# FAR WEST TEXAS INITIALLY PREPARED WATER PLAN

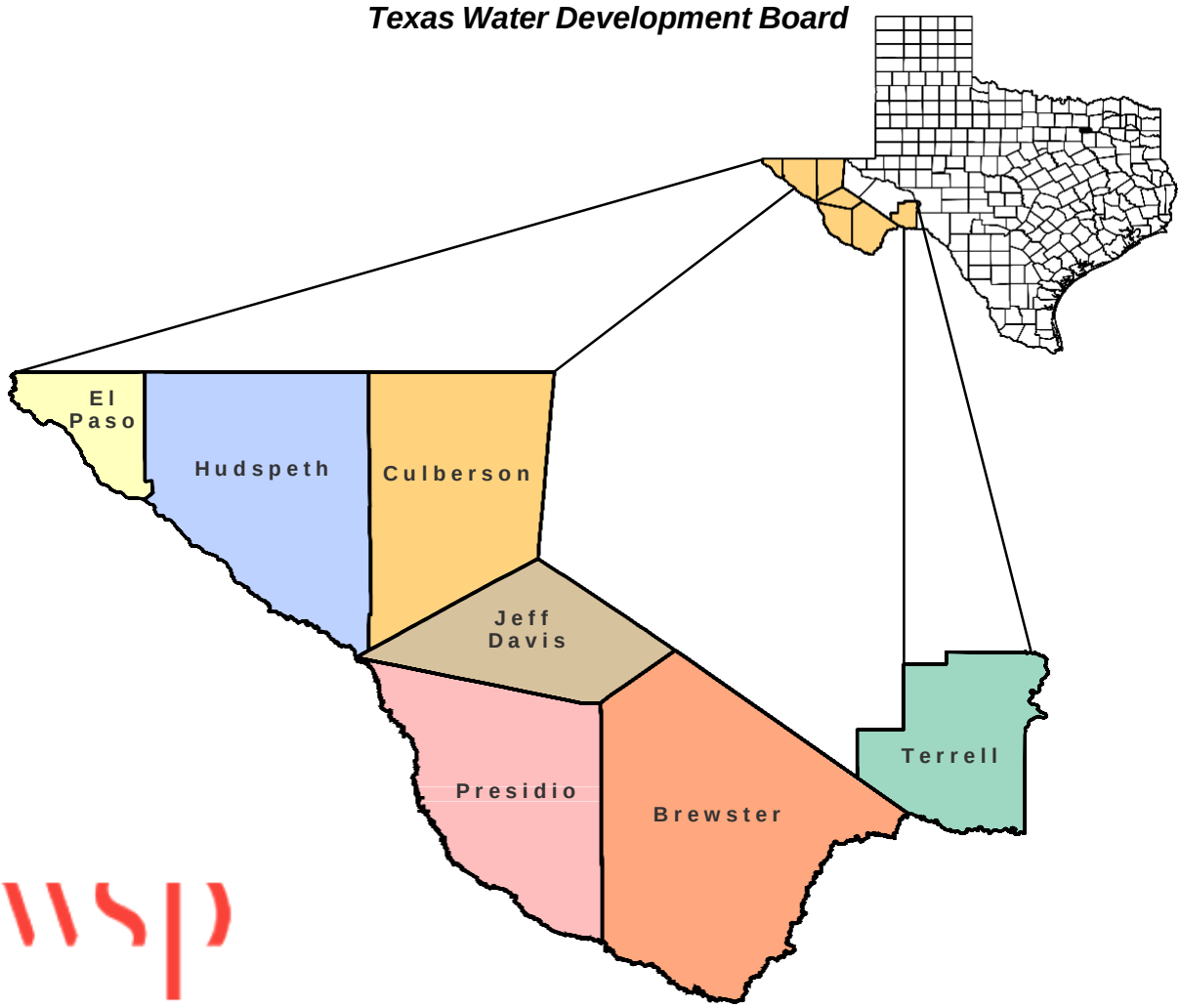
## March, 2020

**Prepared by**

***Far West Texas Water Planning Group***

**Prepared for**

***Texas Water Development Board***

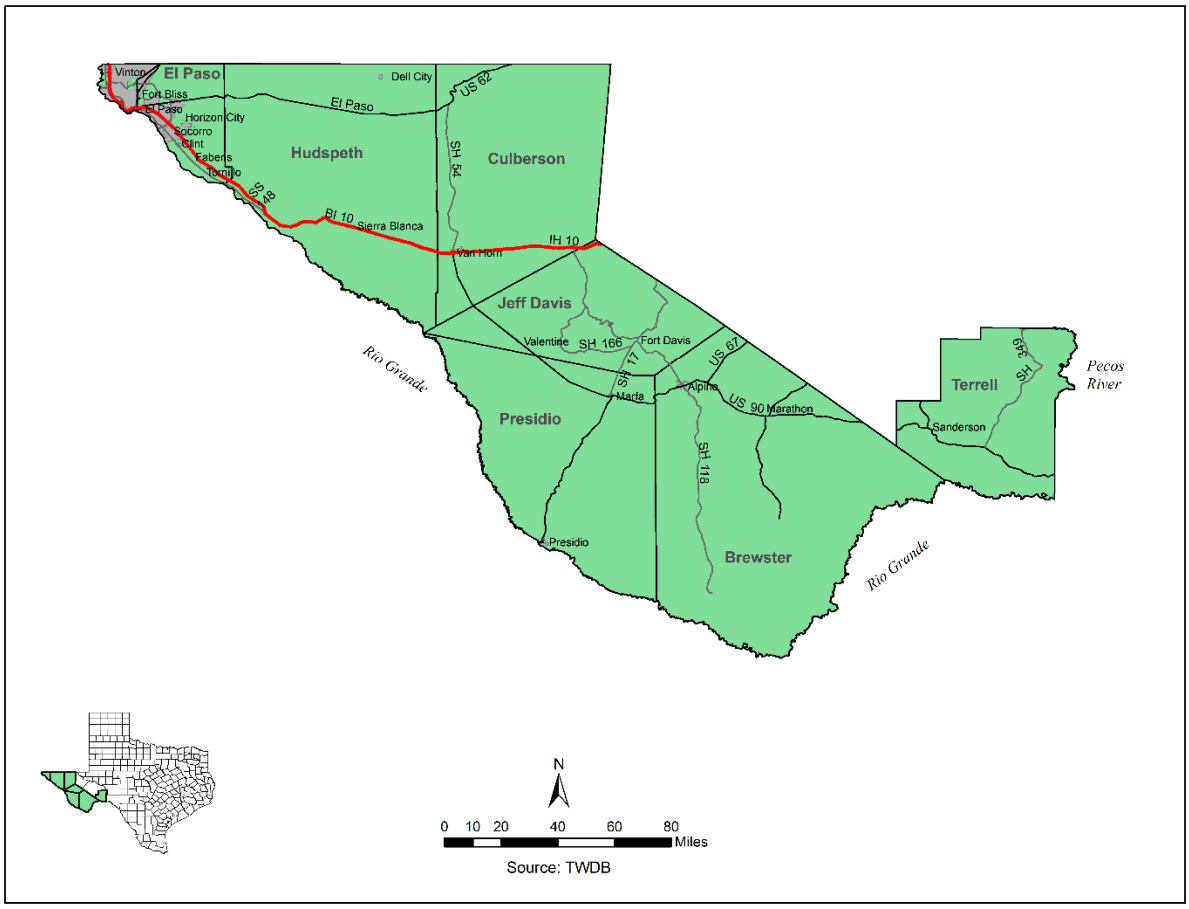


# EXECUTIVE SUMMARY

Far West Texas encompasses the most arid region of the State of Texas. Residents of this expansive desert environment recognize that water is a scarce and valuable resource that must be developed and managed with great care to ensure the area's long-term viability. The Region's economic health and quality of life are dependent on a sustainable water supply that is equitably managed.

Far West Texas is bounded on the north by New Mexico, on the south and west by the Rio Grande and the United Mexican States, and on the east by the Pecos River and incorporates the counties of Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, Presidio and Terrell, all which lie solely within the Rio Grande River Basin. These counties claim some of the most impressive topography and scenic beauty in Texas. The Region is home to the Guadalupe Mountains National Park, Big Bend National Park, and the contiguous Big Bend Ranch State Park. El Paso, the largest city in the Region, is also the nation's largest city on the U.S.-Mexico border. Ciudad Juarez, with an estimated population of over 1.5 million, is located across the Rio Grande from El Paso, and shares the same water sources with El Paso.

**Figure ES-1. Far West Texas Region Water Planning Area Map**




In January of 2016, the fourth round of regional water planning was concluded with the adoption of the *2016 Far West Texas Water Plan*. It is understood that this *Plan* is not a static plan but rather is intended to be revised as conditions change. For this reason, the current *2021 Far West Texas Water Plan* put forth

in this document is not a new plan, but rather an evolutionary modification of the predecessor *Plan*. Only those parts of the original *Plan* that require updating, and there are many, have been revised.

The purpose of the *2021 Far West Texas Water Plan* is to provide a document that water planners and users can reference for long- and short-term water management recommendations. Equally important, this *Plan* serves as an educational tool to inform all citizens of the importance of properly managing and conserving the delicate water resources of this desert community.

The *2021 Far West Texas Water Plan* follows an identical format as the plans prepared by the other 15 water planning regions in the State as mandated by the Texas Legislature and overseen by the Texas Water Development Board. The *Plan* provides an evaluation of current and future water demands for all water-use categories, and water supplies available during drought-of-record conditions to meet those demands. Where future water demands exceed an entity's ability to supply that need, water management strategies are considered to meet the potential water shortages. Water management strategies are also presented that reflects an entity's desire to upgrade their water supply system. In all cases, conservation practices are first considered in managing water supplies.

Because our understanding of current and future water demand and supply sources is constantly changing, it is intended for this *Plan* to be revised every five years or sooner if deemed necessary. This *Plan* fully recognizes and protects existing water rights, water contracts, and option agreements, and there are no known conflicts between this *Plan* and plans prepared for other regions.

# POPULATION AND WATER DEMAND

Except for El Paso County, the counties of Far West Texas are among the least populated in the State. In the year 2020, approximately 97 percent (925,565) of the Region's 954,035 residents are projected to reside in El Paso County, where the population density is 914 persons per square mile. The population density of the six rural counties is 1.2 persons per square mile. Approximately 75 percent of the residents in the Region are Hispanic or Latinos.

El Paso, one of the fastest growing cities in Texas, is the largest city in the Region, with a year-2020 projected population of 734,031. This is 79 percent of the total population of El Paso County and 77 percent of the Region's total population.

The year-2020 projected county populations served by water-supply utilities (mostly representing cities) and representing county other (rural domestic) in the six rural counties are as follows: Brewster County (9,727); Culberson County (2,695); Hudspeth County (3,913); Jeff Davis County (2,398); Presidio County (8,692); and Terrell County (1,045). Population of smaller communities such as Fort Hancock, Dell City, and Valentine are included in the "County Other" (rural) population of each county.

The regional population is projected to increase to 1,551,438 by the year 2070, which is an increase of 597,403 citizens. Most of this increase (563,305) is projected to occur in El Paso County.

Total projected year-2020 water consumptive use in Far West Texas is 480,424 acre-feet. The largest category of use is irrigation (310,403 acre-feet), followed by municipalities and county-other (142,507 acre-feet), steam-electric cooling (10,545 acre-feet), mining (7,835 acre-feet), manufacturing (7,033 acre-feet), and livestock (2,101 acre-feet). Sixty-five percent of water use in the Region is by the agricultural sector in support of irrigation. Thirty percent is used by municipalities and the remaining 5 percent supports manufacturing, steam-electric generation, livestock and mining.

The potential role of conservation is an important factor in projecting future water supply requirements. In this *2021 Plan*, conservation is only included in the municipal projections as a measure of expected savings based on requirements of the State plumbing code. All other conservation practices are discussed in terms of water supply strategies and as a component of drought management plans.

Environmental and recreational water use in Far West Texas is recognized as being an important consideration as it relates to the natural community in which the residents of this Region share and appreciate. In addition, for rural counties, tourism activities based on natural resources offer perhaps the best hope for modest economic growth to areas that have seen a long decline in traditional economic activities such as agriculture and mining.

Rural communities (outside of El Paso County) are relatively small and are generally reliant on self-provided water supplies. Water demand within these communities is related directly to their population trends and is thus relatively stable or moderately increasing over the next 50 years. Projected water-demand growth for the numerous communities within El Paso County is significantly greater and thus will require a level of coordinated intercommunity planning.

Water used for agricultural irrigation in Far West Texas is significantly greater (65 percent of total) than all other water-use categories. On a regional basis, water used for the irrigation of crops is projected to

remain constant over the 50-year planning horizon. However, as any irrigator can attest, climate, water availability, and the market play key roles in how much water is actually applied on a year-by-year basis.

Ciudad Juarez is located across the Rio Grande from El Paso, and currently is 100 percent dependent on the Hueco Bolson and Conejos Medanos Aquifers to satisfy all its municipal and industrial demands. With a growing population that is currently estimated to be over 1.5 million, Ciudad Juarez recognizes the limitations of the Hueco Bolson to supply future demands. In addition, plans are being developed to convert 38,000 acre-feet/year of surface water from the Rio Grande (Rio Bravo) for municipal supply use. Currently, Mexico's allocation from the Rio Grande Project of 60,000 acre-feet/year is used for irrigated agriculture. The conversion would involve supplying wastewater effluent to farmers in exchange for surface water.

# WATER SUPPLY RESOURCES

Whether it flows in rivers and streams or percolates through underground rock formations, water sustains life and thus is our most important natural resource. In the Chihuahuan Desert environment of Far West Texas, water supply availability takes on a more significant meaning than elsewhere in the State. With evaporation far exceeding rainfall, planning for the most efficient management of limited water supplies is essential.

Water supply availability from each recognized source is estimated during drought-of record conditions. This allows each entity and water-use category to observe conditions when their supply source is at its most critical availability level. Specific assumptions used in estimating supply availability are listed below:

- Except for controlled flows in the Rio Grande, very little surface water can be considered as a reliable source of supply in Far West Texas, especially in drought-of-record conditions. In this chapter, two primary surface water sources are considered, the Rio Grande and the Pecos River. Other ephemeral creeks and springs (cienegas) are recognized as important livestock supply, wildlife habitat, and recreational resources. The availability of water in the Rio Grande and Pecos River (Run-of-River) to meet existing water rights, including municipal water rights, is determined by the TCEQ Rio Grande Water Availability Model (WAM)–Run 3, except for supplies from the Rio Grande Project. All surface water rights are listed in Appendix 3A.
- The availability of groundwater is based on TWDB provided Modeled Available Groundwater (MAG) as developed through the Groundwater Management Area process. For aquifers that MAG volumes have not been assigned, groundwater availability is calculated separately.
- Direct reuse refers to wastewater that is reused without first being discharged into a stream or other watercourse. Direct reuse of water is calculated for El Paso Water based on anticipated build-out of their "purple pipe" project and advanced purified water treatment projects. Indirect reuse refers to wastewater that is first discharged to a stream or watercourse before being diverted for use. The indirect reuse supply is used during the irrigation season.
- No groundwater availability requirements or limitations as might have been promulgated by the El Paso County Commissioner's Court are associated with the El Paso County Priority Groundwater Management Area. El Paso Water continues to assume the role as the designated "Regional Water Supply Planner".
- Water supplies based upon contracts are assumed to be renewed if they expire during the planning horizon.

The Rio Grande originates in southwestern Colorado and northern New Mexico, where it derives its headwaters from snowmelt in the Rocky Mountains. The Elephant Butte Dam and Reservoir in New Mexico is approximately 125 miles north of El Paso and can store over two million acre-feet of water. Water in the reservoir is stored to meet irrigation demands in the Rincon, Mesilla, El Paso, and Juarez Valleys and is released in a pattern for power generation. Above El Paso, flow in the River is largely controlled by releases from Caballo Reservoir located below Elephant Butte; while downstream from El Paso to Fort Quitman, flow consists of treated municipal wastewater from El Paso, untreated municipal wastewater from Juarez, and irrigation return flow. Below the El Paso-Hudspeth County line, flow

consists mostly of return flow and occasional floodwater and runoff from adjacent areas. Channel losses are significant enough that the Rio Grande is often dry from below Fort Quitman to the confluence with the Mexican river, the Rio Conchos, upstream of Presidio. There are no significant perennial tributaries, other than the Rio Conchos, in the 350 miles between Elephant Butte Reservoir and Presidio.

The Rio Grande is unique in its complexity of distribution management. Because the waters of the River must be shared between three U.S. states and Mexico, a system of federal, state and local programs has been developed to oversee the equitable distribution of water. Compacts, treaties and projects currently provide the River's management framework.

The Pecos River is the largest Texas river basin that flows into the Rio Grande. Originating in New Mexico, the Pecos flows southerly into Texas, and discharges into the channel of the Rio Grande near Langtry in Val Verde County. The River forms the easternmost border of Far West Texas along the northeast corner of Terrell County. Flows of the Pecos River are controlled by releases from the Red Bluff Reservoir near the Texas - New Mexico state line. Storage in the reservoir is affected by the delivery of water from New Mexico. According to data of the IBWC, the Pecos River contributes an average of 11 percent of the annual streamflow into the Rio Grande near Amistad Reservoir. The Pecos also contributes more than 29 percent of the annual salt loading into the reservoir.

Other than irrigation use and a portion of City of El Paso municipal use from the Rio Grande, almost all other water use in Far West Texas is supplied from groundwater sources. Although not as large in areal extent as some aquifers in the State, individual aquifers in Far West Texas are more numerous (10 TWDB designated and 3 Planning Group designated) than in any of the other planning regions.

El Paso has nearly 50 miles of reclaimed water lines (purple pipeline) in place in all areas of the City. Reclaimed water serves the landscape irrigation demand of golf courses, parks, schools, and cemeteries, and provides water supplies for steam electric plants and industries within the City. Currently EPW is operating three reuse projects that provide 6,000 acre-feet per year. This *Plan* explores the potential of a significant increase in reuse of existing supplies by evaluating strategies of advanced treatment to produce purified water that meets state drinking water standards.

Springs and seeps are found in all seven of the Far West Texas counties and have played an important role in the development of the Region. Springs were important sources of water for Native Americans, as indicated by the artifacts and petroglyphs found near many of the springs. In the 18$^{th}$ and 19$^{th}$ centuries, locations of transportation routes including supply and stage coach lines, military outposts, railroads, and early settlements and ranches were largely determined by the occurrence of springs that issued from locations in the mountains and along mountain fronts.

Springs contribute to the aesthetic and recreational value of private land and parkland in Far West Texas - especially in the Big Bend area, where many thermal springs discharge along the banks of the Rio Grande. Springs are significant sources of water for both aquatic and terrestrial wildlife as they form small wetlands that attract migratory birds and other fowl that inhabit the Region throughout the year. The FWTWPG recognizes the importance of all springs in this desert community for their contribution as a water supply source and as a natural habitat. However, the FWTWPG chooses to respect the privacy of private lands and therefore specifically identifies "Major Springs" occurring only on state, federal, or privately owned conservation managed lands.

# WATER MANAGEMENT STRATEGIES

Projected water supply deficits in Far West Texas during the next 50 years are identified where anticipated water demands exceed available supplies. Available supplies represent the largest amount of water that can be diverted or pumped from a given source without violating the most restrictive physical, regulatory, or policy condition limiting use, under drought-of-record conditions. Water supply deficits are identified for specified municipal utilities, irrigation use, mining use, and steam power electric generation in El Paso County; and in the Rural counties, for irrigation use in Culberson County, and for mining use in Hudspeth and Terrell Counties.

Water supply strategy recommendations intended to meet the deficits are made for those water use groups that have projected water supply shortages. In addition, strategies have been developed for entities that have expressed a desire for planned projects for which funding applications have been or will be made in the future to be included in the *Plan*. In the development of water management strategies, existing water rights, water contracts, and option agreements are recognized and fully protected.

A strategy evaluation procedure was designed to provide a side-by-side comparison such that all the strategies could be assessed based on the same factors. Specific factors considered were:

- Quantity of water supply generated
- Water quality considerations
- Reliability
- Cost (total capital cost, annual cost, and cost per acre-foot)
- Environmental impacts
- Impacts to agricultural and natural resources

To adequately consider the unique challenges faced by municipal and industrial water users in El Paso County, a conjunctive approach was used to establish feasible strategies capable of identifying sufficient future supplies to meet the water needs of El Paso Water, the largest wholesale water provider in the county. The following recommended projects are to be managed conjunctively to produce a mixed total distributed supply:

- Municipal conservation programs
- Advanced water purification at the Bustamante WWTP
- Expansion of current Hueco Bolson Aquifer ASR
- Groundwater development in the Dell City area (Phase I and II)
- Additional alternate projects including advanced water purification, expansion of existing groundwater use, treatment and reuse of other local supplies, and expansion of existing desalination facilities

Recommended strategies for other entities in El Paso County include purchasing needed supplies from El Paso Water or developing needed self-supplied groundwater by drilling additional wells and expanding desalination facilities.

Irrigation shortages in El Paso County is the direct result of insufficient water in the Rio Grande during drought-of-record periods to meet anticipated needs. The quantity of water needed to meet the full demands cannot be realistically achieved and farmers in these areas have generally approached this situation by reducing irrigated acreage, changing types of crops planted, or possibly not planting crops until water becomes available during the following season.

In some cases, farmers may benefit from Best Management Practices (BMPs) for agricultural water users, which are a mixture of site-specific management, educational, and physical procedures that have proven to be effective and are cost-effective for conserving water. However, a local study of these practices found that very limited opportunities exist for significant additional water conservation in Far West Texas irrigated agriculture. Those practices that suggest economic efficient additional water conservation included lining or pipelining district canals and the very small potential for additional irrigation scheduling and tail water recovery systems. In nearly all cases, these practices have been adapted if applicable, further emphasizing the very limited opportunities for additional conservation. If these strategies were implemented, the water conserved would satisfy less than the projected unmet agricultural water demand in 2070 during drought-of-record conditions. Based on this evaluation, the FWTWPG recommends tail-water reuse, improvements to water district delivery systems, construction of a regulating reservoir, and the development of a new diversion point at the La Union canal to attempt to meet the estimated irrigation needs in El Paso County.

Although most of the communities in the rural counties do not project shortages, it is apparent that many the communities have water issues that are appropriate for listing in this *Regional Plan*. Therefore, strategies have been evaluated and presented that will hopefully provide incentive for the future development of water resources to address these issues. The *2021 Far West Texas Water Plan* contains a total of 58 recommended water management strategies and 7 alternative strategy with a total estimated capital cost for develop of $2,169,328,445.00.

# WATER QUALITY

Water quality plays an important role in determining the availability of water supplies to meet current and future water needs in the Region. The quality of groundwater and surface water is evaluated to help determine the suitability of each source for use and the potential impacts on these sources that might result from the implementation of recommended water management strategies.

Groundwater quality issues in the Region are generally related to naturally high concentrations of total dissolved solids (TDS) or to the occurrence of elevated concentrations of individual dissolved constituents. High concentrations of TDS are primarily the result of the lack of sufficient recharge and restricted circulation. Together, these retard the flushing action of fresh water moving through the aquifers. Some aquifers, however, have a low TDS but may contain individual constituent levels that exceed safe drinking-water standards. For example, some wells in the Igneous Aquifer have exceptionally low TDS but contain unsatisfactory levels of fluoride.

Groundwater quality changes are often the result of man's activities. In agricultural areas, aquifers such as the Bone Spring-Victorio Peak have increased in TDS. Irrigation water applied on the fields percolates back to the aquifer carrying salts leached from the soil. Beneath El Paso and Ciudad Juarez, the average concentration of dissolved solids in the Hueco Bolson Aquifer has increased as the fresher water in the aquifer is being consumed. Although local instances of groundwater quality degradation have occurred in the Region, there are no major trends that suggest a widespread water-quality problem due to the downward percolation of surface contaminants.

The Rio Grande and the Pecos River are the principal surface water sources in Far West Texas. Unlike groundwater, surface water quality can vary significantly depending on the amount of flow in the streambed and the rate and source of runoff from adjacent lands. Salinity is an issue associated with the Rio Grande, especially during drought conditions. River flows arriving at El Paso contain a substantial salinity contribution from irrigation return flow and municipal wastewater return in New Mexico. Under current conditions, approximately 25 percent of the applied irrigation water is needed to move through the project in El Paso County to keep the salt loading at reasonable and manageable levels given average surface flow rates. Studies have shown that salinities in the Rio Grande can increase to over 1,000 mg/l during May and September, depending on actual irrigation demands and releases from reservoirs.

