Group is actively involved in groundwater availability modeling (GAM) and has begun by recommending certain policy items for GAM consideration, such as pumping level cutoffs.



(N) Coastal Bend Region

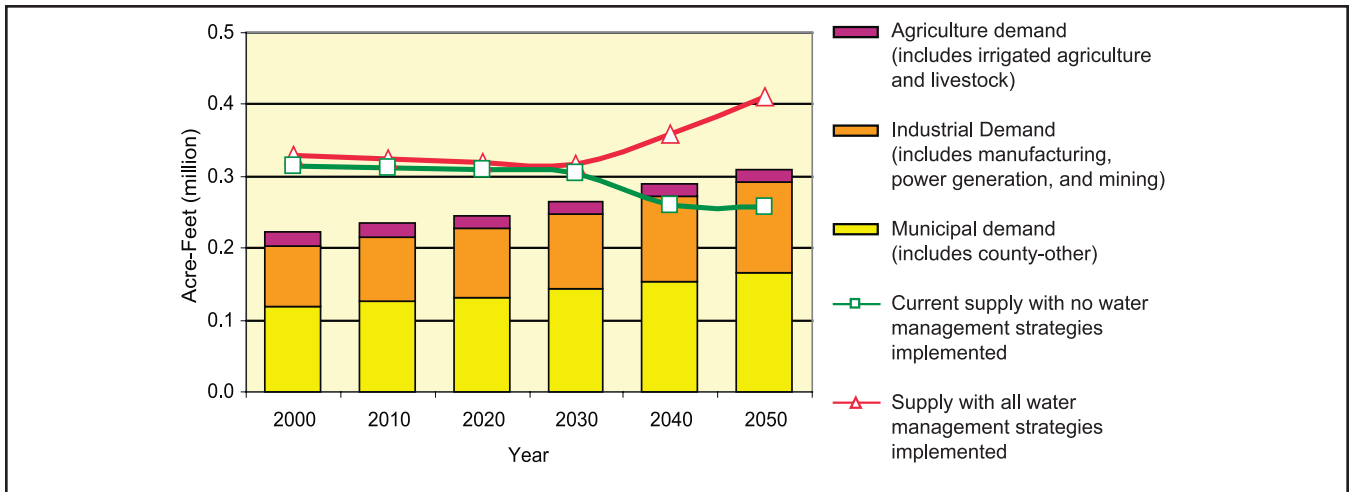


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

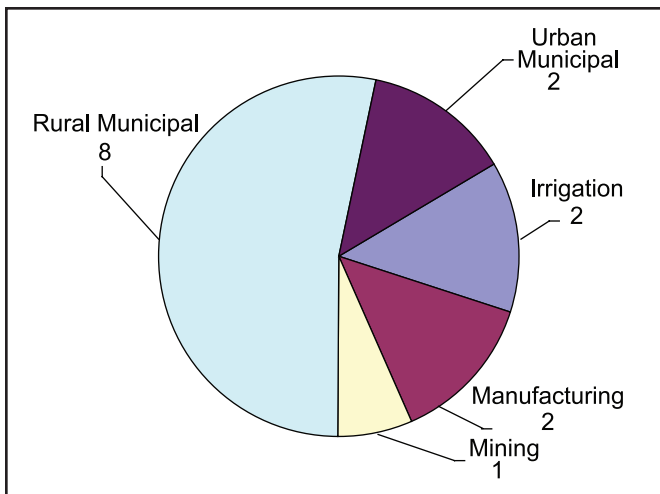
Key Points

- **Total capital cost: Over \$107 million**
- No new reservoirs
- 15 water user groups with projected water needs by 2050
- Several small scale desalination projects proposed
- Interregional cooperation
- Control of groundwater development

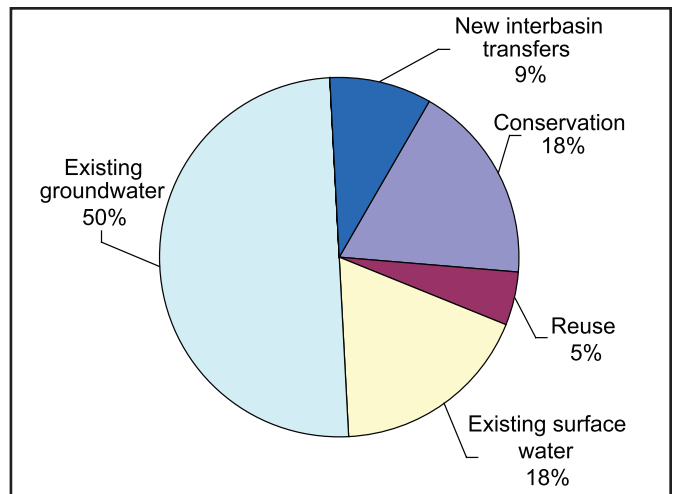
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Llano Estacado Region

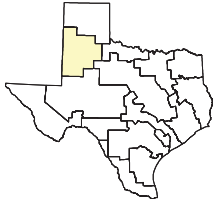
The Planning Group identified water supply needs for 34 out of 149 water user groups in the region. The total needs by 2050 are about 202,204 AFY. There are 26 urban and rural municipalities and 8 irrigation user groups with needs in 2050.