Downstream from El Paso, most of the flow consists of irrigation return flow, and small amounts of treated and untreated municipal wastewater. Heavy metals and pesticides have been identified along this segment of the Rio Grande. Flow is intermittent downstream to Presidio, where the Rio Conchos augments flow. Fresh water springs contribute to the Rio Grande flow in the Big Bend and enhance the overall quality of the River through this reach.

The Pecos River is not a source of drinking water for communities in Far West Texas; however, it is the most prominent tributary to the Rio Grande on the Texas side of the River above Amistad Reservoir. According to IBWC data, the Pecos River contributes an average of 11 percent of the annual stream flow in the Rio Grande above the Reservoir and 29 percent of the annual salt load. Independence Creek's contribution in Terrell County increases the Pecos River water volume by 42 percent at the confluence and significantly reduces the total suspended solids, thus improving both water quantity and quality.

# WATER CONSERVATION AND DROUGHT CONTINGENCY

Water conservation are those practices, techniques, programs, and technologies that will protect water resources, reduce the consumption of water, reduce the loss or waste of water, or improve the efficiency in the use of water. Recycling or reuse of water is also a creative method of managing water so that it can be used more than once or for alternative uses. Water conservation and drought contingency planning implemented by municipalities, water providers, and other water users supersede recommendations in this *Plan* and are considered consistent with this *Plan*. Texas Water Code §11.1271 requires water conservation plans for all municipal and industrial water users with surface water rights of 1,000 acre-feet per year or more and irrigation water users with surface water rights of 10,000 acre-feet per year or more.

El Paso Water is the largest supplier of municipal water in Far West Texas and has been implementing an aggressive water conservation program, which has reduced the per capita demand from about 225 gpcd in the late 1970s to a current level of 128 gpcd. The continuation of the conservation effort is a key component of the El Paso Water Integrated Water Management Strategy.

Drought is a frequent and inevitable factor in the climate of Texas. Therefore, it is vital to plan for the effect that droughts will have on the use, allocation and conservation of water in the State. Far West Texas is perennially under drought or near-drought conditions compared with more humid areas of the State. Although residents of the Region are generally accustomed to these conditions, the low rainfall and the accompanying high levels of evaporation underscore the necessity of developing plans that respond to potential disruptions in the supply of groundwater and surface water caused by drought conditions. In the consideration of regional conservation and drought management issues, the FWTWPG reviewed active water conservation and drought management plans provided to the planning group by public water suppliers and irrigation districts.

The Texas Legislature has established a process for local management of groundwater resources through groundwater conservation districts. The districts are charged with managing groundwater by providing for the conservation, preservation, protection, recharging and prevention of waste of groundwater within their jurisdictions. Six districts are currently in operation within Far West Texas.

- Brewster County Groundwater Conservation District
- Culberson County Groundwater Conservation District
- Hudspeth County Underground Water Conservation District No.1
- Jeff Davis County Underground Water Conservation District
- Presidio County Underground Water Conservation District
- Terrell County Groundwater Conservation District

# PROTECTION OF WATER, AGRICULTURAL, AND NATURAL RESOURCES

The long-term protection of the Region's water, agricultural, and natural resources, and the environment is an important component of this *2021 Far West Texas Water Plan*. The first step in achieving long-term water resources protection was in the process of estimating each source's availability. Surface water estimates were developed through a water availability model process (WAM) and are based on the quantity of surface water available to meet existing water rights during a drought-of-record. The availability of groundwater is based on TWDB provided Modeled Available Groundwater (MAG) as developed through the Groundwater Management Area process. For aquifers that MAG volumes have not been assigned, groundwater availability is based on previous geohydrologic studies, groundwater data including historical use contained in state and federal databases and groundwater availability models (GAMs). Also included are groundwater supplies that are made available by the desalination of brackish groundwater sources. Establishing conservative levels of water source availability thus results in less potential of overexploiting the supply.

The next step in establishing the long-term protection of water resources occurs in the water management strategies to meet potential water supply shortages. Each strategy was evaluated for potential threats to water resources in terms of source depletion (reliability), quality degradation, and impact to environmental habitat. Water conservation strategies are also recommended for each entity with a supply deficit. When enacted, the conservation practices will diminish water demand and thus extend supplies over the stress period.

Agriculture includes the raising of crops and livestock, as well as a multitude of businesses that support this industry. Water is an absolute necessity to maintaining this industry and its use represents over three-fourths of all the water used in the Region. It is thus important to the economic health and way of life in the Region to protect water resources that have historically been used in the support of agricultural activities. The *2021 Far West Texas Water Plan* provides irrigation strategy recommendations that address water conservation management practices. If implemented, these practices will result in reduced water application per acre irrigated and diminished water losses due to canal leakage. All non-agricultural recommended water management strategies include an analysis of potential impact to agricultural interests. Any strategy that necessitates the conversion of water use from agricultural practices is voluntary at the current water right and landowner's discretion.

The FWTWPG has adopted a stance toward the protection of natural resources. The protection is closely linked with the protection of water resources as discussed above. Where possible, the methodology used to assess groundwater source availability is based on not significantly lowering water levels to a point where spring flows might be impacted. Thus, the intention to protect surface flows is directly related to those natural resources that are dependent on surface water sources or spring flows for their existence.

Environmental impacts were evaluated in the consideration of strategies to meet water-supply deficits. Of prime consideration was whether a strategy potentially could diminish the quantity of water currently existing in the natural environment and if a strategy could impact water quality to a level that would be detrimental to animals and plants that naturally inhabit the area under consideration. The FWTWPG has also recommended several "Ecologically Unique River and Stream Segments".

# RECOMMENDATIONS

An important aspect of the regional water planning process is the opportunity to provide recommendations for the improvement of future water management planning in Texas. The recommendations are designed to present new and/or modified approaches to key technical, administrative, institutional, and policy matters that will help to streamline the planning process, and to offer guidance to future planners regarding specific issues of concern within the Region. The FWTWPG approves of the legislative intent of the regional water planning process and supports the continuance of water planning at the regional level. In further support of the planning process, the FWTWPG suggests that the Legislature and TWDB consider the following issues pertaining to water management policy, regional water planning process, and water research needs.

- Stormwater / flood planning that encourages retaining stormwater as a water supply source
- Support of funding for Colonias projects
- Encouragement of State legal rectification to protect Rio Grande Compact
- Re-emphasis of the planning function of the regional water planning group and need for more local planning initiatives
- Allowance of modification of demand numbers
- Dissatisfaction with inter-period modification of contractual planning guidelines
- Dissatisfaction with unfunded Task 5A planning requirement
- Suggestion of several specified water research and data needs that would support the local planning process

As a part of the planning process, each regional planning group may include recommendations for the designation of ecologically unique river and stream segments in their adopted regional water plan. The Texas Legislature may designate a river or stream segment of unique ecological value following the recommendations of a regional water planning group. As per §16.051(f) of the Texas Water Code, this designation solely means that a state agency or political subdivision of the State may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under this subsection. The Far West Texas Water Planning Group intends that no negative impact is to occur to upstream landowners as a result of these designations.

The FWTWPG chooses to respect the privacy of private lands and therefore recommends as "Ecologically Unique River and Stream Segments" the following three streams that lie within the boundaries of state-managed properties, four within National Park boundaries, and specified streams managed by the Texas Nature Conservancy and the Trans Pecos Water Trust. New to this *2016 Plan* is the recommendation of a segment of Terlingua Creek in Brewster County that is within the boundaries of the Big Bend National Park.

- Rio Grande Wild and Scenic River (Big Bend National Park)
- McKittrick Canyon and Choza Creek (Guadalupe Mountains National Park)
- Cienega Creek (Chinati Mountains State Natural Area)

- Alamito and Cienega Creeks (Big Bend Ranch State Park)
- Alamito Creek (Trans Pecos Water Trust)
- Independence Creek (Texas Nature Conservancy - Independence Creek Preserve)
- Madera Creek, Canyon Headwaters of Limpia Creek, Little Aguja Creek, and Upper Cherry Creek (Texas Nature Conservancy - Davis Mountains Preserve)
- Terlingua Creek (Big Bend National Park)

The firm yield for any reservoirs constructed on even the most reliable Far West Texas watercourses is not likely to exceed 2,000 acre-feet per year. For this reason, the *2021 Far West Texas Water Plan* does not recommend any watercourse for designation as "Unique Sites for Reservoir Construction."

*This page is intentionally left blank*

# ES – APPENDIX

# TWDB WATER PLANNING DATA REPORTS

*This page intentionally left blank.*

# Region E Water User Group (WUG) Population

| | WUG POPULATION | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| ALPINE | 6,066 | 6,185 | 6,231 | 6,265 | 6,283 | 6,293 |
| LAJITAS MUNICIPAL SERVICES | 542 | 561 | 568 | 575 | 579 | 579 |
| MARATHON WATER SUPPLY & SEWER SERVICE | 444 | 460 | 466 | 471 | 474 | 475 |
| COUNTY-OTHER | 2,675 | 2,885 | 2,965 | 3,023 | 3,051 | 3,070 |
| **RIO GRANDE BASIN TOTAL** | **9,727** | **10,091** | **10,230** | **10,334** | **10,387** | **10,417** |
| **BREWSTER COUNTY TOTAL** | **9,727** | **10,091** | **10,230** | **10,334** | **10,387** | **10,417** |
| VAN HORN | 2,319 | 2,542 | 2,641 | 2,730 | 2,782 | 2,815 |
| COUNTY-OTHER | 376 | 412 | 428 | 443 | 451 | 457 |
| **RIO GRANDE BASIN TOTAL** | **2,695** | **2,954** | **3,069** | **3,173** | **3,233** | **3,272** |
| **CULBERSON COUNTY TOTAL** | **2,695** | **2,954** | **3,069** | **3,173** | **3,233** | **3,272** |
| ANTHONY | 4,206 | 5,053 | 5,840 | 6,620 | 7,358 | 8,052 |
| EAST BIGGS WATER SYSTEM | 11,870 | 11,870 | 11,870 | 11,870 | 11,870 | 11,870 |
| EAST MONTANA WATER SYSTEM | 6,599 | 7,529 | 8,391 | 9,247 | 10,057 | 10,818 |
| EL PASO COUNTY TORNILLO WID | 3,202 | 3,215 | 3,229 | 3,242 | 3,254 | 3,266 |
| EL PASO COUNTY WCID 4 | 8,858 | 9,131 | 9,385 | 9,636 | 9,874 | 10,098 |
| EL PASO WATER | 734,031 | 822,625 | 904,900 | 986,455 | 1,063,672 | 1,136,275 |
| FEDERAL CORRECTIONAL INSTITUTION LA TUNA | 1,668 | 1,668 | 1,668 | 1,668 | 1,668 | 1,668 |
| FORT BLISS WATER SERVICES | 26,453 | 27,499 | 28,471 | 29,434 | 30,343 | 31,200 |
| HACIENDAS DEL NORTE WID | 1,218 | 1,389 | 1,548 | 1,706 | 1,855 | 1,996 |
| HORIZON REGIONAL MUD | 52,993 | 74,830 | 95,108 | 115,207 | 134,239 | 152,133 |
| LOWER VALLEY WATER DISTRICT | 53,059 | 63,682 | 73,546 | 83,325 | 92,582 | 101,287 |
| PASEO DEL ESTE MUD 1 | 8,116 | 9,260 | 10,320 | 11,372 | 12,369 | 13,304 |
| COUNTY-OTHER \| VINTON HILLS ESTATES | 370 | 505 | 631 | 756 | 874 | 985 |
| COUNTY-OTHER \| VINTON HILLS SUBDIVISION | 861 | 1,176 | 1,469 | 1,759 | 2,034 | 2,292 |
| COUNTY-OTHER | 12,061 | 16,471 | 20,569 | 24,630 | 28,478 | 32,096 |
| **RIO GRANDE BASIN TOTAL** | **925,565** | **1,055,903** | **1,176,945** | **1,296,927** | **1,410,527** | **1,517,340** |
| **EL PASO COUNTY TOTAL** | **925,565** | **1,055,903** | **1,176,945** | **1,296,927** | **1,410,527** | **1,517,340** |
| ESPERANZA WATER SERVICE | 905 | 996 | 1,023 | 1,043 | 1,053 | 1,058 |
| HUDSPETH COUNTY WCID 1 | 952 | 1,044 | 1,073 | 1,095 | 1,105 | 1,112 |
| COUNTY-OTHER \| DELL CITY | 424 | 467 | 480 | 489 | 494 | 496 |
| COUNTY-OTHER \| FORT HANCOCK WCID | 1,079 | 1,188 | 1,222 | 1,246 | 1,258 | 1,263 |
| COUNTY-OTHER | 553 | 609 | 626 | 638 | 643 | 646 |
| **RIO GRANDE BASIN TOTAL** | **3,913** | **4,304** | **4,424** | **4,511** | **4,553** | **4,575** |
| **HUDSPETH COUNTY TOTAL** | **3,913** | **4,304** | **4,424** | **4,511** | **4,553** | **4,575** |
| FORT DAVIS WSC | 1,361 | 1,361 | 1,361 | 1,361 | 1,361 | 1,361 |
| COUNTY-OTHER \| CITY OF VALENTINE | 198 | 198 | 198 | 198 | 198 | 198 |
| COUNTY-OTHER | 839 | 839 | 839 | 839 | 839 | 839 |
| **RIO GRANDE BASIN TOTAL** | **2,398** | **2,398** | **2,398** | **2,398** | **2,398** | **2,398** |
| **JEFF DAVIS COUNTY TOTAL** | **2,398** | **2,398** | **2,398** | **2,398** | **2,398** | **2,398** |
| MARFA | 2,583 | 2,807 | 3,022 | 3,261 | 3,473 | 3,674 |
| PRESIDIO | 5,458 | 5,884 | 6,297 | 6,749 | 7,153 | 7,538 |
| COUNTY-OTHER | 651 | 754 | 855 | 962 | 1,062 | 1,155 |
| **RIO GRANDE BASIN TOTAL** | **8,692** | **9,445** | **10,174** | **10,972** | **11,688** | **12,367** |
| **PRESIDIO COUNTY TOTAL** | **8,692** | **9,445** | **10,174** | **10,972** | **11,688** | **12,367** |
| TERRELL COUNTY WCID 1 | 870 | 890 | 890 | 890 | 890 | 890 |
| COUNTY-OTHER | 175 | 179 | 179 | 179 | 179 | 179 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Population

| | WUG POPULATION | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| RIO GRANDE BASIN TOTAL | 1,045 | 1,069 | 1,069 | 1,069 | 1,069 | 1,069 |
| TERRELL COUNTY TOTAL | 1,045 | 1,069 | 1,069 | 1,069 | 1,069 | 1,069 |
| REGION E POPULATION TOTAL | 954,035 | 1,086,164 | 1,208,309 | 1,329,384 | 1,443,855 | 1,551,438 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Demand

| | WUG DEMAND (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| ALPINE | 1,934 | 1,944 | 1,935 | 1,933 | 1,937 | 1,940 |
| LAJITAS MUNICIPAL SERVICES | 103 | 104 | 103 | 103 | 104 | 104 |
| MARATHON WATER SUPPLY & SEWER SERVICE | 124 | 126 | 126 | 127 | 127 | 127 |
| COUNTY-OTHER | 411 | 431 | 433 | 436 | 439 | 442 |
| LIVESTOCK | 347 | 347 | 347 | 347 | 347 | 347 |
| IRRIGATION | 2,006 | 2,006 | 2,006 | 2,006 | 2,006 | 2,006 |
| **RIO GRANDE BASIN TOTAL** | **4,925** | **4,958** | **4,950** | **4,952** | **4,960** | **4,966** |
| **BREWSTER COUNTY TOTAL** | **4,925** | **4,958** | **4,950** | **4,952** | **4,960** | **4,966** |
| VAN HORN | 662 | 711 | 737 | 760 | 774 | 783 |
| COUNTY-OTHER | 65 | 69 | 71 | 73 | 74 | 75 |
| MANUFACTURING | 5 | 6 | 6 | 6 | 6 | 6 |
| MINING | 2,119 | 2,853 | 3,006 | 2,723 | 2,456 | 2,253 |
| LIVESTOCK | 270 | 270 | 270 | 270 | 270 | 270 |
| IRRIGATION | 37,863 | 37,863 | 37,863 | 37,863 | 37,863 | 37,863 |
| **RIO GRANDE BASIN TOTAL** | **40,984** | **41,772** | **41,953** | **41,695** | **41,443** | **41,250** |
| **CULBERSON COUNTY TOTAL** | **40,984** | **41,772** | **41,953** | **41,695** | **41,443** | **41,250** |
| ANTHONY | 770 | 905 | 1,033 | 1,163 | 1,291 | 1,412 |
| EAST BIGGS WATER SYSTEM | 798 | 798 | 798 | 798 | 798 | 798 |
| EAST MONTANA WATER SYSTEM | 806 | 891 | 974 | 1,064 | 1,155 | 1,241 |
| EL PASO COUNTY TORNILLO WID | 320 | 312 | 306 | 303 | 303 | 304 |
| EL PASO COUNTY WCID 4 | 810 | 793 | 781 | 783 | 798 | 816 |
| EL PASO WATER | 110,572 | 120,315 | 129,713 | 139,978 | 150,601 | 160,792 |
| FEDERAL CORRECTIONAL INSTITUTION LA TUNA | 352 | 345 | 342 | 340 | 339 | 339 |
| FORT BLISS WATER SERVICES | 4,881 | 4,921 | 5,024 | 5,182 | 5,331 | 5,481 |
| HACIENDAS DEL NORTE WID | 196 | 218 | 240 | 262 | 285 | 306 |
| HORIZON REGIONAL MUD | 7,936 | 11,043 | 13,962 | 16,868 | 19,630 | 22,235 |
| LOWER VALLEY WATER DISTRICT | 5,714 | 6,563 | 7,398 | 8,290 | 9,189 | 10,045 |
| PASEO DEL ESTE MUD 1 | 1,054 | 1,167 | 1,278 | 1,397 | 1,515 | 1,629 |
| COUNTY-OTHER \| VINTON HILLS ESTATES | 64 | 85 | 104 | 124 | 144 | 162 |
| COUNTY-OTHER \| VINTON HILLS SUBDIVISION | 149 | 197 | 242 | 290 | 334 | 376 |
| COUNTY-OTHER | 2,086 | 2,758 | 3,395 | 4,055 | 4,680 | 5,272 |
| MANUFACTURING | 7,028 | 8,157 | 8,157 | 8,157 | 8,157 | 8,157 |
| MINING | 4,008 | 4,626 | 5,262 | 5,948 | 6,693 | 7,539 |
| STEAM ELECTRIC POWER | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 |
| LIVESTOCK | 171 | 171 | 171 | 171 | 171 | 171 |
| IRRIGATION | 149,570 | 149,570 | 149,570 | 149,570 | 149,570 | 149,570 |
| **RIO GRANDE BASIN TOTAL** | **307,830** | **324,380** | **339,295** | **355,288** | **371,529** | **387,190** |
| **EL PASO COUNTY TOTAL** | **307,830** | **324,380** | **339,295** | **355,288** | **371,529** | **387,190** |
| ESPERANZA WATER SERVICE | 142 | 152 | 153 | 154 | 155 | 156 |
| HUDSPETH COUNTY WCID 1 | 142 | 151 | 152 | 153 | 154 | 155 |
| COUNTY-OTHER \| DELL CITY | 45 | 47 | 47 | 47 | 47 | 47 |
| COUNTY-OTHER \| FORT HANCOCK WCID | 114 | 119 | 119 | 119 | 120 | 121 |
| COUNTY-OTHER | 58 | 61 | 61 | 61 | 61 | 62 |
| MINING | 479 | 451 | 468 | 483 | 492 | 502 |
| LIVESTOCK | 437 | 437 | 437 | 437 | 437 | 437 |
| IRRIGATION | 115,542 | 115,542 | 115,542 | 115,542 | 115,542 | 115,542 |

*A single asterisk next to a WUG's name denotes that the WUG is split by more than one planning region.

# Region E Water User Group (WUG) Demand

| | WUG DEMAND (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| **RIO GRANDE BASIN TOTAL** | **116,959** | **116,960** | **116,979** | **116,996** | **117,008** | **117,022** |
| **HUDSPETH COUNTY TOTAL** | **116,959** | **116,960** | **116,979** | **116,996** | **117,008** | **117,022** |
| FORT DAVIS WSC | 319 | 314 | 309 | 307 | 307 | 307 |
| COUNTY-OTHER \| CITY OF VALENTINE | 29 | 28 | 28 | 27 | 27 | 27 |
| COUNTY-OTHER | 124 | 120 | 117 | 115 | 115 | 115 |
| MINING | 153 | 153 | 153 | 153 | 153 | 153 |
| LIVESTOCK | 397 | 397 | 397 | 397 | 397 | 397 |
| IRRIGATION | 665 | 665 | 665 | 665 | 665 | 665 |
| **RIO GRANDE BASIN TOTAL** | **1,687** | **1,677** | **1,669** | **1,664** | **1,664** | **1,664** |
| **JEFF DAVIS COUNTY TOTAL** | **1,687** | **1,677** | **1,669** | **1,664** | **1,664** | **1,664** |
| MARFA | 690 | 735 | 781 | 841 | 895 | 947 |
| PRESIDIO | 738 | 772 | 808 | 856 | 905 | 953 |
| COUNTY-OTHER | 100 | 112 | 123 | 139 | 153 | 166 |
| MINING | 403 | 0 | 0 | 0 | 0 | 0 |
| LIVESTOCK | 328 | 328 | 328 | 328 | 328 | 328 |
| IRRIGATION | 4,006 | 4,006 | 4,006 | 4,006 | 4,006 | 4,006 |
| **RIO GRANDE BASIN TOTAL** | **6,265** | **5,953** | **6,046** | **6,170** | **6,287** | **6,400** |
| **PRESIDIO COUNTY TOTAL** | **6,265** | **5,953** | **6,046** | **6,170** | **6,287** | **6,400** |
| TERRELL COUNTY WCID 1 | 178 | 178 | 178 | 177 | 177 | 177 |
| COUNTY-OTHER | 21 | 21 | 20 | 20 | 20 | 20 |
| MINING | 673 | 776 | 740 | 606 | 483 | 385 |
| LIVESTOCK | 151 | 151 | 151 | 151 | 151 | 151 |
| IRRIGATION | 751 | 751 | 751 | 751 | 751 | 751 |
| **RIO GRANDE BASIN TOTAL** | **1,774** | **1,877** | **1,840** | **1,705** | **1,582** | **1,484** |
| **TERRELL COUNTY TOTAL** | **1,774** | **1,877** | **1,840** | **1,705** | **1,582** | **1,484** |
| **REGION E DEMAND TOTAL** | **480,424** | **497,577** | **512,732** | **528,470** | **544,473** | **559,976** |

*A single asterisk next to a WUG's name denotes that the WUG is split by more than one planning region.

# Region E Water User Group (WUG) Category Summary

| MUNICIPAL | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| POPULATION | 933,773 | 1,060,481 | 1,177,848 | 1,294,222 | 1,404,294 | 1,507,762 |
| DEMAND (acre-feet per year) | 139,241 | 153,458 | 167,131 | 181,839 | 196,770 | 211,047 |
| EXISTING SUPPLIES (acre-feet per year) | 170,312 | 170,312 | 170,312 | 170,312 | 170,312 | 170,312 |
| NEEDS (acre-feet per year)* | 4,067 | 8,023 | 11,777 | 24,553 | 38,837 | 52,489 |

| COUNTY-OTHER | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| POPULATION | 20,262 | 25,683 | 30,461 | 35,162 | 39,561 | 43,676 |
| DEMAND (acre-feet per year) | 3,266 | 4,048 | 4,760 | 5,506 | 6,214 | 6,885 |
| EXISTING SUPPLIES (acre-feet per year) | 8,778 | 8,778 | 8,778 | 8,778 | 8,778 | 8,778 |
| NEEDS (acre-feet per year)* | 35 | 38 | 38 | 52 | 116 | 177 |

| MANUFACTURING | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| DEMAND (acre-feet per year) | 7,033 | 8,163 | 8,163 | 8,163 | 8,163 | 8,163 |
| EXISTING SUPPLIES (acre-feet per year) | 7,303 | 7,303 | 7,303 | 7,303 | 7,303 | 7,303 |
| NEEDS (acre-feet per year)* | 0 | 860 | 860 | 860 | 860 | 860 |

| MINING | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| DEMAND (acre-feet per year) | 7,835 | 8,859 | 9,629 | 9,913 | 10,277 | 10,832 |
| EXISTING SUPPLIES (acre-feet per year) | 7,231 | 7,231 | 7,231 | 7,231 | 7,231 | 7,231 |
| NEEDS (acre-feet per year)* | 2,530 | 3,223 | 3,840 | 4,407 | 5,038 | 5,796 |

| STEAM ELECTRIC POWER | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| DEMAND (acre-feet per year) | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 |
| EXISTING SUPPLIES (acre-feet per year) | 3,285 | 3,285 | 3,285 | 3,285 | 3,285 | 3,285 |
| NEEDS (acre-feet per year)* | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 |

| LIVESTOCK | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| DEMAND (acre-feet per year) | 2,101 | 2,101 | 2,101 | 2,101 | 2,101 | 2,101 |
| EXISTING SUPPLIES (acre-feet per year) | 2,391 | 2,391 | 2,391 | 2,391 | 2,391 | 2,391 |
| NEEDS (acre-feet per year)* | 0 | 0 | 0 | 0 | 0 | 0 |

| IRRIGATION | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| DEMAND (acre-feet per year) | 310,403 | 310,403 | 310,403 | 310,403 | 310,403 | 310,403 |
| EXISTING SUPPLIES (acre-feet per year) | 286,318 | 286,318 | 280,793 | 280,793 | 280,793 | 280,793 |
| NEEDS (acre-feet per year)* | 41,737 | 41,737 | 47,262 | 47,262 | 47,262 | 47,262 |

*WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Category Summary report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG category level, calculated surpluses are updated to zero so that only the WUGs with needs in the decade are included with the Needs totals.

# Region E Source Availability

| GROUNDWATER SOURCE TYPE | | | | SOURCE AVAILABILITY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOURCE NAME | COUNTY | BASIN | SALINITY * | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| BONE SPRING-VICTORIO PEAK AQUIFER | HUDSPETH | RIO GRANDE | FRESH/ BRACKISH | 101,400 | 101,400 | 101,400 | 101,400 | 101,400 | 101,400 |
| CAPITAN REEF COMPLEX AQUIFER | BREWSTER | RIO GRANDE | FRESH/ BRACKISH | 583 | 583 | 583 | 583 | 583 | 583 |
| CAPITAN REEF COMPLEX AQUIFER | CULBERSON | RIO GRANDE | FRESH/ BRACKISH | 7,580 | 7,580 | 7,580 | 7,580 | 7,580 | 7,580 |
| CAPITAN REEF COMPLEX AQUIFER | HUDSPETH | RIO GRANDE | FRESH/ BRACKISH | 8,695 | 8,695 | 8,695 | 8,695 | 8,695 | 8,695 |
| CAPITAN REEF COMPLEX AQUIFER | JEFF DAVIS | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS | JEFF DAVIS | RIO GRANDE | FRESH | 374 | 374 | 374 | 374 | 374 | 374 |
| EDWARDS-TRINITY-PLATEAU AQUIFER | BREWSTER | RIO GRANDE | FRESH/ BRACKISH | 1,394 | 1,394 | 1,394 | 1,394 | 1,394 | 1,394 |
| EDWARDS-TRINITY-PLATEAU AQUIFER | CULBERSON | RIO GRANDE | FRESH | 399 | 399 | 399 | 399 | 399 | 399 |
| EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | TERRELL | RIO GRANDE | FRESH | 1,420 | 1,420 | 1,420 | 1,420 | 1,420 | 1,420 |
| HUECO-MESILLA BOLSON AQUIFER | EL PASO | RIO GRANDE | FRESH/ BRACKISH | 435,000 | 435,000 | 435,000 | 435,000 | 435,000 | 435,000 |
| HUECO-MESILLA BOLSON AQUIFER | HUDSPETH | RIO GRANDE | FRESH/ BRACKISH | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 |
| IGNEOUS AQUIFER | BREWSTER | RIO GRANDE | FRESH | 2,586 | 2,586 | 2,585 | 2,583 | 2,583 | 2,582 |
| IGNEOUS AQUIFER | CULBERSON | RIO GRANDE | FRESH | 99 | 99 | 99 | 99 | 99 | 99 |
| IGNEOUS AQUIFER | JEFF DAVIS | RIO GRANDE | FRESH | 4,584 | 4,584 | 4,584 | 4,584 | 4,584 | 4,584 |
| IGNEOUS AQUIFER | PRESIDIO | RIO GRANDE | FRESH | 4,064 | 4,064 | 4,064 | 4,063 | 4,063 | 4,063 |
| MARATHON AQUIFER | BREWSTER | RIO GRANDE | FRESH | 7,327 | 7,327 | 7,327 | 7,327 | 7,327 | 7,327 |
| OTHER AQUIFER | BREWSTER | RIO GRANDE | FRESH | 1,896 | 1,896 | 1,896 | 1,896 | 1,896 | 1,896 |
| OTHER AQUIFER | EL PASO | RIO GRANDE | BRACKISH | 57,922 | 57,922 | 57,922 | 57,922 | 57,922 | 57,922 |
| OTHER AQUIFER | HUDSPETH | RIO GRANDE | BRACKISH | 52,478 | 52,478 | 52,478 | 52,478 | 52,478 | 52,478 |
| OTHER AQUIFER | HUDSPETH | RIO GRANDE | FRESH | 26,400 | 26,400 | 26,400 | 26,400 | 26,400 | 26,400 |
| RUSTLER AQUIFER | BREWSTER | RIO GRANDE | BRACKISH/SALINE | 0 | 0 | 0 | 0 | 0 | 0 |
| RUSTLER AQUIFER | CULBERSON | RIO GRANDE | BRACKISH/SALINE | 53 | 53 | 53 | 53 | 53 | 53 |
| RUSTLER AQUIFER | JEFF DAVIS | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| WEST TEXAS BOLSONS AQUIFER | CULBERSON | RIO GRANDE | BRACKISH | 16,851 | 16,851 | 16,851 | 16,851 | 16,851 | 16,851 |
| WEST TEXAS BOLSONS AQUIFER | CULBERSON | RIO GRANDE | FRESH/ BRACKISH | 35,749 | 35,678 | 35,601 | 35,550 | 35,476 | 35,409 |
| WEST TEXAS BOLSONS AQUIFER | HUDSPETH | RIO GRANDE | BRACKISH | 429 | 429 | 429 | 429 | 429 | 429 |
| WEST TEXAS BOLSONS AQUIFER | HUDSPETH | RIO GRANDE | FRESH/ BRACKISH | 4,582 | 4,582 | 4,582 | 4,582 | 4,582 | 4,582 |
| WEST TEXAS BOLSONS AQUIFER | JEFF DAVIS | RIO GRANDE | FRESH/ BRACKISH | 6,324 | 6,324 | 6,258 | 6,229 | 6,196 | 6,161 |
| WEST TEXAS BOLSONS AQUIFER | PRESIDIO | RIO GRANDE | FRESH | 9,112 | 8,982 | 8,834 | 8,710 | 8,571 | 8,436 |
| WEST TEXAS BOLSONS AQUIFER | PRESIDIO | RIO GRANDE | FRESH/ BRACKISH | 7,743 | 7,743 | 7,743 | 7,743 | 7,743 | 7,743 |
| **GROUNDWATER SOURCE AVAILABILITY TOTAI** | | | | **840,044** | **839,843** | **839,551** | **839,344** | **839,098** | **838,860** |

| REUSE SOURCE TYPE | | | | SOURCE AVAILABILITY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOURCE NAME | COUNTY | BASIN | SALINITY * | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| DIRECT REUSE | BREWSTER | RIO GRANDE | BRACKISH | 84 | 84 | 84 | 84 | 84 | 84 |

* Salinity field indicates whether the source availability is considered 'fresh' (less than 1,000 mg/L), 'brackish' (1,000 to 10,000 mg/L), 'saline' (10,001 mg/L to 34,999 mg/L), or 'seawater' (35,000 mg/L or greater). Sources can also be labeled as 'fresh/brackish' or 'brackish/saline', if a combination of the salinity types is appropriate.

** Since reservoir sources can exist across multiple counties, the county field value, 'reservoir' is applied to all reservoir sources.

# Region E Source Availability

| REUSE SOURCE TYPE | | | | SOURCE AVAILABILITY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOURCE NAME | COUNTY | BASIN | SALINITY * | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| DIRECT REUSE | EL PASO | RIO GRANDE | FRESH | 13,748 | 15,025 | 16,150 | 17,374 | 18,530 | 19,836 |
| INDIRECT REUSE | EL PASO | RIO GRANDE | FRESH | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 |
| INDIRECT REUSE | HUDSPETH | RIO GRANDE | FRESH | 334 | 334 | 334 | 334 | 334 | 334 |
| **REUSE SOURCE AVAILABILITY TOTAI** | | | | **48,335** | **49,612** | **50,737** | **51,961** | **53,117** | **54,423** |

| SURFACE WATERSOURCE TYPE | | | | SOURCE AVAILABILITY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOURCE NAME | COUNTY | BASIN | SALINITY * | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| RIO GRANDE RUN-OF-RIVER | BREWSTER | RIO GRANDE | FRESH | 7,774 | 7,774 | 7,774 | 7,774 | 7,774 | 7,774 |
| RIO GRANDE RUN-OF-RIVER | EL PASO | RIO GRANDE | FRESH | 46,605 | 46,605 | 46,605 | 46,605 | 46,605 | 46,605 |
| RIO GRANDE RUN-OF-RIVER | HUDSPETH | RIO GRANDE | FRESH | 725 | 725 | 725 | 725 | 725 | 725 |
| RIO GRANDE RUN-OF-RIVER | PRESIDIO | RIO GRANDE | FRESH | 10,218 | 10,218 | 10,218 | 10,218 | 10,218 | 10,218 |
| RIO GRANDE RUN-OF-RIVER | TERRELL | RIO GRANDE | FRESH | 441 | 441 | 441 | 441 | 441 | 441 |
| **SURFACE WATERSOURCE AVAILABILITY TOTAI** | | | | **65,763** | **65,763** | **65,763** | **65,763** | **65,763** | **65,763** |

| | | | | | |
|---|---|---|---|---|---|
| **REGION E SOURCE AVAILABILITY TOTAI** | **954,142** | **955,218** | **956,051** | **957,068** | **957,978** | **959,046** |

* Salinity field indicates whether the source availability is considered 'fresh' (less than 1,000 mg/L), 'brackish' (1,000 to 10,000 mg/L), 'saline' (10,001 mg/L to 34,999 mg/L), or 'seawater' (35,000 mg/L or greater). Sources can also be labeled as 'fresh/brackish' or 'brackish/saline', if a combination of the salinity types is appropriate.

** Since reservoir sources can exist across multiple counties, the county field value, 'reservoir' is applied to all reservoir sources.

# Region E Water User Group (WUG) Existing Water Supply

| WUG NAME | SOURCE REGION | SOURCE DESCRIPTION | EXISTING SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| ALPINE | E | DIRECT REUSE | 59 | 59 | 59 | 59 | 59 | 59 |
| ALPINE | E | IGNEOUS AQUIFER \| BREWSTER COUNTY | 1,238 | 1,238 | 1,238 | 1,238 | 1,238 | 1,238 |
| ALPINE | E | IGNEOUS AQUIFER \| JEFF DAVIS COUNTY | 1,234 | 1,234 | 1,234 | 1,234 | 1,234 | 1,234 |
| LAJITAS MUNICIPAL SERVICES | E | OTHER AQUIFER \| BREWSTER COUNTY | 331 | 331 | 331 | 331 | 331 | 331 |
| MARATHON WATER SUPPLY & SEWER SERVICE | E | MARATHON AQUIFER \| BREWSTER COUNTY | 242 | 242 | 242 | 242 | 242 | 242 |
| COUNTY-OTHER | E | EDWARDS-TRINITY-PLATEAU AQUIFER \| BREWSTER COUNTY | 23 | 23 | 23 | 23 | 23 | 23 |
| COUNTY-OTHER | E | IGNEOUS AQUIFER \| BREWSTER COUNTY | 446 | 446 | 446 | 446 | 446 | 446 |
| COUNTY-OTHER | E | OTHER AQUIFER \| BREWSTER COUNTY | 217 | 217 | 217 | 217 | 217 | 217 |
| LIVESTOCK | E | CAPITAN REEF COMPLEX AQUIFER \| BREWSTER COUNTY | 30 | 30 | 30 | 30 | 30 | 30 |
| LIVESTOCK | E | EDWARDS-TRINITY-PLATEAU AQUIFER \| BREWSTER COUNTY | 97 | 97 | 97 | 97 | 97 | 97 |
| LIVESTOCK | E | IGNEOUS AQUIFER \| BREWSTER COUNTY | 112 | 112 | 112 | 112 | 112 | 112 |
| LIVESTOCK | E | MARATHON AQUIFER \| BREWSTER COUNTY | 15 | 15 | 15 | 15 | 15 | 15 |
| LIVESTOCK | E | OTHER AQUIFER \| BREWSTER COUNTY | 112 | 112 | 112 | 112 | 112 | 112 |
| IRRIGATION | E | IGNEOUS AQUIFER \| BREWSTER COUNTY | 291 | 291 | 291 | 291 | 291 | 291 |
| IRRIGATION | E | MARATHON AQUIFER \| BREWSTER COUNTY | 309 | 309 | 309 | 309 | 309 | 309 |
| IRRIGATION | E | OTHER AQUIFER \| BREWSTER COUNTY | 1,236 | 1,236 | 1,236 | 1,236 | 1,236 | 1,236 |
| IRRIGATION | E | RIO GRANDE RUN-OF-RIVER | 1,551 | 1,551 | 1,551 | 1,551 | 1,551 | 1,551 |
| | | **RIO GRANDE BASIN TOTAL** | **7,543** | **7,543** | **7,543** | **7,543** | **7,543** | **7,543** |
| | | **BREWSTER COUNTY TOTAL** | **7,543** | **7,543** | **7,543** | **7,543** | **7,543** | **7,543** |
| VAN HORN | E | WEST TEXAS BOLSONS AQUIFER \| CULBERSON COUNTY | 1,016 | 1,016 | 1,016 | 1,016 | 1,016 | 1,016 |
| COUNTY-OTHER | E | EDWARDS-TRINITY-PLATEAU AQUIFER \| CULBERSON COUNTY | 3 | 3 | 3 | 3 | 3 | 3 |
| COUNTY-OTHER | E | RUSTLER AQUIFER \| CULBERSON COUNTY | 2 | 2 | 2 | 2 | 2 | 2 |
| COUNTY-OTHER | E | WEST TEXAS BOLSONS AQUIFER \| CULBERSON COUNTY | 152 | 152 | 152 | 152 | 152 | 152 |
| MANUFACTURING | E | WEST TEXAS BOLSONS AQUIFER \| CULBERSON COUNTY | 6 | 6 | 6 | 6 | 6 | 6 |
| MINING | E | CAPITAN REEF COMPLEX AQUIFER \| CULBERSON COUNTY | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| MINING | E | RUSTLER AQUIFER \| CULBERSON COUNTY | 0 | 0 | 0 | 0 | 0 | 0 |
| MINING | E | WEST TEXAS BOLSONS AQUIFER \| CULBERSON COUNTY | 2,045 | 2,045 | 2,045 | 2,045 | 2,045 | 2,045 |
| LIVESTOCK | E | CAPITAN REEF COMPLEX AQUIFER \| CULBERSON COUNTY | 55 | 55 | 55 | 55 | 55 | 55 |
| LIVESTOCK | E | EDWARDS-TRINITY-PLATEAU AQUIFER \| CULBERSON COUNTY | 20 | 20 | 20 | 20 | 20 | 20 |
| LIVESTOCK | E | IGNEOUS AQUIFER \| CULBERSON COUNTY | 15 | 15 | 15 | 15 | 15 | 15 |
| LIVESTOCK | E | RUSTLER AQUIFER \| CULBERSON COUNTY | 31 | 31 | 31 | 31 | 31 | 31 |
| LIVESTOCK | E | WEST TEXAS BOLSONS AQUIFER \| CULBERSON COUNTY | 164 | 164 | 164 | 164 | 164 | 164 |
| IRRIGATION | E | CAPITAN REEF COMPLEX AQUIFER \| CULBERSON COUNTY | 5,525 | 5,525 | 0 | 0 | 0 | 0 |
| IRRIGATION | E | WEST TEXAS BOLSONS AQUIFER \| CULBERSON COUNTY | 32,005 | 32,005 | 32,005 | 32,005 | 32,005 | 32,005 |
| | | **RIO GRANDE BASIN TOTAL** | **43,039** | **43,039** | **37,514** | **37,514** | **37,514** | **37,514** |
| | | **CULBERSON COUNTY TOTAL** | **43,039** | **43,039** | **37,514** | **37,514** | **37,514** | **37,514** |
| ANTHONY | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 1,532 | 1,532 | 1,532 | 1,532 | 1,532 | 1,532 |
| EAST BIGGS WATER SYSTEM | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 1,242 | 1,242 | 1,242 | 1,242 | 1,242 | 1,242 |
| EAST MONTANA WATER SYSTEM | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 1,241 | 1,241 | 1,241 | 1,241 | 1,241 | 1,241 |
| EL PASO COUNTY TORNILLO WID | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 807 | 807 | 807 | 807 | 807 | 807 |
| EL PASO COUNTY WCID 4 | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 1,855 | 1,855 | 1,855 | 1,855 | 1,855 | 1,855 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Existing Water Supply

| WUG NAME | SOURCE REGION | SOURCE DESCRIPTION | EXISTING SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| EL PASO WATER | E | DIRECT REUSE | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| EL PASO WATER | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 115,000 | 115,000 | 115,000 | 115,000 | 115,000 | 115,000 |
| EL PASO WATER | E | RIO GRANDE RUN-OF-RIVER | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| FEDERAL CORRECTIONAL INSTITUTION LA TUNA | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 2,016 | 2,016 | 2,016 | 2,016 | 2,016 | 2,016 |
| FORT BLISS WATER SERVICES | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 7,158 | 7,158 | 7,158 | 7,158 | 7,158 | 7,158 |
| HACIENDAS DEL NORTE WID | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 306 | 306 | 306 | 306 | 306 | 306 |
| HORIZON REGIONAL MUD | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 3,649 | 3,649 | 3,649 | 3,649 | 3,649 | 3,649 |
| HORIZON REGIONAL MUD | E | OTHER AQUIFER \| EL PASO COUNTY | 1,578 | 1,578 | 1,578 | 1,578 | 1,578 | 1,578 |
| LOWER VALLEY WATER DISTRICT | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 |
| PASEO DEL ESTE MUD 1 | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 1,629 | 1,629 | 1,629 | 1,629 | 1,629 | 1,629 |
| COUNTY-OTHER \| VINTON HILLS ESTATES | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 120 | 120 | 120 | 120 | 120 | 120 |
| COUNTY-OTHER \| VINTON HILLS SUBDIVISION | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 280 | 280 | 280 | 280 | 280 | 280 |
| COUNTY-OTHER | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 6,278 | 6,278 | 6,278 | 6,278 | 6,278 | 6,278 |
| MANUFACTURING | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 7,297 | 7,297 | 7,297 | 7,297 | 7,297 | 7,297 |
| MINING | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 810 | 810 | 810 | 810 | 810 | 810 |
| MINING | E | OTHER AQUIFER \| EL PASO COUNTY | 1,347 | 1,347 | 1,347 | 1,347 | 1,347 | 1,347 |
| STEAM ELECTRIC POWER | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 3,285 | 3,285 | 3,285 | 3,285 | 3,285 | 3,285 |
| LIVESTOCK | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 205 | 205 | 205 | 205 | 205 | 205 |
| LIVESTOCK | E | OTHER AQUIFER \| EL PASO COUNTY | 33 | 33 | 33 | 33 | 33 | 33 |
| IRRIGATION | E | HUECO-MESILLA BOLSON AQUIFER \| EL PASO COUNTY | 7,392 | 7,392 | 7,392 | 7,392 | 7,392 | 7,392 |
| IRRIGATION | E | OTHER AQUIFER \| EL PASO COUNTY | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 |
| IRRIGATION | E | RIO GRANDE INDIRECT REUSE | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 |
| IRRIGATION | E | RIO GRANDE RUN-OF-RIVER | 36,605 | 36,605 | 36,605 | 36,605 | 36,605 | 36,605 |
| | | **RIO GRANDE BASIN TOTAL** | **286,190** | **286,190** | **286,190** | **286,190** | **286,190** | **286,190** |
| | | **EL PASO COUNTY TOTAL** | **286,190** | **286,190** | **286,190** | **286,190** | **286,190** | **286,190** |
| ESPERANZA WATER SERVICE | E | HUECO-MESILLA BOLSON AQUIFER \| HUDSPETH COUNTY | 484 | 484 | 484 | 484 | 484 | 484 |
| HUDSPETH COUNTY WCID 1 | E | WEST TEXAS BOLSONS AQUIFER \| CULBERSON COUNTY | 532 | 532 | 532 | 532 | 532 | 532 |
| COUNTY-OTHER \| DELL CITY | E | BONE SPRING-VICTORIO PEAK AQUIFER \| HUDSPETH COUNTY | 63 | 63 | 63 | 63 | 63 | 63 |
| COUNTY-OTHER \| FORT HANCOCK WCID | E | OTHER AQUIFER \| HUDSPETH COUNTY | 270 | 270 | 270 | 270 | 270 | 270 |
| COUNTY-OTHER | E | HUECO-MESILLA BOLSON AQUIFER \| HUDSPETH COUNTY | 23 | 23 | 23 | 23 | 23 | 23 |
| MINING | E | HUECO-MESILLA BOLSON AQUIFER \| HUDSPETH COUNTY | 52 | 52 | 52 | 52 | 52 | 52 |
| MINING | E | OTHER AQUIFER \| HUDSPETH COUNTY | 21 | 21 | 21 | 21 | 21 | 21 |
| MINING | E | WEST TEXAS BOLSONS AQUIFER \| HUDSPETH COUNTY | 210 | 210 | 210 | 210 | 210 | 210 |
| LIVESTOCK | E | BONE SPRING-VICTORIO PEAK AQUIFER \| HUDSPETH COUNTY | 84 | 84 | 84 | 84 | 84 | 84 |
| LIVESTOCK | E | CAPITAN REEF COMPLEX AQUIFER \| HUDSPETH COUNTY | 7 | 7 | 7 | 7 | 7 | 7 |
| LIVESTOCK | E | HUECO-MESILLA BOLSON AQUIFER \| HUDSPETH COUNTY | 11 | 11 | 11 | 11 | 11 | 11 |
| LIVESTOCK | E | OTHER AQUIFER \| HUDSPETH COUNTY | 281 | 281 | 281 | 281 | 281 | 281 |
| LIVESTOCK | E | WEST TEXAS BOLSONS AQUIFER \| HUDSPETH COUNTY | 77 | 77 | 77 | 77 | 77 | 77 |
| IRRIGATION | E | BONE SPRING-VICTORIO PEAK AQUIFER \| HUDSPETH COUNTY | 68,495 | 68,495 | 68,495 | 68,495 | 68,495 | 68,495 |
| IRRIGATION | E | CAPITAN REEF COMPLEX AQUIFER \| HUDSPETH COUNTY | 4,213 | 4,213 | 4,213 | 4,213 | 4,213 | 4,213 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Existing Water Supply