Estimated capital costs of recommended water management strategies for meeting needs over the 50-year planning horizon are about \$306 million. These costs include \$33.8 million for additional groundwater for municipalities, \$123.9 million for a treatment plant and pipeline from Lake Alan Henry to the City of Lubbock, and \$148.1 million for conservation for irrigation.

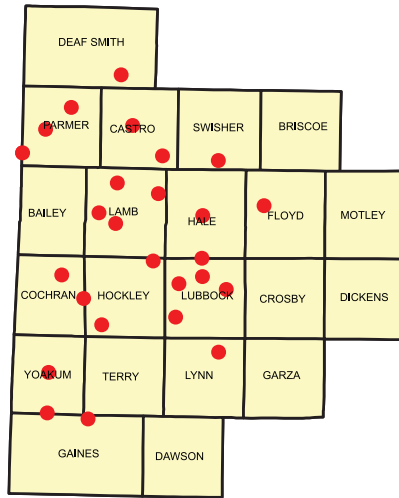
Recommended water management strategies focus on conservation, particularly as a strategy for irrigated agriculture. The Planning Group identified eight irrigation water user groups with needs, and six of these irrigation water user groups have an unmet need in 2050 of about 92,000 AFY. The Planning Group recommended the following water management strategies for reducing irrigation shortages:

- irrigation water conservation,
- agricultural water conservation practices on farms,
- precipitation enhancement,
- brush control,
- recovery of capillary water,
- research and development of drought-tolerant crops and new technology, and
- desalination of brackish groundwater.

The Planning Group also considered but did not recommend a water management strategy to construct a pipeline that would connect small municipalities and feedlots using groundwater from Hartley and Roberts Counties by means of a public/private partnership.