| WUG NAME | SOURCE REGION | SOURCE DESCRIPTION | EXISTING SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| IRRIGATION | E | OTHER AQUIFER \| HUDSPETH COUNTY | 52,187 | 52,187 | 52,187 | 52,187 | 52,187 | 52,187 |
| IRRIGATION | E | RIO GRANDE INDIRECT REUSE | 334 | 334 | 334 | 334 | 334 | 334 |
| IRRIGATION | E | RIO GRANDE RUN-OF-RIVER | 725 | 725 | 725 | 725 | 725 | 725 |
| | | **RIO GRANDE BASIN TOTAL** | **128,069** | **128,069** | **128,069** | **128,069** | **128,069** | **128,069** |
| | | **HUDSPETH COUNTY TOTAL** | **128,069** | **128,069** | **128,069** | **128,069** | **128,069** | **128,069** |
| FORT DAVIS WSC | E | IGNEOUS AQUIFER \| JEFF DAVIS COUNTY | 468 | 468 | 468 | 468 | 468 | 468 |
| COUNTY-OTHER \| CITY OF VALENTINE | E | WEST TEXAS BOLSONS AQUIFER \| JEFF DAVIS COUNTY | 29 | 29 | 29 | 29 | 29 | 29 |
| COUNTY-OTHER | E | EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS \| JEFF DAVIS COUNTY | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER | E | IGNEOUS AQUIFER \| JEFF DAVIS COUNTY | 315 | 315 | 315 | 315 | 315 | 315 |
| MINING | E | IGNEOUS AQUIFER \| JEFF DAVIS COUNTY | 153 | 153 | 153 | 153 | 153 | 153 |
| LIVESTOCK | E | EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS \| JEFF DAVIS COUNTY | 108 | 108 | 108 | 108 | 108 | 108 |
| LIVESTOCK | E | IGNEOUS AQUIFER \| JEFF DAVIS COUNTY | 299 | 299 | 299 | 299 | 299 | 299 |
| LIVESTOCK | E | WEST TEXAS BOLSONS AQUIFER \| JEFF DAVIS COUNTY | 63 | 63 | 63 | 63 | 63 | 63 |
| IRRIGATION | E | EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS \| JEFF DAVIS COUNTY | 70 | 70 | 70 | 70 | 70 | 70 |
| IRRIGATION | E | IGNEOUS AQUIFER \| JEFF DAVIS COUNTY | 735 | 735 | 735 | 735 | 735 | 735 |
| IRRIGATION | E | WEST TEXAS BOLSONS AQUIFER \| JEFF DAVIS COUNTY | 561 | 561 | 561 | 561 | 561 | 561 |
| | | **RIO GRANDE BASIN TOTAL** | **2,801** | **2,801** | **2,801** | **2,801** | **2,801** | **2,801** |
| | | **JEFF DAVIS COUNTY TOTAL** | **2,801** | **2,801** | **2,801** | **2,801** | **2,801** | **2,801** |
| MARFA | E | IGNEOUS AQUIFER \| PRESIDIO COUNTY | 2,097 | 2,097 | 2,097 | 2,097 | 2,097 | 2,097 |
| PRESIDIO | E | WEST TEXAS BOLSONS AQUIFER \| PRESIDIO COUNTY | 3,766 | 3,766 | 3,766 | 3,766 | 3,766 | 3,766 |
| COUNTY-OTHER | E | IGNEOUS AQUIFER \| PRESIDIO COUNTY | 289 | 289 | 289 | 289 | 289 | 289 |
| COUNTY-OTHER | E | WEST TEXAS BOLSONS AQUIFER \| PRESIDIO COUNTY | 193 | 193 | 193 | 193 | 193 | 193 |
| MINING | E | WEST TEXAS BOLSONS AQUIFER \| PRESIDIO COUNTY | 403 | 403 | 403 | 403 | 403 | 403 |
| LIVESTOCK | E | IGNEOUS AQUIFER \| PRESIDIO COUNTY | 224 | 224 | 224 | 224 | 224 | 224 |
| LIVESTOCK | E | WEST TEXAS BOLSONS AQUIFER \| PRESIDIO COUNTY | 142 | 142 | 142 | 142 | 142 | 142 |
| IRRIGATION | E | IGNEOUS AQUIFER \| PRESIDIO COUNTY | 605 | 605 | 605 | 605 | 605 | 605 |
| IRRIGATION | E | RIO GRANDE RUN-OF-RIVER | 6,140 | 6,140 | 6,140 | 6,140 | 6,140 | 6,140 |
| IRRIGATION | E | WEST TEXAS BOLSONS AQUIFER \| PRESIDIO COUNTY | 2,256 | 2,256 | 2,256 | 2,256 | 2,256 | 2,256 |
| | | **RIO GRANDE BASIN TOTAL** | **16,115** | **16,115** | **16,115** | **16,115** | **16,115** | **16,115** |
| | | **PRESIDIO COUNTY TOTAL** | **16,115** | **16,115** | **16,115** | **16,115** | **16,115** | **16,115** |
| TERRELL COUNTY WCID 1 | E | EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS \| TERRELL COUNTY | 476 | 476 | 476 | 476 | 476 | 476 |
| COUNTY-OTHER | E | EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS \| TERRELL COUNTY | 75 | 75 | 75 | 75 | 75 | 75 |
| MINING | E | EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS \| TERRELL COUNTY | 190 | 190 | 190 | 190 | 190 | 190 |
| LIVESTOCK | E | EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS \| TERRELL COUNTY | 206 | 206 | 206 | 206 | 206 | 206 |
| IRRIGATION | E | EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS \| TERRELL COUNTY | 473 | 473 | 473 | 473 | 473 | 473 |
| IRRIGATION | E | RIO GRANDE RUN-OF-RIVER | 441 | 441 | 441 | 441 | 441 | 441 |
| | | **RIO GRANDE BASIN TOTAL** | **1,861** | **1,861** | **1,861** | **1,861** | **1,861** | **1,861** |
| | | **TERRELL COUNTY TOTAL** | **1,861** | **1,861** | **1,861** | **1,861** | **1,861** | **1,861** |
| | | **REGION E EXISTING WATER SUPPLY TOTAL** | **485,618** | **485,618** | **480,093** | **480,093** | **480,093** | **480,093** |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Needs/Surplus

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Needs/Surplus report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Surplus volumes are shown as positive values, and needs are shown as negative values in parentheses.

| | (NEEDS)/SURPLUS (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| **BREWSTER COUNTY - RIO GRANDE BASIN** | | | | | | |
| ALPINE | 597 | 587 | 596 | 598 | 594 | 591 |
| LAJITAS MUNICIPAL SERVICES | 228 | 227 | 228 | 228 | 227 | 227 |
| MARATHON WATER SUPPLY & SEWER SERVICE | 118 | 116 | 116 | 115 | 115 | 115 |
| COUNTY-OTHER | 275 | 255 | 253 | 250 | 247 | 244 |
| LIVESTOCK | 19 | 19 | 19 | 19 | 19 | 19 |
| IRRIGATION | 1,381 | 1,381 | 1,381 | 1,381 | 1,381 | 1,381 |
| **CULBERSON COUNTY - RIO GRANDE BASIN** | | | | | | |
| VAN HORN | 354 | 305 | 279 | 256 | 242 | 233 |
| COUNTY-OTHER | 92 | 88 | 86 | 84 | 83 | 82 |
| MANUFACTURING | 1 | 0 | 0 | 0 | 0 | 0 |
| MINING | 1,926 | 1,192 | 1,039 | 1,322 | 1,589 | 1,792 |
| LIVESTOCK | 15 | 15 | 15 | 15 | 15 | 15 |
| IRRIGATION | (333) | (333) | (5,858) | (5,858) | (5,858) | (5,858) |
| **EL PASO COUNTY - RIO GRANDE BASIN** | | | | | | |
| ANTHONY | 762 | 627 | 499 | 369 | 241 | 120 |
| EAST BIGGS WATER SYSTEM | 444 | 444 | 444 | 444 | 444 | 444 |
| EAST MONTANA WATER SYSTEM | 435 | 350 | 267 | 177 | 86 | 0 |
| EL PASO COUNTY TORNILLO WID | 487 | 495 | 501 | 504 | 504 | 503 |
| EL PASO COUNTY WCID 4 | 1,045 | 1,062 | 1,074 | 1,072 | 1,057 | 1,039 |
| EL PASO WATER | 20,428 | 10,685 | 1,287 | (8,978) | (19,601) | (29,792) |
| FEDERAL CORRECTIONAL INSTITUTION LA TUNA | 1,664 | 1,671 | 1,674 | 1,676 | 1,677 | 1,677 |
| FORT BLISS WATER SERVICES | 2,277 | 2,237 | 2,134 | 1,976 | 1,827 | 1,677 |
| HACIENDAS DEL NORTE WID | 110 | 88 | 66 | 44 | 21 | 0 |
| HORIZON REGIONAL MUD | (2,709) | (5,816) | (8,735) | (11,641) | (14,403) | (17,008) |
| LOWER VALLEY WATER DISTRICT | (1,358) | (2,207) | (3,042) | (3,934) | (4,833) | (5,689) |
| PASEO DEL ESTE MUD 1 | 575 | 462 | 351 | 232 | 114 | 0 |
| COUNTY-OTHER \| VINTON HILLS ESTATES | 56 | 35 | 16 | (4) | (24) | (42) |
| COUNTY-OTHER \| VINTON HILLS SUBDIVISION | 131 | 83 | 38 | (10) | (54) | (96) |
| COUNTY-OTHER | 4,192 | 3,520 | 2,883 | 2,223 | 1,598 | 1,006 |
| MANUFACTURING | 269 | (860) | (860) | (860) | (860) | (860) |
| MINING | (1,851) | (2,469) | (3,105) | (3,791) | (4,536) | (5,382) |
| STEAM ELECTRIC POWER | (7,260) | (7,260) | (7,260) | (7,260) | (7,260) | (7,260) |
| LIVESTOCK | 67 | 67 | 67 | 67 | 67 | 67 |
| IRRIGATION | (41,404) | (41,404) | (41,404) | (41,404) | (41,404) | (41,404) |
| **HUDSPETH COUNTY - RIO GRANDE BASIN** | | | | | | |
| ESPERANZA WATER SERVICE | 342 | 332 | 331 | 330 | 329 | 328 |
| HUDSPETH COUNTY WCID 1 | 390 | 381 | 380 | 379 | 378 | 377 |
| COUNTY-OTHER \| DELL CITY | 18 | 16 | 16 | 16 | 16 | 16 |
| COUNTY-OTHER \| FORT HANCOCK WCID | 156 | 151 | 151 | 151 | 150 | 149 |
| COUNTY-OTHER | (35) | (38) | (38) | (38) | (38) | (39) |
| MINING | (196) | (168) | (185) | (200) | (209) | (219) |
| LIVESTOCK | 23 | 23 | 23 | 23 | 23 | 23 |
| IRRIGATION | 10,412 | 10,412 | 10,412 | 10,412 | 10,412 | 10,412 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Needs/Surplus

| | | | | | | |
|---|---|---|---|---|---|---|
| **JEFF DAVIS COUNTY - RIO GRANDE BASIN** | | | | | | |
| FORT DAVIS WSC | 149 | 154 | 159 | 161 | 161 | 161 |
| COUNTY-OTHER \| CITY OF VALENTINE | 0 | 1 | 1 | 2 | 2 | 2 |
| COUNTY-OTHER | 191 | 195 | 198 | 200 | 200 | 200 |
| MINING | 0 | 0 | 0 | 0 | 0 | 0 |
| LIVESTOCK | 73 | 73 | 73 | 73 | 73 | 73 |
| IRRIGATION | 701 | 701 | 701 | 701 | 701 | 701 |
| **PRESIDIO COUNTY - RIO GRANDE BASIN** | | | | | | |
| MARFA | 1,407 | 1,362 | 1,316 | 1,256 | 1,202 | 1,150 |
| PRESIDIO | 3,028 | 2,994 | 2,958 | 2,910 | 2,861 | 2,813 |
| COUNTY-OTHER | 382 | 370 | 359 | 343 | 329 | 316 |
| MINING | 0 | 403 | 403 | 403 | 403 | 403 |
| LIVESTOCK | 38 | 38 | 38 | 38 | 38 | 38 |
| IRRIGATION | 4,995 | 4,995 | 4,995 | 4,995 | 4,995 | 4,995 |
| **TERRELL COUNTY - RIO GRANDE BASIN** | | | | | | |
| TERRELL COUNTY WCID 1 | 298 | 298 | 298 | 299 | 299 | 299 |
| COUNTY-OTHER | 54 | 54 | 55 | 55 | 55 | 55 |
| MINING | (483) | (586) | (550) | (416) | (293) | (195) |
| LIVESTOCK | 55 | 55 | 55 | 55 | 55 | 55 |
| IRRIGATION | 163 | 163 | 163 | 163 | 163 | 163 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Second-Tier Identified Water Needs

Second-tier needs are WUG split needs adjusted to include the implementation of recommended demand reduction and direct reuse water management strategies.

| | WUG SECOND-TIER NEEDS (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| **BREWSTER COUNTY - RIO GRANDE BASIN** | | | | | | |
| ALPINE | 0 | 0 | 0 | 0 | 0 | 0 |
| LAJITAS MUNICIPAL SERVICES | 0 | 0 | 0 | 0 | 0 | 0 |
| MARATHON WATER SUPPLY & SEWER SERVICE | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER | 0 | 0 | 0 | 0 | 0 | 0 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 0 | 0 | 0 | 0 | 0 | 0 |
| **CULBERSON COUNTY - RIO GRANDE BASIN** | | | | | | |
| VAN HORN | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER | 0 | 0 | 0 | 0 | 0 | 0 |
| MANUFACTURING | 0 | 0 | 0 | 0 | 0 | 0 |
| MINING | 0 | 0 | 0 | 0 | 0 | 0 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 226 | 226 | 5,751 | 5,751 | 5,751 | 5,751 |
| **EL PASO COUNTY - RIO GRANDE BASIN** | | | | | | |
| ANTHONY | 0 | 0 | 0 | 0 | 0 | 0 |
| EAST BIGGS WATER SYSTEM | 0 | 0 | 0 | 0 | 0 | 0 |
| EAST MONTANA WATER SYSTEM | 0 | 0 | 0 | 0 | 0 | 0 |
| EL PASO COUNTY TORNILLO WID | 0 | 0 | 0 | 0 | 0 | 0 |
| EL PASO COUNTY WCID 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| EL PASO WATER | 0 | 0 | 0 | 0 | 0 | 0 |
| FEDERAL CORRECTIONAL INSTITUTION LA TUNA | 0 | 0 | 0 | 0 | 0 | 0 |
| FORT BLISS WATER SERVICES | 0 | 0 | 0 | 0 | 0 | 0 |
| HACIENDAS DEL NORTE WID | 0 | 0 | 0 | 0 | 0 | 0 |
| HORIZON REGIONAL MUD | 2,433 | 5,432 | 8,249 | 11,054 | 13,720 | 16,235 |
| LOWER VALLEY WATER DISTRICT | 1,301 | 2,141 | 2,968 | 3,851 | 4,741 | 5,589 |
| PASEO DEL ESTE MUD 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER \| VINTON HILLS ESTATES | 0 | 0 | 0 | 4 | 24 | 42 |
| COUNTY-OTHER \| VINTON HILLS SUBDIVISION | 0 | 0 | 0 | 10 | 54 | 96 |
| MANUFACTURING | 0 | 430 | 430 | 430 | 430 | 430 |
| MINING | 1,573 | 2,099 | 2,639 | 3,222 | 3,856 | 4,575 |
| STEAM ELECTRIC POWER | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 12,941 | 12,941 | 12,941 | 12,941 | 12,941 | 12,941 |
| **HUDSPETH COUNTY - RIO GRANDE BASIN** | | | | | | |
| ESPERANZA WATER SERVICE | 0 | 0 | 0 | 0 | 0 | 0 |
| HUDSPETH COUNTY WCID 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER \| DELL CITY | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER \| FORT HANCOCK WCID | 0 | 0 | 0 | 0 | 0 | 0 |
| MINING | 167 | 143 | 157 | 170 | 178 | 186 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 0 | 0 | 0 | 0 | 0 | 0 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Second-Tier Identified Water Needs

| | WUG SECOND-TIER NEEDS (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| **JEFF DAVIS COUNTY - RIO GRANDE BASIN** | | | | | | |
| FORT DAVIS WSC | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER \| CITY OF VALENTINE | 0 | 0 | 0 | 0 | 0 | 0 |
| MINING | 0 | 0 | 0 | 0 | 0 | 0 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 0 | 0 | 0 | 0 | 0 | 0 |
| **PRESIDIO COUNTY - RIO GRANDE BASIN** | | | | | | |
| MARFA | 0 | 0 | 0 | 0 | 0 | 0 |
| PRESIDIO | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER | 0 | 0 | 0 | 0 | 0 | 0 |
| MINING | 0 | 0 | 0 | 0 | 0 | 0 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 0 | 0 | 0 | 0 | 0 | 0 |
| **TERRELL COUNTY - RIO GRANDE BASIN** | | | | | | |
| TERRELL COUNTY WCID 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| COUNTY-OTHER | 0 | 0 | 0 | 0 | 0 | 0 |
| MINING | 411 | 498 | 467 | 354 | 249 | 166 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 0 | 0 | 0 | 0 | 0 | 0 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Second-Tier Identified Water Needs Summary

Second-tier needs are WUG split needs adjusted to include the implementation of recommended demand reduction and direct reuse water management strategies.

| WUG CATEGORY | NEEDS (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MUNICIPAL | 3,734 | 7,573 | 11,217 | 14,905 | 18,461 | 21,824 |
| COUNTY-OTHER | 0 | 0 | 0 | 14 | 78 | 138 |
| MANUFACTURING | 0 | 430 | 430 | 430 | 430 | 430 |
| MINING | 2,151 | 2,740 | 3,263 | 3,746 | 4,283 | 4,927 |
| STEAM ELECTRIC POWER | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 13,167 | 13,167 | 18,692 | 18,692 | 18,692 | 18,692 |

# Region E Source Water Balance (Availability - WUG Supply)

| GROUNDWATER SOURCE TYPE | | | | SOURCE WATER BALANCE (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOURCE NAME | COUNTY | BASIN | SALINITY* | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| BONE SPRING-VICTORIO PEAK AQUIFER | HUDSPETH | RIO GRANDE | FRESH/ BRACKISH | 32,758 | 32,758 | 32,758 | 32,758 | 32,758 | 32,758 |
| CAPITAN REEF COMPLEX AQUIFER | BREWSTER | RIO GRANDE | FRESH/ BRACKISH | 553 | 553 | 553 | 553 | 553 | 553 |
| CAPITAN REEF COMPLEX AQUIFER | CULBERSON | RIO GRANDE | FRESH/ BRACKISH | 0 | 0 | 5,525 | 5,525 | 5,525 | 5,525 |
| CAPITAN REEF COMPLEX AQUIFER | HUDSPETH | RIO GRANDE | FRESH/ BRACKISH | 4,475 | 4,475 | 4,475 | 4,475 | 4,475 | 4,475 |
| CAPITAN REEF COMPLEX AQUIFER | JEFF DAVIS | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| EDWARDS-TRINITY-PLATEAU AND PECOS VALLEY AQUIFERS | JEFF DAVIS | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| EDWARDS-TRINITY-PLATEAU AQUIFER | BREWSTER | RIO GRANDE | FRESH/ BRACKISH | 1,274 | 1,274 | 1,274 | 1,274 | 1,274 | 1,274 |
| EDWARDS-TRINITY-PLATEAU AQUIFER | CULBERSON | RIO GRANDE | FRESH | 376 | 376 | 376 | 376 | 376 | 376 |
| EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS | TERRELL | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| HUECO-MESILLA BOLSON AQUIFER | EL PASO | RIO GRANDE | FRESH/ BRACKISH | 268,542 | 268,542 | 268,542 | 268,542 | 268,542 | 268,542 |
| HUECO-MESILLA BOLSON AQUIFER | HUDSPETH | RIO GRANDE | FRESH/ BRACKISH | 44,430 | 44,430 | 44,430 | 44,430 | 44,430 | 44,430 |
| IGNEOUS AQUIFER | BREWSTER | RIO GRANDE | FRESH | 499 | 499 | 498 | 496 | 496 | 495 |
| IGNEOUS AQUIFER | CULBERSON | RIO GRANDE | FRESH | 84 | 84 | 84 | 84 | 84 | 84 |
| IGNEOUS AQUIFER | JEFF DAVIS | RIO GRANDE | FRESH | 644 | 644 | 644 | 644 | 644 | 644 |
| IGNEOUS AQUIFER | PRESIDIO | RIO GRANDE | FRESH | 849 | 849 | 849 | 848 | 848 | 848 |
| MARATHON AQUIFER | BREWSTER | RIO GRANDE | FRESH | 6,761 | 6,761 | 6,761 | 6,761 | 6,761 | 6,761 |
| OTHER AQUIFER | BREWSTER | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| OTHER AQUIFER | EL PASO | RIO GRANDE | BRACKISH | 24,964 | 24,964 | 24,964 | 24,964 | 24,964 | 24,964 |
| OTHER AQUIFER | HUDSPETH | RIO GRANDE | BRACKISH | 0 | 0 | 0 | 0 | 0 | 0 |
| OTHER AQUIFER | HUDSPETH | RIO GRANDE | FRESH | 26,119 | 26,119 | 26,119 | 26,119 | 26,119 | 26,119 |
| RUSTLER AQUIFER | BREWSTER | RIO GRANDE | BRACKISH/SALINE | 0 | 0 | 0 | 0 | 0 | 0 |
| RUSTLER AQUIFER | CULBERSON | RIO GRANDE | BRACKISH/SALINE | 20 | 20 | 20 | 20 | 20 | 20 |
| RUSTLER AQUIFER | JEFF DAVIS | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| WEST TEXAS BOLSONS AQUIFER | CULBERSON | RIO GRANDE | BRACKISH | 16,340 | 16,340 | 16,340 | 16,340 | 16,340 | 16,340 |
| WEST TEXAS BOLSONS AQUIFER | CULBERSON | RIO GRANDE | FRESH/ BRACKISH | 340 | 269 | 192 | 141 | 67 | 0 |
| WEST TEXAS BOLSONS AQUIFER | HUDSPETH | RIO GRANDE | BRACKISH | 219 | 219 | 219 | 219 | 219 | 219 |
| WEST TEXAS BOLSONS AQUIFER | HUDSPETH | RIO GRANDE | FRESH/ BRACKISH | 4,505 | 4,505 | 4,505 | 4,505 | 4,505 | 4,505 |
| WEST TEXAS BOLSONS AQUIFER | JEFF DAVIS | RIO GRANDE | FRESH/ BRACKISH | 5,671 | 5,671 | 5,605 | 5,576 | 5,543 | 5,508 |
| WEST TEXAS BOLSONS AQUIFER | PRESIDIO | RIO GRANDE | FRESH | 7,887 | 7,757 | 7,609 | 7,485 | 7,346 | 7,211 |
| WEST TEXAS BOLSONS AQUIFER | PRESIDIO | RIO GRANDE | FRESH/ BRACKISH | 2,208 | 2,208 | 2,208 | 2,208 | 2,208 | 2,208 |
| **GROUNDWATER SOURCE WATER BALANCE TOTAI** | | | | **449,518** | **449,317** | **454,550** | **454,343** | **454,097** | **453,859** |

| REUSE SOURCE TYPE | | | | SOURCE WATER BALANCE (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOURCE NAME | COUNTY | BASIN | SALINITY* | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| DIRECT REUSE | BREWSTER | RIO GRANDE | BRACKISH | 25 | 25 | 25 | 25 | 25 | 25 |

* Salinity field indicates whether the source availability is considered 'fresh' (less than 1,000 mg/L), 'brackish' (1,000 to 10,000 mg/L), 'saline' (10,001 mg/L to 34,999 mg/L), or 'seawater' (35,000 mg/L or greater). Sources can also be labeled as 'fresh/brackish' or 'brackish/saline', if a combination of the salinity types is appropriate.

** Since reservoir sources can exist across multiple counties, the county field value, 'reservoir' is applied to all reservoir sources.

# Region E Source Water Balance (Availability - WUG Supply)

| REUSE SOURCE TYPE | | | | SOURCE WATER BALANCE (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOURCE NAME | COUNTY | BASIN | SALINITY* | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| DIRECT REUSE | EL PASO | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| INDIRECT REUSE | EL PASO | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| INDIRECT REUSE | HUDSPETH | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| REUSE SOURCE WATER BALANCE TOTAI | | | | 25 | 25 | 25 | 25 | 25 | 25 |

| SURFACE WATERSOURCE TYPE | | | | SOURCE WATER BALANCE (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SOURCE NAME | COUNTY | BASIN | SALINITY* | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| RIO GRANDE RUN-OF-RIVER | BREWSTER | RIO GRANDE | FRESH | 6,223 | 6,223 | 6,223 | 6,223 | 6,223 | 6,223 |
| RIO GRANDE RUN-OF-RIVER | EL PASO | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| RIO GRANDE RUN-OF-RIVER | HUDSPETH | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| RIO GRANDE RUN-OF-RIVER | PRESIDIO | RIO GRANDE | FRESH | 4,078 | 4,078 | 4,078 | 4,078 | 4,078 | 4,078 |
| RIO GRANDE RUN-OF-RIVER | TERRELL | RIO GRANDE | FRESH | 0 | 0 | 0 | 0 | 0 | 0 |
| SURFACE WATERSOURCE WATER BALANCE TOTAI | | | | 10,301 | 10,301 | 10,301 | 10,301 | 10,301 | 10,301 |

| | | | | | |
|---|---|---|---|---|---|
| REGION E SOURCE WATER BALANCE TOTAL | 459,844 | 459,643 | 464,876 | 464,669 | 464,423 | 464,185 |

* Salinity field indicates whether the source availability is considered 'fresh' (less than 1,000 mg/L), 'brackish' (1,000 to 10,000 mg/L), 'saline' (10,001 mg/L to 34,999 mg/L), or 'seawater' (35,000 mg/L or greater). Sources can also be labeled as 'fresh/brackish' or 'brackish/saline', if a combination of the salinity types is appropriate.

** Since reservoir sources can exist across multiple counties, the county field value, 'reservoir' is applied to all reservoir sources.

# Region E Water User Group (WUG) Data Comparison to 2016 Regional Water Plan (RWP)

| | 2020 PLANNING DECADE | | | 2070 PLANNING DECADE | | |
|---|---|---|---|---|---|---|
| | 2016 RWP | 2021 RWP | DIFFERENCE (%) | 2016 RWP | 2021 RWP | DIFFERENCE (%) |
| **BREWSTER COUNTY \| COUNTY-OTHER WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 1,066 | 686 | -35.6% | 1,066 | 686 | -35.6% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 563 | 411 | -27.0% | 594 | 442 | -25.6% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **BREWSTER COUNTY \| IRRIGATION WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 3,272 | 3,387 | 3.5% | 3,272 | 3,387 | 3.5% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 2,304 | 2,006 | -12.9% | 2,247 | 2,006 | -10.7% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **BREWSTER COUNTY \| LIVESTOCK WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 386 | 366 | -5.2% | 386 | 366 | -5.2% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 386 | 347 | -10.1% | 386 | 347 | -10.1% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **BREWSTER COUNTY \| MANUFACTURING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 4 | 0 | -100.0% | 4 | 0 | -100.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 4 | 0 | -100.0% | 4 | 0 | -100.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **BREWSTER COUNTY \| MUNICIPAL WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 2,166 | 3,104 | 43.3% | 2,166 | 3,104 | 43.3% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 1,935 | 2,161 | 11.7% | 1,940 | 2,171 | 11.9% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **CULBERSON COUNTY \| COUNTY-OTHER WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 140 | 157 | 12.1% | 140 | 157 | 12.1% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 65 | 65 | 0.0% | 75 | 75 | 0.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **CULBERSON COUNTY \| IRRIGATION WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 39,985 | 37,530 | -6.1% | 39,985 | 32,005 | -20.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 39,928 | 37,863 | -5.2% | 35,835 | 37,863 | 5.7% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 333 | 100.0% | 0 | 5,858 | 100.0% |
| **CULBERSON COUNTY \| LIVESTOCK WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 300 | 285 | -5.0% | 300 | 285 | -5.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 300 | 270 | -10.0% | 300 | 270 | -10.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **CULBERSON COUNTY \| MANUFACTURING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 0 | 6 | 100.0% | 0 | 6 | 100.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 0 | 5 | 100.0% | 0 | 6 | 100.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **CULBERSON COUNTY \| MINING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 215 | 4,045 | 1781.4% | 215 | 4,045 | 1781.4% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 506 | 2,119 | 318.8% | 640 | 2,253 | 252.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 291 | 0 | -100.0% | 425 | 0 | -100.0% |
| **CULBERSON COUNTY \| MUNICIPAL WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 1,351 | 1,016 | -24.8% | 1,351 | 1,016 | -24.8% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 662 | 662 | 0.0% | 784 | 783 | -0.1% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |

*WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Data Comparison to 2016 RWP report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG county and category level, calculated surpluses are updated to zero so that only the WUGs with needs in the decade are included with the Needs totals.

# Region E Water User Group (WUG) Data Comparison to 2016 Regional Water Plan (RWP)

| | 2020 PLANNING DECADE | | | 2070 PLANNING DECADE | | |
|---|---|---|---|---|---|---|
| | 2016 RWP | 2021 RWP | DIFFERENCE (%) | 2016 RWP | 2021 RWP | DIFFERENCE (%) |
| **EL PASO COUNTY \| COUNTY-OTHER WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 6,278 | 6,678 | 6.4% | 6,278 | 6,678 | 6.4% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 6,646 | 2,299 | -65.4% | 9,023 | 5,810 | -35.6% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 368 | 0 | -100.0% | 2,745 | 138 | -95.0% |
| **EL PASO COUNTY \| IRRIGATION WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 167,633 | 108,166 | -35.5% | 174,328 | 108,166 | -38.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 242,798 | 149,570 | -38.4% | 221,162 | 149,570 | -32.4% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 75,165 | 41,404 | -44.9% | 46,834 | 41,404 | -11.6% |
| **EL PASO COUNTY \| LIVESTOCK WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 629 | 238 | -62.2% | 629 | 238 | -62.2% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 629 | 171 | -72.8% | 629 | 171 | -72.8% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **EL PASO COUNTY \| MANUFACTURING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 7,297 | 7,297 | 0.0% | 7,297 | 7,297 | 0.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 16,138 | 7,028 | -56.5% | 22,347 | 8,157 | -63.5% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 8,841 | 0 | -100.0% | 15,050 | 860 | -94.3% |
| **EL PASO COUNTY \| MINING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 5,706 | 2,157 | -62.2% | 5,706 | 2,157 | -62.2% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 4,008 | 4,008 | 0.0% | 7,539 | 7,539 | 0.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 1,851 | 100.0% | 1,833 | 5,382 | 193.6% |
| **EL PASO COUNTY \| MUNICIPAL WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 145,803 | 158,369 | 8.6% | 145,803 | 158,369 | 8.6% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 129,266 | 134,209 | 3.8% | 200,292 | 205,398 | 2.5% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 5,255 | 4,067 | -22.6% | 55,266 | 52,489 | -5.0% |
| **EL PASO COUNTY \| STEAM ELECTRIC POWER WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 3,286 | 3,285 | 0.0% | 3,286 | 3,285 | 0.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 6,937 | 10,545 | 52.0% | 15,937 | 10,545 | -33.8% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 3,651 | 7,260 | 98.8% | 12,651 | 7,260 | -42.6% |
| **HUDSPETH COUNTY \| COUNTY-OTHER WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 916 | 356 | -61.1% | 916 | 356 | -61.1% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 347 | 217 | -37.5% | 368 | 230 | -37.5% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 35 | 100.0% | 0 | 39 | 100.0% |
| **HUDSPETH COUNTY \| IRRIGATION WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 83,993 | 125,954 | 50.0% | 83,993 | 125,954 | 50.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 178,840 | 115,542 | -35.4% | 161,053 | 115,542 | -28.3% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 94,847 | 0 | -100.0% | 77,060 | 0 | -100.0% |
| **HUDSPETH COUNTY \| LIVESTOCK WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 541 | 460 | -15.0% | 541 | 460 | -15.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 541 | 437 | -19.2% | 541 | 437 | -19.2% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **HUDSPETH COUNTY \| MANUFACTURING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 10 | 0 | -100.0% | 10 | 0 | -100.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 2 | 0 | -100.0% | 2 | 0 | -100.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |

*WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Data Comparison to 2016 RWP report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG county and category level, calculated surpluses are updated to zero so that only the WUGs with needs in the decade are included with the Needs totals.

# Region E Water User Group (WUG) Data Comparison to 2016 Regional Water Plan (RWP)

| | 2020 PLANNING DECADE | | | 2070 PLANNING DECADE | | |
|---|---|---|---|---|---|---|
| | 2016 RWP | 2021 RWP | DIFFERENCE (%) | 2016 RWP | 2021 RWP | DIFFERENCE (%) |
| **HUDSPETH COUNTY \| MINING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 481 | 283 | -41.2% | 481 | 283 | -41.2% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 479 | 479 | 0.0% | 502 | 502 | 0.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 196 | 100.0% | 21 | 219 | 942.9% |
| **HUDSPETH COUNTY \| MUNICIPAL WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 842 | 1,016 | 20.7% | 842 | 1,016 | 20.7% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 151 | 284 | 88.1% | 169 | 311 | 84.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **JEFF DAVIS COUNTY \| COUNTY-OTHER WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 672 | 344 | -48.8% | 672 | 344 | -48.8% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 168 | 153 | -8.9% | 155 | 142 | -8.4% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **JEFF DAVIS COUNTY \| IRRIGATION WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 3,357 | 1,366 | -59.3% | 3,357 | 1,366 | -59.3% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 2,560 | 665 | -74.0% | 2,490 | 665 | -73.3% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **JEFF DAVIS COUNTY \| LIVESTOCK WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 495 | 470 | -5.1% | 495 | 470 | -5.1% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 495 | 397 | -19.8% | 495 | 397 | -19.8% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **JEFF DAVIS COUNTY \| MINING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 0 | 153 | 100.0% | 0 | 153 | 100.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 0 | 153 | 100.0% | 0 | 153 | 100.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **JEFF DAVIS COUNTY \| MUNICIPAL WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 343 | 468 | 36.4% | 343 | 468 | 36.4% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 297 | 319 | 7.4% | 285 | 307 | 7.7% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **PRESIDIO COUNTY \| COUNTY-OTHER WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 588 | 482 | -18.0% | 588 | 482 | -18.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 249 | 100 | -59.8% | 361 | 166 | -54.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **PRESIDIO COUNTY \| IRRIGATION WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 9,001 | 9,001 | 0.0% | 9,001 | 9,001 | 0.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 4,630 | 4,006 | -13.5% | 4,197 | 4,006 | -4.6% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **PRESIDIO COUNTY \| LIVESTOCK WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 408 | 366 | -10.3% | 408 | 366 | -10.3% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 408 | 328 | -19.6% | 408 | 328 | -19.6% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **PRESIDIO COUNTY \| MINING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 403 | 403 | 0.0% | 403 | 403 | 0.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 403 | 403 | 0.0% | 0 | 0 | 0.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |

*WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Data Comparison to 2016 RWP report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG county and category level, calculated surpluses are updated to zero so that only the WUGs with needs in the decade are included with the Needs totals.

# Region E Water User Group (WUG) Data Comparison to 2016 Regional Water Plan (RWP)

| | 2020 PLANNING DECADE | | | 2070 PLANNING DECADE | | |
|---|---|---|---|---|---|---|
| | 2016 RWP | 2021 RWP | DIFFERENCE (%) | 2016 RWP | 2021 RWP | DIFFERENCE (%) |
| **PRESIDIO COUNTY \| MUNICIPAL WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 5,363 | 5,863 | 9.3% | 5,363 | 5,863 | 9.3% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 1,248 | 1,428 | 14.4% | 1,659 | 1,900 | 14.5% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **TERRELL COUNTY \| COUNTY-OTHER WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 61 | 75 | 23.0% | 61 | 75 | 23.0% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 19 | 21 | 10.5% | 19 | 20 | 5.3% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **TERRELL COUNTY \| IRRIGATION WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 1,091 | 914 | -16.2% | 1,091 | 914 | -16.2% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 379 | 751 | 98.2% | 337 | 751 | 122.8% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **TERRELL COUNTY \| LIVESTOCK WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 238 | 206 | -13.4% | 238 | 206 | -13.4% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 238 | 151 | -36.6% | 238 | 151 | -36.6% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **TERRELL COUNTY \| MINING WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 224 | 190 | -15.2% | 224 | 190 | -15.2% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 673 | 673 | 0.0% | 385 | 385 | 0.0% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 449 | 483 | 7.6% | 161 | 195 | 21.1% |
| **TERRELL COUNTY \| MUNICIPAL WUG TYPE** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 527 | 476 | -9.7% | 527 | 476 | -9.7% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 202 | 178 | -11.9% | 199 | 177 | -11.1% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 0 | 0 | 0.0% | 0 | 0 | 0.0% |
| **REGION E** | | | | | | |
| EXISTING WUG SUPPLY TOTAL (acre-feet per year) | 495,071 | 485,618 | -1.9% | 501,766 | 480,093 | -4.3% |
| PROJECTED DEMAND TOTAL (acre-feet per year) | 645,404 | 480,424 | -25.6% | 693,597 | 559,976 | -19.3% |
| WATER SUPPLY NEEDS TOTAL (acre-feet per year)* | 188,867 | 55,629 | -70.5% | 212,046 | 113,844 | -46.3% |

*WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The needs shown in the WUG Data Comparison to 2016 RWP report are calculated by first deducting the WUG split's projected demand from its total existing water supply volume. If the WUG split has a greater existing supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG county and category level, calculated surpluses are updated to zero so that only the WUGs with needs in the decade are included with the Needs totals.

# Region E Source Data Comparison to 2016 Regional Water Plan (RWP)

| | 2020 PLANNING DECADE | | | 2070 PLANNING DECADE | | |
|---|---|---|---|---|---|---|
| | 2016 RWP | 2021 RWP | DIFFERENCE (%) | 2016 RWP | 2021 RWP | DIFFERENCE (%) |
| **BREWSTER COUNTY** | | | | | | |
| GROUNDWATER AVAILABILITY TOTAL (acre-feet per year | 16,207 | 13,786 | -14.9% | 16,202 | 13,782 | -14.9% |
| SURFACE WATER AVAILABILITY TOTAL (acre-feet per year | 8,101 | 7,774 | -4.0% | 8,101 | 7,774 | -4.0% |
| **CULBERSON COUNTY** | | | | | | |
| GROUNDWATER AVAILABILITY TOTAL (acre-feet per year | 63,433 | 60,731 | -4.3% | 63,193 | 60,391 | -4.4% |
| **EL PASO COUNTY** | | | | | | |
| GROUNDWATER AVAILABILITY TOTAL (acre-feet per year | 610,380 | 492,922 | -19.2% | 610,380 | 492,922 | -19.2% |
| REUSE AVAILABILITY TOTAL (acre-feet per year | 37,002 | 47,917 | 29.5% | 47,102 | 54,005 | 14.7% |
| SURFACE WATER AVAILABILITY TOTAL (acre-feet per year | 69,683 | 46,605 | -33.1% | 69,683 | 46,605 | -33.1% |
| **HUDSPETH COUNTY** | | | | | | |
| GROUNDWATER AVAILABILITY TOTAL (acre-feet per year | 168,761 | 238,984 | 41.6% | 168,761 | 238,984 | 41.6% |
| REUSE AVAILABILITY TOTAL (acre-feet per year | 334 | 334 | 0.0% | 334 | 334 | 0.0% |
| SURFACE WATER AVAILABILITY TOTAL (acre-feet per year | 1,471 | 725 | -50.7% | 1,471 | 725 | -50.7% |
| **JEFF DAVIS COUNTY** | | | | | | |
| GROUNDWATER AVAILABILITY TOTAL (acre-feet per year | 20,509 | 11,282 | -45.0% | 20,396 | 11,119 | -45.5% |
| **PRESIDIO COUNTY** | | | | | | |
| GROUNDWATER AVAILABILITY TOTAL (acre-feet per year | 20,540 | 20,919 | 1.8% | 20,067 | 20,242 | 0.9% |
| SURFACE WATER AVAILABILITY TOTAL (acre-feet per year | 10,894 | 10,218 | -6.2% | 10,894 | 10,218 | -6.2% |
| **TERRELL COUNTY** | | | | | | |
| GROUNDWATER AVAILABILITY TOTAL (acre-feet per year | 1,421 | 1,420 | -0.1% | 1,421 | 1,420 | -0.1% |
| SURFACE WATER AVAILABILITY TOTAL (acre-feet per year | 720 | 441 | -38.8% | 720 | 441 | -38.8% |
| **REGION E** | | | | | | |
| GROUNDWATER AVAILABILITY TOTAL (acre-feet per year | 901,251 | 840,044 | -6.8% | 900,420 | 838,860 | -6.8% |
| REUSE AVAILABILITY TOTAL (acre-feet per year | 37,336 | 48,251 | 29.2% | 47,436 | 54,339 | 14.6% |
| SURFACE WATER AVAILABILITY TOTAL (acre-feet per year | 90,869 | 65,763 | -27.6% | 90,869 | 65,763 | -27.6% |

* Since reservoir sources can exist across multiple counties, the county field value, 'reservoir' is applied to all reservoir sources.

# Region E Water User Group (WUG) Unmet Needs

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The unmet needs shown in the WUG Unmet Needs report are calculated by first deducting the WUG split's projected demand from the sum of its total existing water supply volume and all associated recommended water management strategy water volumes. If the WUG split has a greater future supply volume than projected demand in any given decade, this amount is considered a surplus volume. In order to display only unmet needs associated with the WUG split, these surplus volumes are updated to a zero and the unmet needs water volumes are shown as absolute values.

| | WUG UNMET NEEDS (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| **CULBERSON COUNTY - RIO GRANDE BASIN** | | | | | | |
| IRRIGATION | 0 | 0 | 5,418 | 5,418 | 5,418 | 5,418 |
| **EL PASO COUNTY - RIO GRANDE BASIN** | | | | | | |
| HORIZON REGIONAL MUD | 0 | 0 | 0 | 0 | 0 | 1,195 |
| COUNTY-OTHER \| VINTON HILLS SUBDIVISION | 0 | 0 | 0 | 10 | 54 | 96 |
| MINING | 0 | 0 | 0 | 0 | 0 | 324 |
| IRRIGATION | 4,691 | 4,691 | 4,691 | 4,691 | 4,691 | 4,691 |
| **TERRELL COUNTY - RIO GRANDE BASIN** | | | | | | |
| MINING | 411 | 498 | 467 | 354 | 249 | 166 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Water User Group (WUG) Unmet Needs Summary

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. The unmet needs shown in the WUG Unmet Needs Summary report are calculated by first deducting the WUG split's projected demand from the sum of its total existing water supply volume and all associated recommended water management strategy water volumes. If the WUG split has a greater future supply volume than projected demand in any given decade, this amount is considered a surplus volume. Before aggregating the difference between supplies and demands to the WUG category level, calculated surpluses are updated to zerc so that only the WUGs with unmet needs in the decade are included with the Needs totals. Unmet needs water volumes are shown as absolute values.

| WUG CATEGORY | NEEDS (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MUNICIPAL | 0 | 0 | 0 | 0 | 0 | 1,195 |
| COUNTY-OTHER | 0 | 0 | 0 | 10 | 54 | 96 |
| MANUFACTURING | 0 | 0 | 0 | 0 | 0 | 0 |
| MINING | 411 | 498 | 467 | 354 | 249 | 490 |
| STEAM ELECTRIC POWER | 0 | 0 | 0 | 0 | 0 | 0 |
| LIVESTOCK | 0 | 0 | 0 | 0 | 0 | 0 |
| IRRIGATION | 4,691 | 4,691 | 10,109 | 10,109 | 10,109 | 10,109 |

# Region E Recommended Water User Group (WUG) Water Management Strategies (WMS)

| | | | | | | WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WUG ENTITY NAME | WMS SPONSOR REGION | WMS NAME | SOURCE NAME | UNIT COST 2020 | UNIT COST 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| ALPINE | E | CITY OF ALPINE - IRRIGATION APPLICATION OF CAPTURED RAINWATER RUNOFF | DEMAND REDUCTION | $30 | $24 | 70 | 70 | 70 | 70 | 70 | 70 |
| ALPINE | E | CITY OF ALPINE - MODIFICATION TO WASTEWATER TREATMENT FACILITY & IRRIGATION SYSTEM | E \| DIRECT NON-POTABLE REUSE | $178 | $74 | 25 | 25 | 25 | 25 | 25 | 25 |
| ANTHONY | E | TOWN OF ANTHONY - ADDITIONAL GROUNDWATER WELL | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | $200 | $65 | 960 | 960 | 960 | 960 | 960 | 960 |
| ANTHONY | E | TOWN OF ANTHONY - ARSENIC TREATMENT FACILITY | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | $562 | $302 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 |
| COUNTY-OTHER, BREWSTER | E | BREWSTER COUNTY OTHER - STUDY BUTTE TERLINGUA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR | DEMAND REDUCTION | $8600 | $8600 | 25 | 25 | 25 | 25 | 25 | 25 |
| COUNTY-OTHER, BREWSTER | E | MARATHON WSSSERVICE - WATER LOSS AUDIT AND MAIN-LINE REPAIR | DEMAND REDUCTION | $1500 | $1500 | 12 | 12 | 12 | 12 | 12 | 12 |
| COUNTY-OTHER, EL PASO | E | EL PASO COUNTY OTHER - (VINTON HILLS) - HIGH CAPACITY WATER LINES FOR IMPROVED DISTRIBUTION OF WATER | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | N/A | $320 | 0 | 0 | 0 | 400 | 400 | 400 |
| COUNTY-OTHER, EL PASO | E | EL PASO COUNTY OTHER - (VINTON HILLS) - PURCHASE WATER FROM EPW | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | N/A | $1041 | 0 | 0 | 0 | 14 | 77 | 137 |
| COUNTY-OTHER, EL PASO | E | EL PASO COUNTY-OTHER - PUBLIC CONSERVATION EDUCATION | DEMAND REDUCTION | $919 | $404 | 2 | 3 | 3 | 4 | 5 | 5 |
| COUNTY-OTHER, HUDSPETH | E | DELL CITY - BRACKISH GROUNDWATER DESALINATION FACILITY | E \| BONE SPRING-VICTORIO PEAK AQUIFER FRESH/BRACKISH \| HUDSPETH COUNTY | $2964 | $1928 | 111 | 111 | 111 | 111 | 111 | 111 |
| COUNTY-OTHER, HUDSPETH | E | HUDSPETH COUNTY - HUDSPETH CO. WCID #1 - GROUNDWATER WELL NE OF VAN HORN | E \| WEST TEXAS BOLSONS AQUIFER FRESH/BRACKISH \| CULBERSON COUNTY | $4385 | N/A | 39 | 39 | 39 | 39 | 39 | 0 |
| COUNTY-OTHER, HUDSPETH | E | HUDSPETH COUNTY - HUDSPETH CO. WCID #1 - REPLACE WATER SUPPLY LINE FROM VAN HORN | DEMAND REDUCTION | $37282 | $4026 | 39 | 39 | 39 | 39 | 39 | 39 |
| COUNTY-OTHER, HUDSPETH | E | HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - GROUNDWATER WELL WEST OF VAN HORN | E \| OTHER AQUIFER \| HUDSPETH COUNTY | $1333 | $179 | 39 | 39 | 39 | 39 | 39 | 39 |
| COUNTY-OTHER, HUDSPETH | E | HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - LOCAL GROUNDWATER WELL | E \| OTHER AQUIFER \| HUDSPETH COUNTY | $8375 | $4375 | 16 | 16 | 16 | 16 | 16 | 16 |
| COUNTY-OTHER, HUDSPETH | E | HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - PUBLIC CONSERVATION EDUCATION | DEMAND REDUCTION | $402 | $371 | 1 | 2 | 2 | 2 | 2 | 2 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Recommended Water User Group (WUG) Water Management Strategies (WMS)

| | | | | | | WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WUG ENTITY NAME | WMS SPONSOR REGION | WMS NAME | SOURCE NAME | UNIT COST 2020 | UNIT COST 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| COUNTY-OTHER, JEFF DAVIS | E | TOWN OF VALENTINE - ADDITIONAL GROUNDWATER WELL | E \| WEST TEXAS BOLSONS AQUIFER FRESH/BRACKISH \| JEFF DAVIS COUNTY | $574 | $147 | 129 | 129 | 129 | 129 | 129 | 129 |
| EAST MONTANA WATER SYSTEM | E | EAST MONTANA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR | DEMAND REDUCTION | $1756 | $1143 | 41 | 46 | 50 | 54 | 59 | 63 |
| EL PASO COUNTY TORNILLO WID | E | EL PASO CO. TORNILLO WID - ADDITIONAL GROUNDWATER WELL AND TRANSMISSION LINE | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | $676 | $240 | 333 | 333 | 333 | 333 | 333 | 333 |
| EL PASO WATER | E | EPW - ADVANCED PURIFIED WATER AT THE BUSTAMANTE WWTP | E \| DIRECT NON-POTABLE REUSE | $1718 | $771 | 8,500 | 9,200 | 9,900 | 10,600 | 10,600 | 10,600 |
| EL PASO WATER | E | EPW - ADVANCED PURIFIED WATER AT THE HASKELL STREET RWP | E \| DIRECT NON-POTABLE REUSE | N/A | $2948 | 0 | 0 | 0 | 0 | 0 | 8,900 |
| EL PASO WATER | E | EPW - ADVANCED WATER PURIFICATION AT THE FRED HERVEY WWTP | E \| DIRECT NON-POTABLE REUSE | N/A | $808 | 0 | 0 | 10,000 | 10,000 | 10,000 | 10,000 |
| EL PASO WATER | E | EPW - EXPANSION OF THE KAY BAILEY HUTCHISON DESAL PLANT | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | N/A | $888 | 0 | 0 | 0 | 0 | 5,000 | 5,000 |
| EL PASO WATER | E | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1) | E \| CAPITAN REEF COMPLEX AQUIFER FRESH/BRACKISH \| CULBERSON COUNTY | N/A | $692 | 0 | 0 | 5,525 | 5,525 | 5,525 | 5,525 |
| EL PASO WATER | E | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1) | E \| CAPITAN REEF COMPLEX AQUIFER FRESH/BRACKISH \| HUDSPETH COUNTY | N/A | $692 | 0 | 0 | 4,475 | 4,475 | 4,475 | 4,475 |
| EL PASO WATER | E | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 2) | E \| BONE SPRING-VICTORIO PEAK AQUIFER FRESH/BRACKISH \| HUDSPETH COUNTY | N/A | $1548 | 0 | 0 | 0 | 10,000 | 10,000 | 10,000 |
| EL PASO WATER | E | EPW - HUECO BOLSON ARTIFICIAL RECHARGE | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | N/A | $251 | 0 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| EL PASO WATER | E | EPW - MUNICIPAL CONSERVATION PROGRAM | DEMAND REDUCTION | $216 | $60 | 4,950 | 5,530 | 5,080 | 9,940 | 13,140 | 17,820 |
| EL PASO WATER | E | EPW - RIVERSIDE REGULATING RESERVOIR | E \| REGULATING LAKE/RESERVOIR | N/A | $51 | 0 | 0 | 3,250 | 3,250 | 3,250 | 3,250 |
| FORT DAVIS WSC | E | FORT DAVIS WSC - ADDITIONAL GROUNDWATER WELL | E \| IGNEOUS AQUIFER \| JEFF DAVIS COUNTY | $285 | $135 | 274 | 274 | 274 | 274 | 274 | 274 |
| FORT DAVIS WSC | E | FORT DAVIS WSC - TRANSMISSION LINE TO CONNECT FORT DAVIS WSC TO FORT DAVIS ESTATES | E \| IGNEOUS AQUIFER \| JEFF DAVIS COUNTY | $1263 | $228 | 114 | 114 | 114 | 114 | 114 | 114 |
| HACIENDAS DEL NORTE WID | E | HACIENDAS DEL NORTE WID - WATER LOSS AUDIT AND MAIN-LINE REPAIR | DEMAND REDUCTION | $4500 | $2842 | 12 | 13 | 15 | 16 | 17 | 19 |
| HORIZON REGIONAL MUD | E | HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESAL PLANT | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | $895 | $594 | 7,460 | 7,460 | 7,460 | 7,460 | 7,460 | 7,460 |
| HORIZON REGIONAL MUD | E | HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESAL PLANT | E \| OTHER AQUIFER BRACKISH \| EL PASO COUNTY | $895 | $594 | 9,326 | 9,326 | 9,326 | 9,326 | 9,326 | 9,326 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Recommended Water User Group (WUG) Water Management Strategies (WMS)

| | | | | | | WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WUG ENTITY NAME | WMS SPONSOR REGION | WMS NAME | SOURCE NAME | UNIT COST 2020 | UNIT COST 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| HORIZON REGIONAL MUD | E | HORIZON REGIONAL MUD - PUBLIC CONSERVATION EDUCATION | DEMAND REDUCTION | $248 | $99 | 79 | 110 | 140 | 169 | 196 | 222 |
| HORIZON REGIONAL MUD | E | HORIZON REGIONAL MUD - WATER LOSS AUDIT AND MAIN-LINE REPAIR | DEMAND REDUCTION | $91 | $33 | 197 | 274 | 346 | 418 | 487 | 551 |
| IRRIGATION, CULBERSON | E | CULBERSON COUNTY IRRIGATION - ADDITIONAL GROUNDWATER WELL IN THE WEST TEXAS BOLSONS AQUIFER | E \| WEST TEXAS BOLSONS AQUIFER BRACKISH \| CULBERSON COUNTY | $162 | $54 | 333 | 333 | 333 | 333 | 333 | 333 |
| IRRIGATION, CULBERSON | E | CULBERSON COUNTY IRRIGATION - IRRIGATION SCHEDULING | DEMAND REDUCTION | $0 | $0 | 107 | 107 | 107 | 107 | 107 | 107 |
| IRRIGATION, EL PASO | E | EPCWID #1 - IMPROVEMENTS TO WATER DISTRICT DELIVERY SYSTEM | DEMAND REDUCTION | $9 | $9 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 |
| IRRIGATION, EL PASO | E | EPCWID #1 - IRRIGATION SCHEDULING | DEMAND REDUCTION | $59 | $59 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 |
| IRRIGATION, EL PASO | E | EPCWID #1 - NEW WASTEWAY 32 RIVER DIVERSON PUMPING PLANT | E \| RIO GRANDE RUN-OF-RIVER | $18 | $3 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| IRRIGATION, EL PASO | E | EPCWID #1 - RIVERSIDE REGULATING RESERVOIR | E \| REGULATING LAKE/RESERVOIR | $368 | $51 | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 |
| IRRIGATION, EL PASO | E | EPCWID #1 - TAILWATER REUSE | DEMAND REDUCTION | $565 | $565 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 |
| IRRIGATION, HUDSPETH | E | HUDSPETH IRRIGATION - HCUWCD #1 - IRRIGATION SCHEDULING | DEMAND REDUCTION | $82 | $82 | 3,535 | 3,535 | 3,535 | 3,535 | 3,535 | 3,535 |
| IRRIGATION, HUDSPETH | E | HUDSPETH IRRIGATION - HCUWCD #1 - TAILWATER REUSE | DEMAND REDUCTION | $352 | $352 | 589 | 589 | 589 | 589 | 589 | 589 |
| LAJITAS MUNICIPAL SERVICES | E | LAJITAS MUNICIPAL SERVICES - WATER LOSS AUDIT AND MAIN-LINE REPAIR | DEMAND REDUCTION | $3510 | $3510 | 51 | 51 | 51 | 51 | 51 | 51 |
| LOWER VALLEY WATER DISTRICT | E | LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | $1470 | $1096 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 |
| LOWER VALLEY WATER DISTRICT | E | LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER | E \| OTHER AQUIFER BRACKISH \| EL PASO COUNTY | $1505 | $1099 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 |
| LOWER VALLEY WATER DISTRICT | E | LVWD - PUBLIC CONSERVATION EDUCATION | DEMAND REDUCTION | $5950 | $570 | 57 | 66 | 74 | 83 | 92 | 100 |
| LOWER VALLEY WATER DISTRICT | E | LVWD - PURCHASE WATER FROM EPW | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | $436 | $436 | 1,344 | 2,185 | 3,012 | 3,895 | 4,785 | 5,632 |
| LOWER VALLEY WATER DISTRICT | E | LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINE | E \| RIO GRANDE RUN-OF-RIVER | $1491 | $445 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| LOWER VALLEY WATER DISTRICT | E | LVWD - WASTEWATER TREATMENT FACILITY AND ASR | E \| HUECO-MESILLA BOLSON AQUIFER ASR FRESH/BRACKISH \| EL PASO COUNTY | $508 | $212 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 |
| MANUFACTURING, EL PASO | E | EL PASO COUNTY (MANUFACTURING) - CONSERVATION | DEMAND REDUCTION | N/A | $0 | 0 | 430 | 430 | 430 | 430 | 430 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Recommended Water User Group (WUG) Water Management Strategies (WMS)

| | | | | | | WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WUG ENTITY NAME | WMS SPONSOR REGION | WMS NAME | SOURCE NAME | UNIT COST 2020 | UNIT COST 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MANUFACTURING, EL PASO | E | EL PASO COUNTY (MANUFACTURING) - PURCHASE WATER FROM EPW | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | N/A | $1168 | 0 | 860 | 860 | 860 | 860 | 860 |
| MINING, EL PASO | E | EL PASO CO. MINING - ADDITIONAL GROUNDWATER WELLS | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | $41 | $21 | 4,251 | 4,251 | 4,251 | 4,251 | 4,251 | 4,251 |
| MINING, EL PASO | E | EL PASO COUNTY (MINING) - CONSERVATION | DEMAND REDUCTION | $0 | $0 | 278 | 370 | 466 | 569 | 680 | 807 |
| MINING, HUDSPETH | E | HUDSPETH COUNTY (MINING) - CONSERVATION | DEMAND REDUCTION | $0 | $0 | 29 | 25 | 28 | 30 | 31 | 33 |
| MINING, HUDSPETH | E | HUDSPETH COUNTY MINING - ADDITIONAL GROUNDWATER WELL | E \| WEST TEXAS BOLSONS AQUIFER BRACKISH \| HUDSPETH COUNTY | $146 | $46 | 219 | 219 | 219 | 219 | 219 | 219 |
| MINING, TERRELL | E | TERRELL COUNTY (MINING) - CONSERVATION | DEMAND REDUCTION | $0 | $0 | 72 | 88 | 83 | 62 | 44 | 29 |
| PRESIDIO | E | CITY OF PRESIDIO - ADDITIONAL GROUNDWATER WELL IN THE WEST TEXAS BOLSONS AQUIFER | E \| WEST TEXAS BOLSONS AQUIFER FRESH/BRACKISH \| PRESIDIO COUNTY | $1558 | $86 | 120 | 120 | 120 | 120 | 120 | 120 |
| PRESIDIO | E | CITY OF PRESIDIO - WATER LOSS AUDIT AND MAIN-LINE REPAIR | DEMAND REDUCTION | $1029 | $800 | 35 | 37 | 38 | 41 | 43 | 45 |
| STEAM ELECTRIC POWER, EL PASO | E | EL PASO (SEP) - CONSERVATION | DEMAND REDUCTION | $0 | $0 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 |
| STEAM ELECTRIC POWER, EL PASO | E | EL PASO COUNTY (SEP) - PURCHASE WATER FROM EPW | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | $475 | $475 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **REGION E RECOMMENDED WMS SUPPLY TOTAI** | 118,366 | 127,008 | 151,546 | 168,606 | 177,967 | 192,635 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Recommended Projects Associated with Water Management Strategies

| SPONSOR NAME | SPONSOR IS WWP? | ONLINE DECADE | PROJECT NAME | PROJECT DESCRIPTION | CAPITAL COST |
|---|---|---|---|---|---|
| ALPINE | NO | 2020 | CITY OF ALPINE - IRRIGATION APPLICATION OF CAPTURED RAINWATER RUNOFF | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); RAINWATER HARVESTING SYSTEM | $14,500 |
| ALPINE | NO | 2020 | CITY OF ALPINE - MODIFICATION TO WASTEWATER TREATMENT FACILITY & IRRIGATION SYSTEM | STORAGE TANK; CONVEYANCE/TRANSMISSION PIPELINE | $74,400 |
| ANTHONY | NO | 2020 | TOWN OF ANTHONY - ADDITIONAL GROUNDWATER WELL | CONVEYANCE/TRANSMISSION PIPELINE; NEW AGREEMENT; SINGLE WELL | $1,913,000 |
| ANTHONY | NO | 2020 | TOWN OF ANTHONY - ARSENIC TREATMENT FACILITY | CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; STORAGE TANK | $10,334,000 |
| COUNTY-OTHER, BREWSTER | NO | 2020 | BREWSTER COUNTY OTHER (MARATHON WSSSERVICE) - WATER LOSS AUDIT AND MAIN-LINE REPAIR | CONVEYANCE/TRANSMISSION PIPELINE; WATER LOSS CONTROL | $255,000 |
| COUNTY-OTHER, BREWSTER | NO | 2020 | BREWSTER COUNTY OTHER (STUDY BUTTE TERLINGUA WS) - WATER LOSS AUDIT AND MAIN-LINE REPAIR | WATER LOSS CONTROL | $3,054,000 |
| COUNTY-OTHER, EL PASO | NO | 2020 | EL PASO COUNTY OTHER - PUBLIC CONSERVATION EDUCATION | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS) | $6,072 |
| COUNTY-OTHER, EL PASO | NO | 2050 | EL PASO COUNTY OTHER (VINTON HILLS) - HIGH CAPACITY WATER LINES | CONVEYANCE/TRANSMISSION PIPELINE | $17,075,000 |
| COUNTY-OTHER, EL PASO | NO | 2050 | EL PASO COUNTY OTHER (VINTON HILLS) - PURCHASE WATER FROM EPW | CONTRACT AMENDMENT | $143,000 |
| COUNTY-OTHER, HUDSPETH | NO | 2020 | HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - GROUNDWATER WELL NE OF VAN HORN | SINGLE WELL; CONVEYANCE/TRANSMISSION PIPELINE | $2,132,000 |
| COUNTY-OTHER, HUDSPETH | NO | 2020 | HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - GROUNDWATER WELL WEST OF VAN HORN | CONVEYANCE/TRANSMISSION PIPELINE; SINGLE WELL | $636,000 |
| COUNTY-OTHER, HUDSPETH | NO | 2020 | HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - LOCAL GROUNDWATER WELL | SINGLE WELL; CONVEYANCE/TRANSMISSION PIPELINE | $940,000 |
| COUNTY-OTHER, HUDSPETH | NO | 2020 | HUDSPETH COUNTY OTHER - HUDSPETH CO. WCID #1 - PUBLIC CONSERVATION EDUCATION | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS) | $3,513 |
| COUNTY-OTHER, HUDSPETH | NO | 2020 | HUDSPETH COUNTY OTHER (CITY OF SIERRA BLANCA - HUDSPETH CO. WCID #1) - REPLACE WATER SUPPLY LINE | CONVEYANCE/TRANSMISSION PIPELINE | $18,432,000 |
| COUNTY-OTHER, HUDSPETH | NO | 2020 | HUDSPETH COUNTY OTHER (DELL CITY) - BRACKISH GROUNDWATER DESALINATION FACILITY | NEW WATER TREATMENT PLANT | $1,636,000 |
| COUNTY-OTHER, JEFF DAVIS | NO | 2020 | JEFF DAVIS COUNTY OTHER (TOWN OF VALENTINE) - ADDITIONAL GROUNDWATER WELL | CONVEYANCE/TRANSMISSION PIPELINE; SINGLE WELL | $783,000 |
| EAST MONTANA WATER SYSTEM | NO | 2020 | EAST MONTANA WS - WATER LOSS AUDIT AND MAIN-LINE REPAIR | WATER LOSS CONTROL | $1,018,000 |
| EL PASO COUNTY TORNILLO WID | NO | 2020 | EL PASO CO. TORNILLO WID - ADDITIONAL GROUNDWATER WELL AND TRANSMISSION LINE | CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; PUMP STATION; SINGLE WELL; STORAGE TANK | $2,060,000 |
| EL PASO WATER | YES | 2020 | EPW - ADVANCED PURIFIED WATER AT THE BUSTAMANTE WWTP | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; WATER TREATMENT PLANT EXPANSION; PUMP STATION | $142,608,000 |
| EL PASO WATER | YES | 2070 | EPW - ADVANCED PURIFIED WATER AT THE HASKELL STREET RWP | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; PUMP STATION; WATER TREATMENT PLANT EXPANSION | $189,356,000 |
| EL PASO WATER | YES | 2040 | EPW - ADVANCED WATER PURIFICATION AT THE FRED HERVEY WWTP | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; PUMP STATION; WATER TREATMENT PLANT EXPANSION | $140,394,000 |
| EL PASO WATER | YES | 2060 | EPW - EXPANSION OF THE KAY BAILEY HUTCHINSON DESAL PLANT | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; STORAGE TANK; WATER TREATMENT PLANT EXPANSION | $26,490,000 |
| EL PASO WATER | YES | 2040 | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1) | CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK | $569,357,000 |
| EL PASO WATER | YES | 2060 | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 2) | CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK | $320,226,000 |
| EL PASO WATER | YES | 2030 | EPW - HUECO BOLSON ARTIFICIAL RECHARGE | CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE | $38,003,000 |
| EL PASO WATER | YES | 2020 | EPW - MUNICIPAL CONSERVATION PROGRAM | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL | $1,071,000 |
| EL PASO WATER | YES | 2040 | EPW - RIVERSIDE REGULATING RESERVOIR | CANAL LINING; CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE; NEW SURFACE WATER INTAKE; PUMP STATION | $6,754,036 |

# Region E Recommended Projects Associated with Water Management Strategies

| SPONSOR NAME | SPONSOR IS WWP? | ONLINE DECADE | PROJECT NAME | PROJECT DESCRIPTION | CAPITAL COST |
|---|---|---|---|---|---|
| FORT DAVIS WSC | NO | 2020 | FORT DAVIS WSC - ADDITIONAL GROUNDWATER WELL | CONVEYANCE/TRANSMISSION PIPELINE; SINGLE WELL | $584,000 |
| FORT DAVIS WSC | NO | 2020 | FORT DAVIS WSC - ADDITIONAL TRANSMISSION LINE | CONVEYANCE/TRANSMISSION PIPELINE | $1,671,000 |
| HACIENDAS DEL NORTE WID | NO | 2020 | HACIENDAS DEL NORTE WID - WATER LOSS AUDIT AND MAIN-LINE REPAIR | WATER LOSS CONTROL | $764,000 |
| HORIZON REGIONAL MUD | NO | 2020 | HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESAL PLANT | CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; WATER TREATMENT PLANT EXPANSION | $71,809,000 |
| HORIZON REGIONAL MUD | NO | 2020 | HORIZON REGIONAL MUD - PUBLIC CONSERVATION EDUCATION | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS) | $136,793 |
| HORIZON REGIONAL MUD | NO | 2020 | HORIZON REGIONAL MUD - WATER LOSS AUDIT AND MAIN-LINE REPAIR | WATER LOSS CONTROL | $255,000 |
| IRRIGATION, CULBERSON | NO | 2020 | CULBERSON COUNTY IRRIGATION - ADDITIONAL GROUNDWATER WELL - WEST TEXAS BOLSONS AQUIFER | SINGLE WELL | $510,000 |
| IRRIGATION, EL PASO | NO | 2020 | EL PASO COUNTY - EPCWID #1 - IMPROVEMENTS TO WATER DISTRICT DELIVERY SYSTEM | CANAL LINING; CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE | $157,777,783 |
| IRRIGATION, EL PASO | NO | 2020 | EL PASO COUNTY - EPCWID #1 - IRRIGATION SCHEDULING | CONSERVATION - AGRICULTURAL | $102,595 |
| IRRIGATION, EL PASO | NO | 2020 | EL PASO COUNTY - EPCWID #1 - REGULATING RIVERSIDE RESERVOIR | DIVERSION AND CONTROL STRUCTURE | $6,754,036 |
| IRRIGATION, EL PASO | NO | 2020 | EL PASO COUNTY - EPCWID #1 - TAILWATER REUSE | CONSERVATION - AGRICULTURAL | $973,368 |
| IRRIGATION, EL PASO | NO | 2020 | EL PASO COUNTY - EPCWID#1 - NEW WATERWAY 32 RIVER DIVERSON PUMPING POINT | CANAL LINING | $4,055,887 |
| LAJITAS MUNICIPAL SERVICES | NO | 2020 | LAJITAS MUNICIPAL SERVICES - WATER LOSS AND MAIN-LINE REPAIR | WATER LOSS CONTROL | $2,545,000 |
| LOWER VALLEY WATER DISTRICT | NO | 2020 | LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK | $36,110,000 |
| LOWER VALLEY WATER DISTRICT | NO | 2020 | LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK | $39,236,000 |
| LOWER VALLEY WATER DISTRICT | NO | 2020 | LVWD - PUBLIC CONSERVATION EDUCATION | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL | $591,000 |
| LOWER VALLEY WATER DISTRICT | NO | 2020 | LVWD - PURCHASE WATER FROM EPW | CONTRACT AMENDMENT | $591,000 |
| LOWER VALLEY WATER DISTRICT | NO | 2020 | LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINES | CONVEYANCE/TRANSMISSION PIPELINE; NEW AGREEMENT; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION | $74,338,000 |
| LOWER VALLEY WATER DISTRICT | NO | 2020 | LVWD - WASTEWATER TREATMENT AND ASR FACILITY | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; NEW WATER TREATMENT PLANT | $23,509,000 |
| MANUFACTURING, EL PASO | NO | 2030 | EL PASO COUNTY (MANUFACTURING) - PURCHASE WATER FROM EPW | CONTRACT AMENDMENT | $1,049,000 |
| MINING, EL PASO | NO | 2020 | EL PASO COUNTY - MINING - ADDITIONAL GROUNDWATER WELLS | MULTIPLE WELLS/WELL FIELD | $1,208,000 |
| MINING, HUDSPETH | NO | 2020 | HUDSPETH MINING - ADDITIONAL GROUNDWATER WELL | SINGLE WELL | $306,000 |
| PRESIDIO | NO | 2020 | CITY OF PRESIDIO - ADDITIONAL GROUNDWATER WELL | CONVEYANCE/TRANSMISSION PIPELINE; NEW WATER TREATMENT PLANT; PUMP STATION; SINGLE WELL; STORAGE TANK | $5,509,000 |
| PRESIDIO | NO | 2020 | CITY OF PRESIDIO - WATER LOSS AUDIT AND MAIN-LINE REPAIR | CONVEYANCE/TRANSMISSION PIPELINE; WATER LOSS CONTROL | $509,000 |
| STEAM ELECTRIC POWER, EL PASO | NO | 2020 | EL PASO COUNTY (SEP) - PURCHASE WATER FROM EPW | CONTRACT AMENDMENT | $951,000 |
| | | | | **REGION E RECOMMENDED CAPITAL COST TOTAL** | **$1,926,613,983** |

# Region E Alternative Water User Group (WUG) Water Management Strategies (WMS)

| | | | | | | WATER MANAGEMENT STRATEGY SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WUG ENTITY NAME | WMS SPONSOR REGION | WMS NAME | SOURCE NAME | UNIT COST 2020 | UNIT COST 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| EL PASO WATER | E | EPW - EXPANSION OF CANUTILLO MESILLA BOLSON WELL FIELD | E \| HUECO-MESILLA BOLSON AQUIFER FRESH/BRACKISH \| EL PASO COUNTY | N/A | $70 | 0 | 7,760 | 11,640 | 15,520 | 19,400 | 23,280 |
| EL PASO WATER | E | EPW - LOWER VALLEY WELL HEAD RO | E \| OTHER AQUIFER BRACKISH \| EL PASO COUNTY | N/A | $658 | 0 | 0 | 5,000 | 5,000 | 5,000 | 5,000 |
| EL PASO WATER | E | EPW - TREATMENT AND REUSE OF AGRICULTURAL DRAIN WATER | E \| RIO GRANDE INDIRECT REUSE | N/A | $51 | 0 | 0 | 2,700 | 2,700 | 2,700 | 2,700 |
| MINING, TERRELL | E | TERRELL COUNTY MINING - ADDITIONAL GROUNDWATER WELLS | E \| EDWARDS-TRINITY-PLATEAU, PECOS VALLEY, AND TRINITY AQUIFERS \| TERRELL COUNTY | $166 | $28 | 470 | 470 | 470 | 470 | 470 | 470 |
| | | | | | | | | | | | |
| **REGION E ALTERNATIVE WMS SUPPLY TOTAL** | | | | | | 470 | 8,230 | 19,810 | 23,690 | 27,570 | 31,450 |

*A single asterisk next to a WUG's name denotes that the WUG is split by two or more planning regions.