(O) Llano Estacado Region

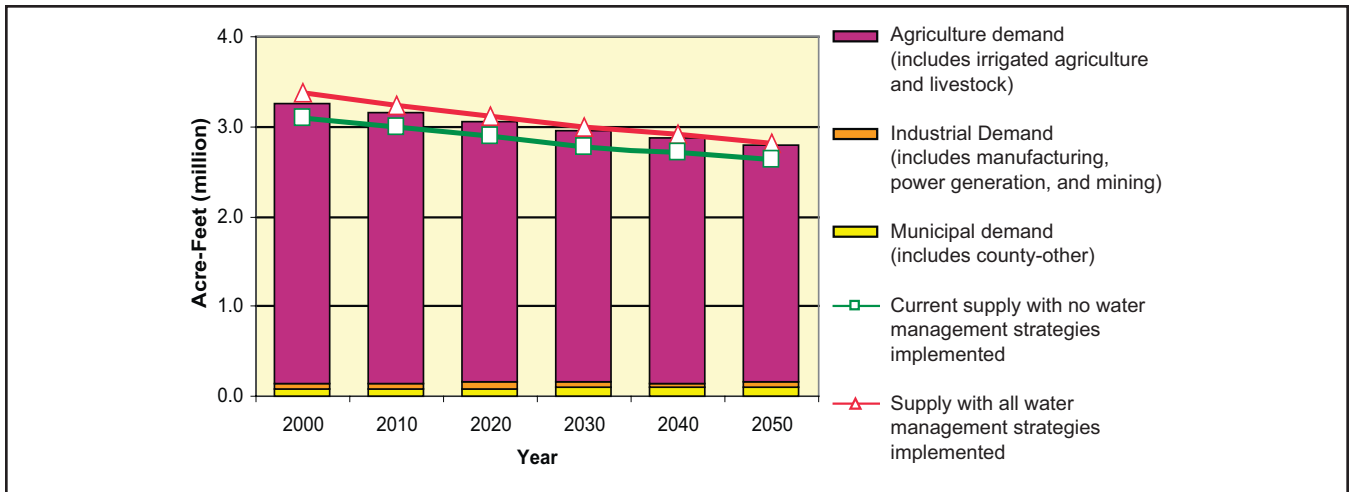


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

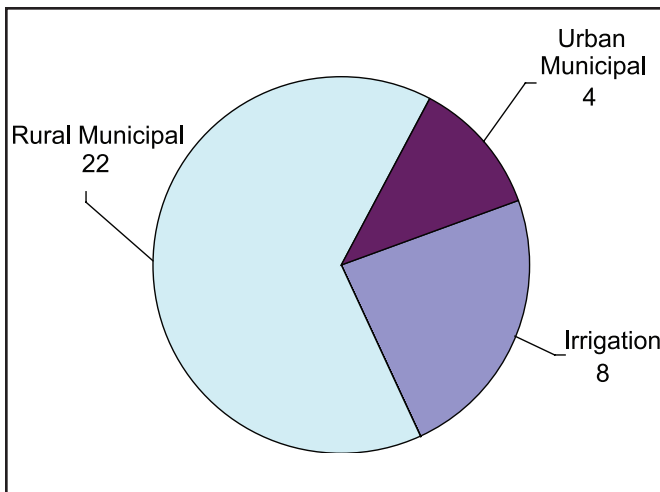
Key Points

- **Total capital cost: \$306 million**
- Strategies to meet all municipal needs occurring by 2050
- 34 water user groups with projected water needs by 2050
- Variety of water transfer proposals being considered
- Focus on conservation, especially for irrigated agriculture

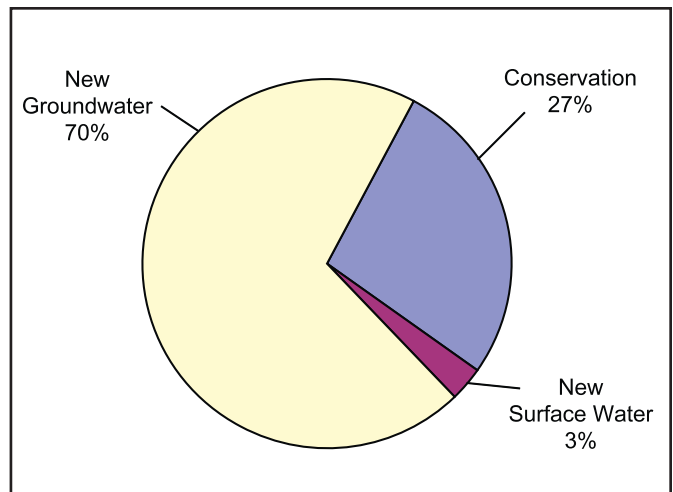
Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050



Summary of Lavaca Region

The Planning Group identified water supply needs for 4 out of 22 water user groups in the region. The total needs by 2050 are about 51,845 AFY. There are no urban or rural municipalities with needs, but 4 irrigation and livestock user groups will have needs in 2050. There are no capital costs for meeting the needs within the Lavaca Region.

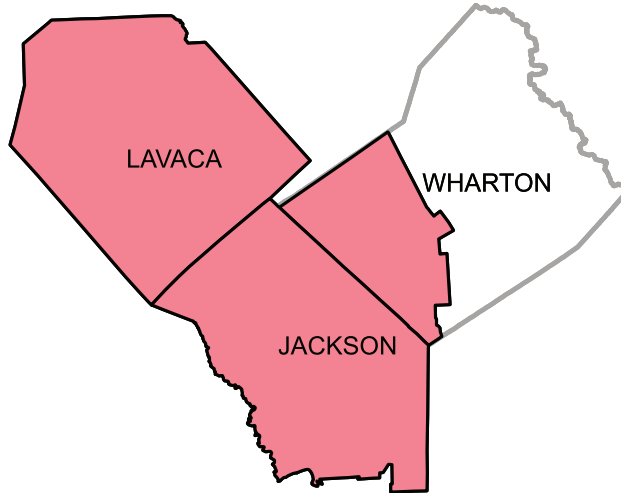
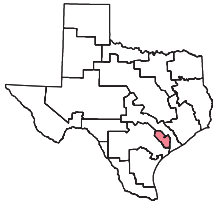
The recommended water management strategy for the Lavaca Planning Group is the temporary overdraft of the Gulf Coast aquifer during drought, allowing water levels to recover during normal conditions. The majority of demands in the region come from irrigated agriculture, which is a seasonal demand. Historical data indicate that water can be produced from aquifer storage during drought and that water levels will begin to recover between irrigation seasons. During normal rainfall years, water levels fully recover from recharge to the aquifer.