# Region E Alternative Projects Associated with Water Management Strategies

| SPONSOR NAME | SPONSOR IS WWP? | ONLINE DECADE | PROJECT NAME | PROJECT DESCRIPTION | CAPITAL COST |
|---|---|---|---|---|---|
| EL PASO WATER | YES | 2030 | EPW - CONJUNCTIVE TREATMENT OF GROUNDWATER AND SURFACE WATER AT THE UPPER VALLEY WWTP | WATER TREATMENT PLANT EXPANSION | $72,873,000 |
| EL PASO WATER | YES | 2030 | EPW - EXPANSION OF CANUTILLO MESILLA BOLSON WELL FIELD | CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD | $6,444,000 |
| EL PASO WATER | YES | 2040 | EPW - EXPANSION OF JONATHAN ROGERS WTP | WATER RIGHT/PERMIT LEASE OR PURCHASE; WATER TREATMENT PLANT EXPANSION | $88,679,000 |
| EL PASO WATER | YES | 2040 | EPW - LOWER VALLEY WELL HEAD RO | MULTIPLE WELLS/WELL FIELD; PUMP STATION; STORAGE TANK; CONVEYANCE/TRANSMISSION PIPELINE | $52,681,000 |
| EL PASO WATER | YES | 2040 | EPW - TREATMENT AND REUSE OF AGRICULTURAL DRAIN WATER | NEW CONTRACT; NEW WATER TREATMENT PLANT; STORAGE TANK | $21,466,000 |
| MINING, TERRELL | NO | 2020 | TERRELL COUNTY MINING - ADDITIONAL GROUNDWATER WELLS | MULTIPLE WELLS/WELL FIELD | $921,000 |
| | | | | **REGION E ALTERNATIVE CAPITAL COST TOTAL** | **$243,064,000** |

# Region E Water User Group (WUG) Management Supply Factor

WUG supplies and projected demands are entered for each of a WUG's region-county-basin divisions. To calculate the Management Supply Factor for each WUG as a whole, not split by region-county-basin, the combined total of existing and future supply is divided by the total projected demand. If a WUG is split by more than one planning region, the whole WUG's management supply factor will show up in each of its planning region's management supply factor reports.

| | WUG MANAGEMENT SUPPLY FACTOR | | | | | |
|---|---|---|---|---|---|---|
| WUG NAME | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| ALPINE | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| ANTHONY | 6.9 | 5.8 | 5.1 | 4.6 | 4.1 | 3.7 |
| COUNTY-OTHER, BREWSTER | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 |
| COUNTY-OTHER, CULBERSON | 2.4 | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 |
| COUNTY-OTHER, EL PASO | 3.0 | 2.3 | 1.9 | 1.5 | 1.3 | 1.2 |
| COUNTY-OTHER, EL PASO \| VINTON HILLS ESTATES | 1.9 | 1.4 | 1.2 | 4.3 | 4.1 | 4.1 |
| COUNTY-OTHER, EL PASO \| VINTON HILLS SUBDIVISION | 1.9 | 1.4 | 1.2 | 1.0 | 0.8 | 0.7 |
| COUNTY-OTHER, HUDSPETH | 4.6 | 4.4 | 4.4 | 4.4 | 4.4 | 3.7 |
| COUNTY-OTHER, HUDSPETH \| DELL CITY | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| COUNTY-OTHER, HUDSPETH \| FORT HANCOCK WCID | 2.4 | 2.3 | 2.3 | 2.3 | 2.3 | 2.2 |
| COUNTY-OTHER, JEFF DAVIS | 2.5 | 2.6 | 2.7 | 2.7 | 2.7 | 2.7 |
| COUNTY-OTHER, JEFF DAVIS \| CITY OF VALENTINE | 5.4 | 5.6 | 5.6 | 5.9 | 5.9 | 5.9 |
| COUNTY-OTHER, PRESIDIO | 4.8 | 4.3 | 3.9 | 3.5 | 3.2 | 2.9 |
| COUNTY-OTHER, TERRELL | 3.6 | 3.6 | 3.8 | 3.8 | 3.8 | 3.8 |
| EAST BIGGS WATER SYSTEM | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| EAST MONTANA WATER SYSTEM | 1.6 | 1.4 | 1.3 | 1.2 | 1.1 | 1.1 |
| EL PASO COUNTY TORNILLO WID | 3.6 | 3.7 | 3.7 | 3.8 | 3.8 | 3.8 |
| EL PASO COUNTY WCID 4 | 2.3 | 2.3 | 2.4 | 2.4 | 2.3 | 2.3 |
| EL PASO WATER | 1.2 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 |
| ESPERANZA WATER SERVICE | 3.4 | 3.2 | 3.2 | 3.1 | 3.1 | 3.1 |
| FEDERAL CORRECTIONAL INSTITUTION LA TUNA | 5.7 | 5.8 | 5.9 | 5.9 | 5.9 | 5.9 |
| FORT BLISS WATER SERVICES | 1.5 | 1.5 | 1.4 | 1.4 | 1.3 | 1.3 |
| FORT DAVIS WSC | 2.7 | 2.7 | 2.8 | 2.8 | 2.8 | 2.8 |
| HACIENDAS DEL NORTE WID | 1.6 | 1.5 | 1.3 | 1.2 | 1.1 | 1.1 |
| HORIZON REGIONAL MUD | 2.6 | 1.9 | 1.5 | 1.2 | 1.1 | 0.9 |
| HUDSPETH COUNTY WCID 1 | 3.7 | 3.5 | 3.5 | 3.5 | 3.5 | 3.4 |
| IRRIGATION, BREWSTER | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| IRRIGATION, CULBERSON | 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 |
| IRRIGATION, EL PASO | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| IRRIGATION, HUDSPETH | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| IRRIGATION, JEFF DAVIS | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 |
| IRRIGATION, PRESIDIO | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 |
| IRRIGATION, TERRELL | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| LAJITAS MUNICIPAL SERVICES | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 |
| LIVESTOCK, BREWSTER | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| LIVESTOCK, CULBERSON | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| LIVESTOCK, EL PASO | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| LIVESTOCK, HUDSPETH | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| LIVESTOCK, JEFF DAVIS | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| LIVESTOCK, PRESIDIO | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| LIVESTOCK, TERRELL | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| LOWER VALLEY WATER DISTRICT | 5.2 | 4.7 | 4.3 | 3.9 | 3.6 | 3.4 |
| MANUFACTURING, CULBERSON | 1.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MANUFACTURING, EL PASO | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |

*A single asterisk next to a WUG's name denotes that the WUG is split by more than one planning region.

# Region E Water User Group (WUG) Management Supply Factor

| | WUG MANAGEMENT SUPPLY FACTOR | | | | | |
|---|---|---|---|---|---|---|
| **WUG NAME** | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| MARATHON WATER SUPPLY & SEWER SERVICE | 2.0 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |
| MARFA | 3.0 | 2.9 | 2.7 | 2.5 | 2.3 | 2.2 |
| MINING, CULBERSON | 1.9 | 1.4 | 1.3 | 1.5 | 1.6 | 1.8 |
| MINING, EL PASO | 1.7 | 1.5 | 1.3 | 1.2 | 1.1 | 1.0 |
| MINING, HUDSPETH | 1.1 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 |
| MINING, JEFF DAVIS | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| MINING, PRESIDIO | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| MINING, TERRELL | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.6 |
| PASEO DEL ESTE MUD 1 | 1.5 | 1.4 | 1.3 | 1.2 | 1.1 | 1.0 |
| PRESIDIO | 5.3 | 5.1 | 4.9 | 4.6 | 4.3 | 4.1 |
| STEAM ELECTRIC POWER, EL PASO | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| TERRELL COUNTY WCID 1 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| VAN HORN | 1.5 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 |

*A single asterisk next to a WUG's name denotes that the WUG is split by more than one planning region.

# Region E Recommended Water Managment Strategy (WMS) Supply Associated with a New or Amended Inter-Basin Transfer (IBT) Permit

IBT WMS supply is the portion of the total WMS benefitting WUGs that will require a new or amended IBT permit that is not considered exempt under the Texas Water Code § 11.085.

| | | | IBT WMS SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|
| **WMS NAME** | **SOURCE BASIN** | **RECIPIENT WUG BASIN** | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |

# Region E Water User Groups (WUGs)
# Recommended Water Managment Strategy (WMS) Supply Associated with a
# New or Amended Inter-Basin Transfer (IBT) Permit and Total Recommended Conservation WMS Supply

IBT WMS supply is the portion of the total WMS benefitting the WUG basin split listed that will require a new or amended IBT permit that is not considered exempt under the Texas Water Code § 11.085. Total conservation supply represents all conservation WMS volumes recommended within the WUG's region-basin geographic split.

| BENEFITTING WUG NAME \| BASIN | WMS SOURCE ORIGIN BASIN \| WMS NAME | WMS SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |

# Region E Sponsored Recommended Water Management Strategy (WMS) Supplies Unallocated* to Water User Groups (WUG)

| WMS NAME | WMS SPONSOR | SOURCE NAME | UNALLOCATED STRATEGY SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| TOTAL UNALLOCATED STRATEGY SUPPLIES | | | | | | | | |

* Strategy supplies created through the WMS that have not been assigned to a WUG will be allocated to the entity responsible for the water through an‘unassigned water volumes’ entity. Only strategy supplies associated with an 'unassigned water volume' entity are shown in this report, and may not represent all strategy supplies associated with the listed WMS.

# Region E Water User Group (WUG) Strategy Supplies by Water Management Strategy (WMS) Type

| WMS TYPE * | STRATEGY SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| AQUIFER STORAGE & RECOVERY | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 |
| CONJUNCTIVE USE | 0 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| GROUNDWATER DESALINATION | 23,916 | 23,916 | 23,916 | 23,916 | 28,916 | 28,916 |
| GROUNDWATER WELLS & OTHER | 24,812 | 26,513 | 37,340 | 48,637 | 49,590 | 50,458 |
| IRRIGATION CONSERVATION | 37,694 | 37,694 | 37,694 | 37,694 | 37,694 | 37,694 |
| MUNICIPAL CONSERVATION | 5,571 | 6,278 | 5,945 | 10,924 | 14,238 | 19,024 |
| NEW MAJOR RESERVOIR | 0 | 0 | 3,250 | 3,250 | 3,250 | 3,250 |
| OTHER CONSERVATION | 4,009 | 4,543 | 4,637 | 4,721 | 4,815 | 4,929 |
| OTHER DIRECT REUSE | 8,525 | 9,225 | 19,925 | 20,625 | 20,625 | 29,525 |
| OTHER SURFACE WATER | 8,250 | 8,250 | 8,250 | 8,250 | 8,250 | 8,250 |
| DROUGHT MANAGEMENT | 0 | 0 | 0 | 0 | 0 | 0 |
| INDIRECT REUSE | 0 | 0 | 0 | 0 | 0 | 0 |
| OTHER STRATEGIES | 0 | 0 | 0 | 0 | 0 | 0 |
| DIRECT POTABLE REUSE | 0 | 0 | 0 | 0 | 0 | 0 |
| SEAWATER DESALINATION | 0 | 0 | 0 | 0 | 0 | 0 |
| **TOTAL STRATEGY SUPPLIES** | **118,366** | **127,008** | **151,546** | **168,606** | **177,967** | **192,635** |

* WMS type descriptions can be found on the interactive state water plan website at http://texasstatewaterplan.org/ using the 'View data for' drop-down menus to navigate to a specific WMS Type page. The data used to create each WMS type value is available in Appendix 3 of the Guidelines for Regional Water Planning Data Deliverable (Exhibit D) document at http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/doc/current_docs/contract_docs/ExhibitD.pdf.

# Region E Water User Group (WUG)
# Recommended Water Management Strategy (WMS) Supplies by Source Type

| SOURCE SUBTYPE* | STRATEGY SUPPLY (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| AQUIFER STORAGE & RECOVERY | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 |
| GROUNDWATER | 48,728 | 55,429 | 66,256 | 77,553 | 83,506 | 84,374 |
| **GROUNDWATER TOTAL STRATEGY SUPPLIES** | **54,317** | **61,018** | **71,845** | **83,142** | **89,095** | **89,963** |
| DIRECT NON-POTABLE REUSE | 8,525 | 9,225 | 19,925 | 20,625 | 20,625 | 29,525 |
| DIRECT POTABLE REUSE | 0 | 0 | 0 | 0 | 0 | 0 |
| INDIRECT NON-POTABLE REUSE | 0 | 0 | 0 | 0 | 0 | 0 |
| INDIRECT POTABLE REUSE | 0 | 0 | 0 | 0 | 0 | 0 |
| **REUSE TOTAL STRATEGY SUPPLIES** | **8,525** | **9,225** | **19,925** | **20,625** | **20,625** | **29,525** |
| ATMOSPHERE | 0 | 0 | 0 | 0 | 0 | 0 |
| GULF OF MEXICO | 0 | 0 | 0 | 0 | 0 | 0 |
| LIVESTOCK LOCAL SUPPLY | 0 | 0 | 0 | 0 | 0 | 0 |
| OTHER LOCAL SUPPLY | 0 | 0 | 0 | 0 | 0 | 0 |
| RAINWATER HARVESTING | 0 | 0 | 0 | 0 | 0 | 0 |
| RESERVOIR | 3,250 | 3,250 | 6,500 | 6,500 | 6,500 | 6,500 |
| RESERVOIR SYSTEM | 0 | 0 | 0 | 0 | 0 | 0 |
| RUN-OF-RIVER | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| **SURFACE WATER TOTAL STRATEGY SUPPLIES** | **13,250** | **13,250** | **16,500** | **16,500** | **16,500** | **16,500** |
| **REGION E TOTAL STRATEGY SUPPLIES** | **76,092** | **83,493** | **108,270** | **120,267** | **126,220** | **135,988** |

* A full list of source subtype definitions can be found in section 3 of the Guidelines for Regional Water Planning Data Deliverable (Exhibit D) document at http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/doc/current_docs/contract_docs/ExhibitD.pdf.

# Region E Major Water Provider (MWP) Existing Sales and Transfers

Major Water Providers are entities of particular significance to a region's water supply as defined by the Regional Water Planning Group (RWPG), and may be a Water User Group (WUG) entity, Wholesale Water Provider (WWP) entity , or both (WUG/WWP).

Retail denotes WUG projected demands and existing water supplies used by the WUG. Wholesale denotes a WWP or WUG/WWP selling water to another entity.

| EL PASO COUNTY WID #1 - WWP | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| DATA DESCRIPTION | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| PROJECTED WHOLESALE CONTRACT DEMANDS | 80,774 | 80,774 | 80,774 | 80,774 | 80,774 | 80,774 |
| **TOTAL PROJECTED WHOLESALE CONTRACT AND RETAIL DEMANDS** | **80,774** | **80,774** | **80,774** | **80,774** | **80,774** | **80,774** |
| REUSE SALES TO WHOLESALE CUSTOMERS | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 |
| SURFACE WATER SALES TO WHOLESALE CUSTOMERS | 46,605 | 46,605 | 46,605 | 46,605 | 46,605 | 46,605 |
| **TOTAL WHOLESALE AND RETAIL SALES TO CUSTOMERS** | **80,774** | **80,774** | **80,774** | **80,774** | **80,774** | **80,774** |

| EL PASO WATER - WUG/WWP | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| DATA DESCRIPTION | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| PROJECTED RETAIL WUG DEMANDS | 110,572 | 120,315 | 129,713 | 139,978 | 150,601 | 160,792 |
| PROJECTED WHOLESALE CONTRACT DEMANDS | 26,331 | 26,331 | 26,331 | 26,331 | 26,331 | 26,331 |
| **TOTAL PROJECTED WHOLESALE CONTRACT AND RETAIL DEMANDS** | **136,903** | **146,646** | **156,044** | **166,309** | **176,932** | **187,123** |
| GROUNDWATER SALES TO RETAIL CUSTOMERS | 115,000 | 115,000 | 115,000 | 115,000 | 115,000 | 115,000 |
| REUSE SALES TO RETAIL CUSTOMERS | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| SURFACE WATER SALES TO RETAIL CUSTOMERS | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| GROUNDWATER SALES TO WHOLESALE CUSTOMERS | 26,331 | 26,331 | 26,331 | 26,331 | 26,331 | 26,331 |
| **TOTAL WHOLESALE AND RETAIL SALES TO CUSTOMERS** | **157,331** | **157,331** | **157,331** | **157,331** | **157,331** | **157,331** |

| HORIZON REGIONAL MUD - WUG | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| DATA DESCRIPTION | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| PROJECTED RETAIL WUG DEMANDS | 7,936 | 11,043 | 13,962 | 16,868 | 19,630 | 22,235 |
| **TOTAL PROJECTED WHOLESALE CONTRACT AND RETAIL DEMANDS** | **7,936** | **11,043** | **13,962** | **16,868** | **19,630** | **22,235** |
| GROUNDWATER SALES TO RETAIL CUSTOMERS | 5,227 | 5,227 | 5,227 | 5,227 | 5,227 | 5,227 |
| **TOTAL WHOLESALE AND RETAIL SALES TO CUSTOMERS** | **5,227** | **5,227** | **5,227** | **5,227** | **5,227** | **5,227** |

| LOWER VALLEY WATER DISTRICT- WUG | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| DATA DESCRIPTION | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| PROJECTED RETAIL WUG DEMANDS | 5,714 | 6,563 | 7,398 | 8,290 | 9,189 | 10,045 |
| **TOTAL PROJECTED WHOLESALE CONTRACT AND RETAIL DEMANDS** | **5,714** | **6,563** | **7,398** | **8,290** | **9,189** | **10,045** |
| GROUNDWATER SALES TO RETAIL CUSTOMERS | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 |
| **TOTAL WHOLESALE AND RETAIL SALES TO CUSTOMERS** | **4,356** | **4,356** | **4,356** | **4,356** | **4,356** | **4,356** |

# Region E Major Water Provider (MWP) Water Management Strategy (WMS) Summary

MWPs are entities of significance to a region's water supply as defined by the Regional Water Planning Group (RWPG) and may be a Water User Group (WUG) entity, Wholesale Water Provider (WWP) entity, or both (WUG/WWP).'MWP Retail Customers' denotes recommended WMS supply used by the WUG. 'Transfers Related to Wholesale Customers' denotes a WWP or WUG/WWP selling or transferring recommended WMS supply to another entity. Supply associated with the MWP's wholesale transfers will only display if it is listed as the main seller in the State Water Planning database, even if multiple sellers are involved with the sale o water to WUGs. Unallocated water volumes represent MWP recommended WMS supply not currently allocated to a customer of the MWP.'Total MWP Related WMS Supply' will display if the MWP's WMS is related to more than one WMS supply type (retail, wholesale, and/or unallocated). Associated WMS Projects are listed when the MWP is one of the project's sponsors. Report contains draft data and is subject to change.

**EL PASO COUNTY WID #1 | NO RECOMMENDED WMS SUPPLY RELATED TO MWP**

**EL PASO WATER | EL PASO COUNTY (MANUFACTURING) - PURCHASE WATER FROM EPW**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| TRANSFERS RELATED TO WHOLESALE CUSTOMERS | 0 | 860 | 860 | 860 | 860 | 860 |

**EL PASO WATER | EL PASO COUNTY (SEP) - PURCHASE WATER FROM EPW**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| TRANSFERS RELATED TO WHOLESALE CUSTOMERS | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 |

**EL PASO WATER | EL PASO COUNTY OTHER - (VINTON HILLS) - PURCHASE WATER FROM EPW**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| TRANSFERS RELATED TO WHOLESALE CUSTOMERS | 0 | 0 | 0 | 14 | 77 | 137 |

**EL PASO WATER | EPW - ADVANCED PURIFIED WATER AT THE BUSTAMANTE WWTP**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 8,500 | 9,200 | 9,900 | 10,600 | 10,600 | 10,600 |
| **WMS RELATED MWP SPONSORED PROJECTS** | **PROJECT DESCRIPTION** | | | | | |
| EPW - ADVANCED PURIFIED WATER AT THE BUSTAMANTE WWTP | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; WATER TREATMENT PLANT EXPANSION; PUMP STATION | | | | | |

**EL PASO WATER | EPW - ADVANCED PURIFIED WATER AT THE HASKELL STREET RWP**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 0 | 0 | 0 | 0 | 0 | 8,900 |
| **WMS RELATED MWP SPONSORED PROJECTS** | **PROJECT DESCRIPTION** | | | | | |
| EPW - ADVANCED PURIFIED WATER AT THE HASKELL STREET RWP | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; PUMP STATION; WATER TREATMENT PLANT EXPANSION | | | | | |

**EL PASO WATER | EPW - ADVANCED WATER PURIFICATION AT THE FRED HERVEY WWTP**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 0 | 0 | 10,000 | 10,000 | 10,000 | 10,000 |
| **WMS RELATED MWP SPONSORED PROJECTS** | **PROJECT DESCRIPTION** | | | | | |
| EPW - ADVANCED WATER PURIFICATION AT THE FRED HERVEY WWTP | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; PUMP STATION; WATER TREATMENT PLANT EXPANSION | | | | | |

**EL PASO WATER | EPW - EXPANSION OF THE KAY BAILEY HUTCHISON DESAL PLANT**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 0 | 0 | 0 | 0 | 5,000 | 5,000 |

# Region E Major Water Provider (MWP) Water Management Strategy (WMS) Summary

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| EPW - EXPANSION OF THE KAY BAILEY HUTCHINSON DESAL PLANT | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; STORAGE TANK; WATER TREATMENT PLANT EXPANSION |

**EL PASO WATER | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1)**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 0 | 0 | 10,000 | 10,000 | 10,000 | 10,000 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 1) | CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK |

**EL PASO WATER | EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 2)**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 0 | 0 | 0 | 10,000 | 10,000 | 10,000 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| EPW - GROUNDWATER FROM DELL CITY AREA (PHASE 2) | CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK |

**EL PASO WATER | EPW - HUECO BOLSON ARTIFICIAL RECHARGE**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 0 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| EPW - HUECO BOLSON ARTIFICIAL RECHARGE | CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE |

**EL PASO WATER | EPW - MUNICIPAL CONSERVATION PROGRAM**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 4,950 | 5,530 | 5,080 | 9,940 | 13,140 | 17,820 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| EPW - MUNICIPAL CONSERVATION PROGRAM | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL |

**EL PASO WATER | EPW - RIVERSIDE REGULATING RESERVOIR**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 0 | 0 | 3,250 | 3,250 | 3,250 | 3,250 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| EPW - RIVERSIDE REGULATING RESERVOIR | CANAL LINING; CONVEYANCE/TRANSMISSION PIPELINE; DIVERSION AND CONTROL STRUCTURE; NEW SURFACE WATER INTAKE; PUMP STATION |

**EL PASO WATER | LVWD - PURCHASE WATER FROM EPW**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| TRANSFERS RELATED TO WHOLESALE CUSTOMERS | 1,344 | 2,185 | 3,012 | 3,895 | 4,785 | 5,632 |

**HORIZON REGIONAL MUD | HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESAL PLANT**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 16,786 | 16,786 | 16,786 | 16,786 | 16,786 | 16,786 |

# Region E Major Water Provider (MWP) Water Management Strategy (WMS) Summary

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| HORIZON REGIONAL MUD - ADDITIONAL WELLS AND EXPANSION OF DESAL PLANT | CONVEYANCE/TRANSMISSION PIPELINE; MULTIPLE WELLS/WELL FIELD; WATER TREATMENT PLANT EXPANSION |

**HORIZON REGIONAL MUD | HORIZON REGIONAL MUD - PUBLIC CONSERVATION EDUCATION**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 79 | 110 | 140 | 169 | 196 | 222 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| HORIZON REGIONAL MUD - PUBLIC CONSERVATION EDUCATION | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS) |

**HORIZON REGIONAL MUD | HORIZON REGIONAL MUD - WATER LOSS AUDIT AND MAIN-LINE REPAIR**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 197 | 274 | 346 | 418 | 487 | 551 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| HORIZON REGIONAL MUD - WATER LOSS AUDIT AND MAIN-LINE REPAIR | WATER LOSS CONTROL |

**LOWER VALLEY WATER DISTRICT | LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - HUECO BOLSON AQUIFER | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK |

**LOWER VALLEY WATER DISTRICT | LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| LVWD - GROUNDWATER FROM PROPOSED WELL FIELD - RIO GRANDE ALLUVIUM AQUIFER | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; MULTIPLE WELLS/WELL FIELD; NEW WATER TREATMENT PLANT; PUMP STATION; STORAGE TANK |