In order to meet municipal and industrial needs in other regions and to reduce any external pressure on local groundwater supplies, a large-scale desalination project on Lavaca Bay was recommended. This project involves a modular design that uses a multistage distillation or reverse-osmosis process. For additional water the project would most likely blend the high quality water from the desalination facility with water from other sources for transport to entities with needs. The capital cost of the desalination project is estimated to be \$800 to \$900 million, which would probably be borne by the entities receiving the water. Therefore, no capital costs are associated with the water management strategies to meet the needs within the Lavaca Region.

Groundwater availability throughout the region is defined on a sustainable basis (estimated recharge to the aquifer), as opposed to the total amount of water in aquifer storage. Water conservation was recommended for all user groups in the region.

New reservoirs are not recommended for meeting needs in the Lavaca Region. The Palmetto Bend II Reservoir site was recommended for designation as a unique reservoir site. This reservoir, which would be a companion project to the existing Lake Texana, already has a State permit.

(P) Lavaca Region

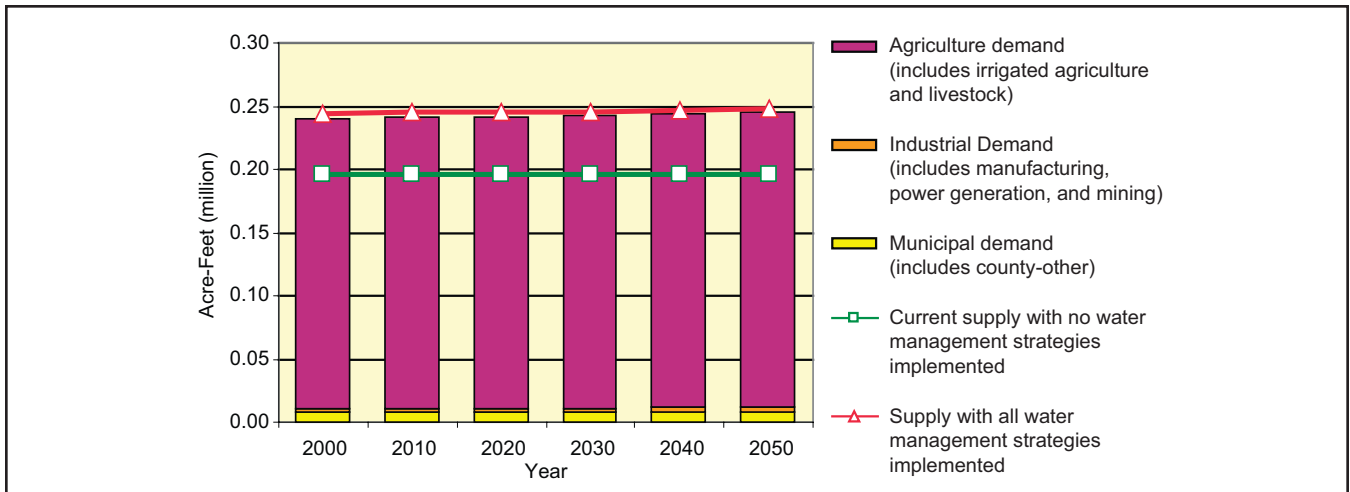


● Cities with needs based on comparison of **current** water supplies with **projected** demands.

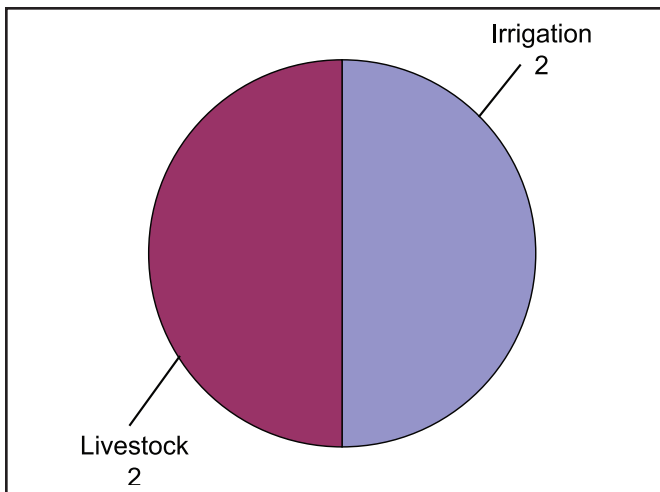
Key Points

- **Total capital cost: \$0**
- No new reservoirs
- Strategies to meet all municipal needs occurring by 2050
- Four water user groups with projected water needs by 2050
- Desalination plant to meet water needs in neighboring regions recommended
- Groundwater availability defined on a sustainable basis rather than on a storage basis

Projected Water Supplies and Demands



Water User Groups with Needs by 2050



Types of Water Management Strategies Used to Meet Needs by 2050