**LOWER VALLEY WATER DISTRICT | LVWD - PUBLIC CONSERVATION EDUCATION**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 57 | 66 | 74 | 83 | 92 | 100 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| LVWD - PUBLIC CONSERVATION EDUCATION | CONSERVATION - MUNICIPAL (DOES NOT INCLUDE METER REPLACEMENT OR WATER LOSS); WATER LOSS CONTROL |

**LOWER VALLEY WATER DISTRICT | LVWD - PURCHASE WATER FROM EPW**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| MWP RETAIL CUSTOMERS | 1,344 | 2,185 | 3,012 | 3,895 | 4,785 | 5,632 |

| WMS RELATED MWP SPONSORED PROJECTS | PROJECT DESCRIPTION |
|---|---|
| LVWD - PURCHASE WATER FROM EPW | CONTRACT AMENDMENT |

**LOWER VALLEY WATER DISTRICT | LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINE**

| DATA DESCRIPTION | WATER VOLUMES (ACRE-FEET PER YEAR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |

## Region E Major Water Provider (MWP) Water Management Strategy (WMS) Summary

| | | | | | | |
|---|---|---|---|---|---|---|
| MWP RETAIL CUSTOMERS | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| **WMS RELATED MWP SPONSORED PROJECTS** | **PROJECT DESCRIPTION** | | | | | |
| LVWD - SURFACE WATER TREATMENT PLANT AND TRANSMISSION LINES | CONVEYANCE/TRANSMISSION PIPELINE; NEW AGREEMENT; NEW SURFACE WATER INTAKE; NEW WATER TREATMENT PLANT; PUMP STATION | | | | | |

| **LOWER VALLEY WATER DISTRICT \| LVWD - WASTEWATER TREATMENT FACILITY AND ASR** | | | | | | |
|---|---|---|---|---|---|---|
| | **WATER VOLUMES (ACRE-FEET PER YEAR)** | | | | | |
| **DATA DESCRIPTION** | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| MWP RETAIL CUSTOMERS | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 |
| **WMS RELATED MWP SPONSORED PROJECTS** | **PROJECT DESCRIPTION** | | | | | |
| LVWD - WASTEWATER TREATMENT AND ASR FACILITY | CONVEYANCE/TRANSMISSION PIPELINE; INJECTION WELL; NEW WATER TREATMENT PLANT | | | | | |

# Table of Contents

ES **EXECUTIVE SUMMARY** ……ES-1
ES APPENDIX A – TWDB WATER PLANNING DATA REPORTS

1 **FAR WEST TEXAS**…… 1-1

1.1 WATER PLANNING AND MANAGEMENT …… 1-2
1.1.1 Regional Water Planning …….. 1-2
1.1.2 Interim Regional Water Supply Research Projects …….. 1-3
1.1.3 State Water Plan …… 1-4
1.1.4 Groundwater Conservation Districts ……. 1-4
1.1.5 Groundwater Management Areas ……. 1-5
1.1.6 El Paso Water as the Declared Regional Water Supply Planner …….. 1-6
1.1.7 El Paso County Priority Groundwater Management Area …… 1-7
1.1.8 Hudspeth County Priority Groundwater Management Area Consideration ……. 1-8
1.2 FAR WEST TEXAS GEOGRAPHIC SETTING …….. 1-9
1.2.1 Physiography …… 1-9
1.2.2 Population and Regional Economy …… 1-11
1.2.3 Land Use …… 1-13
1.2.4 Climate …….. 1-15
1.2.5 Far West Texas Climate Change Conference …… 1-17
1.2.6 Drought …….. 1-18
1.2.7 Native Vegetation and Ecology ……. 1-20
1.2.8 Agricultural Resources ……... 1-20
1.2.9 Natural Resources ……... 1-21
1.3 REGIONAL WATER DEMAND …….. 1-22
1.3.1 Major Demand Centers …….. 1-22
1.3.2 Agriculture ……. 1-22
1.3.3 Municipal and County-Other ……. 1-24
1.3.4 Major Water Providers ……... 1-25
1.3.5 Industrial, Manufacturing, Electric Power Generation, and Mining …….. 1-26
1.3.6 Environmental and Recreational Water Needs …….. 1-26
1.4 SURFACE WATER SUPPLY SOURCES …… 1-28
1.4.1 Rio Grande …… 1-28
1.4.2 Pecos River …… 1-28
1.4.3 Ecologically Unique River and Stream Segments …… 1-30
1.5 GROUNDWATER SUPPLY SOURCES ……. 1-31
1.5.1 Hueco and Mesilla Bolson Aquifers ……. 1-33
1.5.2 West Texas Bolsons Aquifer ……. 1-33
1.5.3 Bone Spring-Victorio Peak Aquifer …….. 1-33
1.5.4 Igneous Aquifer ……. 1-33
1.5.5 Edwards-Trinity (Plateau) Aquifer …… 1-33
1.5.6 Capitan Reef Aquifer ……. 1-34
1.5.7 Marathon Aquifer …….…….. 1-34

1.5.8 Rustler Aquifer …….. 1-34
1.5.9 Pecos Valley (Balmorhea Alluvium) Aquifer …… 1-34
1.5.10 Other Groundwater Resources ……... 1-34
1.6 MAJOR SPRINGS …….. 1-36
1.7 REUSE …… 1-39
1.8 IDENTIFIED WATER QUALITY PROBLEMS …….. 1-40
1.8.1 Water Quality Issues …….. 1-40
1.8.2 Supply Source Protection ……... 1-41
1.8.3 Water Supply Source Vulnerability …… 1-41
1.9 WATER LOSS AUDITS …… 1-42
1.10 COLONIAS ……. 1-43
1.10.1 Far West Texas Colonias …… 1-43
1.10.2 TWDB Economically Distressed Area Program……. 1-43
1.10.2 El Paso County Colonias …… 1-45
1.11 INTERNATIONAL WATER ISSUES …… 1-46
1.11.1 Ciudad Juarez ……. 1-46
1.11.2 City of El Paso …… 1-47
1.11.3 Transboundary Effects of Groundwater Pumpage ……. 1-47
1.11.4 Transboundary Aquifer Assessment Program……. 1-47
1.12 STATE AND FEDERAL AGENCIES WITH WATER RESPONSIBILITIES …… 1-49
1.13 LOCAL ORGANIZATIONS AND UNIVERSITIES …… 1-51

APPENDIX 1A – MAJOR SPRINGS

2 **POPULATION AND WATER DEMAND** …… 2-1

2.1 POPULATION ……. 2-2
2.1.1 Population Projection Methodology …… 2-2
2.1.2 Current and Projected Population …… 2-2
2.2 WATER DEMAND ……. 2-6
2.2.1 Major …….. 2-11
2.2.2 Municipal and County-Other ……. 2-12
2.2.3 Manufacturing …… 2-17
2.2.4 Irrigation …… 2-17
2.2.5 Steam Electric Power Generation …….. 2-18
2.2.6 Livestock …… 2-19
2.2.7 Mining …… 2-20
2.3 ENVIRONMENTAL AND RECREATIONAL WATER NEEDS …… 2-23

3 **REGIONAL WATER SUPPLY SOURCES** …… 3-1

3.1 SURFACE WATER …… 3-10

3.1.1 Rio Grande…….. 3-10

3.1.1.1 Rio Grande Treaties and Compacts ……3-12
3.1.1.2 Rio Grande Project and the EPCWID #1 ……. 3-13
3.1.1.3 Hudspeth County Conservation and Reclamation District No. 1 …..… 3-15

3.1.1.4 Rio Grande Watermaster ……3-16
3.1.1.5 Rio Grande Water Quality ……..3-16
3.1.1.6 Long Term Reliability of the Rio Grande ……..3-16
3.1.1.7 Rio Grande Channelization ……3-16
3.1.1.8 Forgotten River Ranch of the Rio Grande ……3-16
3.1.1.9 Rio Grande Interstate Litigation…… 3-17
3.1.2 PECOS RIVER ……3-18
3.1.2.1 Pecos River Compact …… 3-18
3.1.2.2 Water Allocation and Water Rights ……3-19
3.1.2.3 Significant Pecos River Basin Tributaries …… 3-19
3.1.2.4 Pecos River Watershed Protection Plan …… 3-20
3.2 GROUNDWATER …….. 3-20
3.2.1 Hueco Bolson Aquifer…… 3-27
3.2.2 Mesilla Bolson Aquifer …….. 3-27
3.2.3 West Texas Bolsons Aquifer …….. 3-28
3.2.3.1 Salt Basin Bolson …….. 3-28
3.2.3.2 Presidio-Redford Bolson …… 3-28
3.2.3.3 Green River Valley Bolson …… 3-29
3.2.3.4 Red Light Draw Bolson …… 3-29
3.2.3.5 Eagle Flat Bolson ……... 3-29
3.2.4 Bone Spring-Victorio Peak Aquifer ……... 3-29
3.2.5 Igneous Aquifer (Davis Mountains Igneous) …….. 3-30
3.2.6 Edward-Trinity (Plateau) Aquifer …….. 3-30
3.2.7 Capitan Reef Aquifer …….. 3-31
3.2.8 Marathon Aquifer …… 3-31
3.2.9 Rustler Aquifer …… 3-31
3.2.10 Pecos Valley Aquifer (Balmorhea Alluvium) …… 3-32
3.2.11 Other Groundwater Resources …… 3-32
3.2.12 Groundwater Conditions in Municipal Well Fields …… 3-33
3.2.12.1 Brewster County …… 3-33
3.2.12.2 Culberson County …….. 3-34
3.2.12.3 El Paso County …….. 3-34
3.2.12.4 Hudspeth County …… 3-34
3.2.12.5 Jeff Davis County …….. 3-35
3.2.12.6 Presidio County ……. 3-35
3.2.12.7 Terrell County …… 3-35
3.3.12 Groundwater Exports ……. 3-36
3.3 LOCAL SUPPLY …… 3-37
3.4 REUSE ……. 3-38
APPENDIX 3A – AUTHORIZED SURFACE WATER RIGHTS

4 **IDENTIFICATION OF WATER NEEDS** ……..4-1

5 **WATER MANAGEMENT STRATEGIES AND CONSERVATION RECOMMENDATIONS** …… 5-1
5.1 IDENTIFICATION OF POTENTIALLY FEASIBLE WATER MANAGEMENT STRATEGIES ……. 5-2
5.1.1 Selection Process ……. 5-2
5.2 EVAULATION AND RECOMMENDATION OF WATER MANAGEMENT STRATEGIES ……... 5-6
5.2.1 Strategy Evaluation Procedure ……. 5-6
5.2.2 Emphasis on Conservation and Reuse ……. 5-7
5.2.3 Recommended Water Management Strategies …… 5-8
5.2.4 Alternate Water Management Strategies ……. 5-8
5.2.5 Unmet Needs ……... 5-8
5.3 WATER CONSERVATION ……5-22
5.3.1 Water Conservation Overview …… 5-22
5.3.2 Model Water Conservation Plans…… 5-23
5.3.3 State Water Conservation Programs and Guides……. 5-24
5.3.4 Regional Conservation Water Management Strategies……... 5-26
5.3.5 Gallons Per Capita Daily Goals…… 5-28
5.3.6 Municipal Conservation…… 5-29
5.3.7 Irrigation Conservation……. 5-29
5.3.8 Manufacturing Conservation…… 5-30
5.3.9 Water Loss Audit and Main-Line Repair……. 5-31
5.3.10 Water User Group Conservation Management Plans ……. 5-32
5.3.11 Groundwater Conservation Districts Management Plans ……... 5-33
5.3.11.1 Brewster County Groundwater Conservation District …… 5-34
5.3.11.2 Culberson County Groundwater Conservation District ……. 5-34
5.3.11.3 Hudspeth County Underground Water Conservation District …… 5-34
5.3.11.4 Jeff Davis County Underground Water Conservation District ……... 5-35
5.3.11.5 Presidio County Underground Water Conservation District …….. 5-35
5.3.11.6 Terrell County Groundwater Conservation District ……5-35
APPENDIX 5A – RECOMMENDED AND ALTERNATE WATER MANAGEMENT STRATEGIES
APPENDIX 5B – STRATEGY EVALUATION QUANTIFICATION MATRIX

6 **REGIONAL WATER PLAN IMPACTS AND CONSISTENCY WITH PROTECTION OF WATER AGRICULTURAL AND NATRUAL RESOURCES** ……... 6-1

6.1 PROTECTION OF WATER RESOURCES ……. 6-2
6.2 PROTECTION OF AGRICULTURAL RESOURCES …… 6-3
6.3 PROTECTION OF NATURAL RESOURCES …… 6-4
APPENDIX 6A – SOCIOECONOMIC IMPACT OF UNMET WATER NEEDS

7 **REGIONAL DROUGHT RESPONSE, INFORMATION, ACTIVITIES, AND RECOMMENDATIONS** ..... 7-1

7.1 DROUGHTS OF RECORD IN FAR WEST TEXAS..... 7-2
7.1.1 Precipitation Indicator ..... 7-3
7.1.2 Stream Flow Indicator ..... 7-5
7.1.3 Spring Discharge Indicator ..... 7-6
7.1.4 Groundwater Level Indicator ..... 7-7
7.1.5 Far West Texas Region Drought of Record ..... 7-8
7.2 CURRENT DROUGHT PREPARATIONS AND RESPONSE ..... 7-9
7.2.1 Drought Response Triggers ..... 7-9
7.2.2 Surface Water Triggers ..... 7-9
7.2.3 Groundwater Triggers ..... 7-11
7.2.4 System Capacity Triggers ..... 7-12
7.2.5 Municipal and Wholesale Water Provider Drought Contingency Plans ..... 7-12
7.2.6 Groundwater Conservation District Drought Management ..... 7-18
7.2.6.1 Brewster County Groundwater Conservation District ..... 7-18
7.2.6.2 Culberson County Groundwater Conservation District ..... 7-18
7.2.6.3 Hudspeth County Underground Water Conservation District ..... 7-18
7.2.6.4 Jeff Davis County Underground Water Conservation District ..... 7-18
7.2.6.5 Presidio County Underground Water Conservation District ..... 7-19
7.2.6.6 Terrell County Groundwater Conservation District ..... 7-19
7.3 EXISTING AND POTENTIAL EMERGENCY INTERCONNECTS ..... 7-20
7.4 EMERGENCY RESPONSES TO LOCAL DROUGHT CONDITIONS ..... 7-21
7.5 REGION-SPECIFIC MODEL DROUGHT CONTINGENCY PLANS ..... 7-25
7.5.1 Regional Groundwater Resources and Monitoring ..... 7-25
7.5.2 Regional Surface Water Resources ..... 7-29
7.5.3 Regional Model Drought Contingency Plan ..... 7-31
7.5.4 Model Drought Contingency Plans ..... 7-36
7.6 DROUGHT MANAGEMENT WATER MANAGEMENT STRATEGIES..... 7-38
7.7 OTHER DROUGHT-RELATED CONSIDERATIONS AND RECOMMENDATIONS..... 7-40

8 **POLICY RECOMMENDATIONS AND UNIQUE SITES** ..... 8-1

8.1 WATER MANAGEMENT POLICY..... 8-2
8.2 REGIONAL WATER PLANNING PROCESS..... 8-3
8.3 WATER RESEARCH NEEDS..... 8-5
8.4 ECOLOGICALLY UNIQUE RIVER AND STREAM SEGEMENTS ..... 8-6
8.5 CONSIDERATION OF UNIQUE SITES FOR RESERVOIR CONSTRUCTION ..... 8-9

9 **WATER INFRASTRUCTURE FINANCING ANALYSIS** ..... 9-1

9.1 TWDB FUNDING PROGRAMS ..... 9-2
9.1.1 State Water Implementation Fund for Texas (SWIFT) ..... 9-2
9.1.2 Water Infrastructure Fund (WIF) ..... 9-2
9.1.3 State Participation Fund (SP) ..... 9-2

9.1.4 Rural and Economically Distressed Areas (EDAP) ……. 9-2
9.2 INFRASTRUCTURE FINANCE SURVEY …… 9-3

10 **PUBLIC PARTICIPATION AND PLAN ADOPTION** ……. 10-1

10.1 REGIONAL WATER PLANNING GROUP ……...10-2
10.2 PROJECT MANAGEMENT ……... 10-4
10.3 PLANNING GROUP MEETINGS AND PUBLIC HEARINGS ……... 10-5
10.4 COORDINATION WITH OTHER REGIONS …….. 10-7
10.5 PLAN IMPLEMENTATION ……. 10-8
APPENDIX 10A – RESPONSE TO PUBLIC COMMENTS
APPENDIX 10B – RESPONSE TO TWDB COMMENTS
APPENDIX 10C – RESPONSE TO TPWD COMMENTS

11 **IMPLEMENTATION AND COMPARISON TO THE PREVIOUS REGIONAL WATER PLAN** …… 11-1

11.1 IMPLEMENTATION OF PREVIOUS REGIONAL WATER PLAN ……... 11-2
11.2 COMPARISON TO PREVIOUS PLAN ……. 11-4
11.2.1 Water Demand Projections ……. 11-5
11.2.2 Drought of Record and Hydrologic and Modeling Assumptions ……... 11-5
11.2.3 Source Water Availability ……..…… 11-5
11.2.4 Existing Water Supplies of WUGs …… 11-6
11.2.5 WUG and WWP Needs ……. 11-11
11.2.6 Recommended and Alternate Water Management Strategies ……11-12
11.3 PROGRESS OF REGIONALIZATION……. 11-21

# CHAPTER 1
# FAR WEST TEXAS DESCRIPTION

*This page intentionally left blank.*

# 1 FAR WEST TEXAS

Far West Texas encompasses the most arid region of the State of Texas (Figure 1-1). Residents of this expansive desert environment recognize that water is a scarce and valuable resource that must be developed and managed with great care to ensure the area's long-term viability. The Region's economic health and quality of life are dependent on a sustainable water supply that is equitably managed.

Chapter 1 presents a broad descriptive overview of Far West Texas including currently existing water management facilities and international water issues. This chapter also summarizes specific planning components that are presented in more detail elsewhere in this *Plan*, such as projected population and water demand and available water-supply sources to meet these anticipated demands. Also provided in this chapter is a listing of State and Federal agencies, universities, and private organizations that are involved in various aspects of water supply issues.

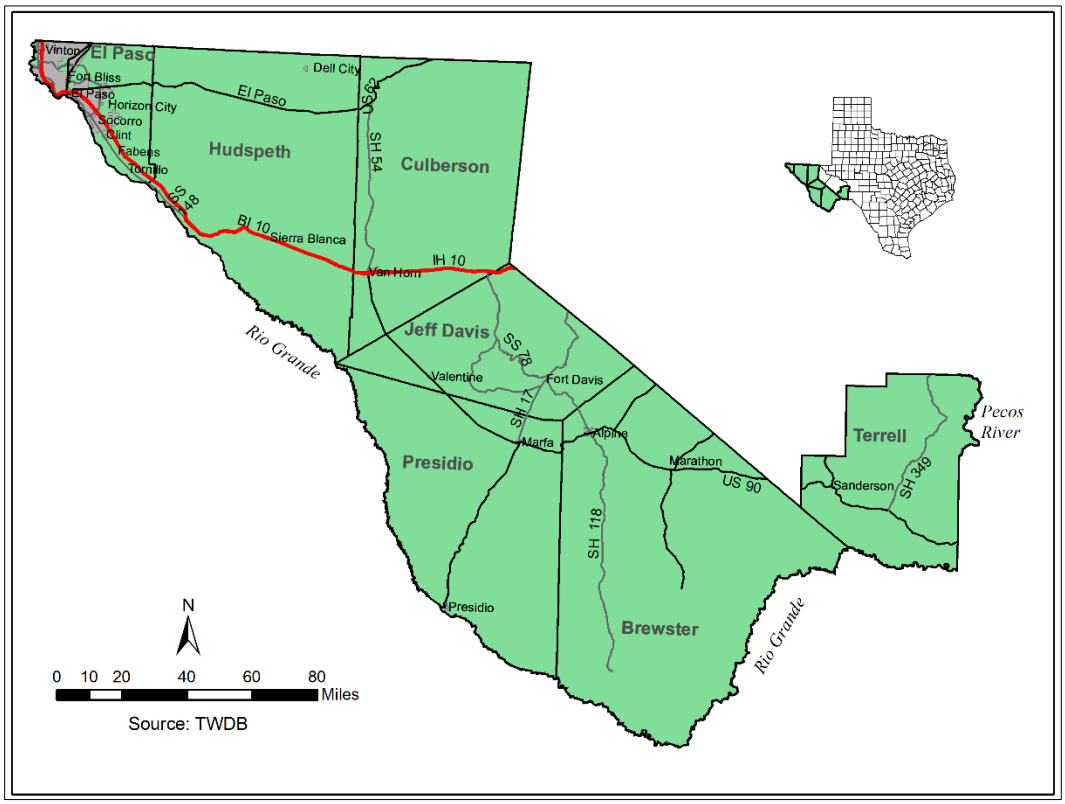



**Figure 1-1. Location of Far West Texas**

# 1.1 WATER PLANNING AND MANAGEMENT

### 1.1.1 Regional Water Planning

The *2021 Far West Texas Water Plan* follows an identical format as the plans prepared by the other 15 water planning regions in the State as mandated by the Texas Legislature and overseen by the Texas Water Development Board. The *Plan* provides an evaluation of current and future water demands for all water-use categories, and water supplies available during drought-of-record conditions to meet those demands. Where future water demands exceed an entity's ability to supply that need, alternative strategies are considered to meet the potential water shortages. Water management strategies are also presented that reflects an entity's desire to upgrade their water supply system. In all cases, conservation practices are first considered in managing water supplies.

In January of 2016, the fourth round of regional water planning was concluded with the adoption of the *2016 Far West Texas Water Plan*. It is understood that this *Plan* was not a static plan but rather is intended to be revised as conditions change. For this reason, the current *2021 Plan* put forth in this document is not a new plan, but rather an evolutionary modification of the preceding *2016 Plan*. Only those parts of the previous *Plan* that require updating, and there are many, have been revised.

The purpose of the *2021 Far West Texas Water Plan* is to provide a document that water planners and users can reference for long- and short-term water management recommendations. Equally important, this *Plan* serves as an educational tool to inform all citizens of the importance of properly managing and conserving the delicate water resources of this desert community.

Previous regional and state water plans have been aligned with political boundaries, such as city limits rather than water utility service areas. Recent TWDB rule changes now define a municipal water user group (WUG) as being utility-based, and thus the emphasis of the development of population and municipal water demands for the 2021 regional water plans transition from political boundaries to utility-service area boundaries.

Because our understanding of current and future water demand and supply sources is constantly changing, it is intended for this *Plan* to be revised every five years or sooner if deemed necessary. This *Plan* fully recognizes and protects existing water rights, water contracts, and option agreements. There are no known conflicts between this *Plan* and plans prepared for other regions. Publicly available water plans of major agricultural, municipal and commercial water users were considered in the development of this *Plan*, primarily as they relate to Chapter 5 recommended water management strategies, Chapters 5 and 7 conservation and drought topics.

The Far West Texas Water Planning Group (FWTWPG) is a voluntary association comprised of voting and non-voting members whom represent a minimum of 11 water use categories. Since 1997, the planning group has been involved in a wide range of projects, programs and the development of the regional water plan. All meetings and activities of the FWTWPG met all requirements under the Texas Open Meetings Act.

Water supply availability under drought-of-record conditions is considered in the planning process to ensure that water demands can be met under the most challenging hydrologic circumstances. For surface water supplies, drought-of-record conditions relate to the quantity of water available to meet existing

permits from the Rio Grande and the Pecos River as estimated by the TCEQ Rio Grande Water Availability Model (WAM). This *2021 Plan* has no impact on navigation on these surface water courses.

The availability of groundwater during drought-of-record conditions is based on the Modeled Available Groundwater (MAG) volumes that may be produced on an average annual basis to achieve a Desired Future Condition (DFC) as adopted by Groundwater Management Areas (GMAs) (per Texas Water Code §36.001). Groundwater availability volumes for parts of the Region where MAGs are not determined by the TWDB are calculated separately. Chapter 3 contains a detailed analysis of water supply availability in the Region.

Since the completion of the *2016 Far West Texas Water Plan*, several changed conditions have occurred in the Region which warrants this 2021 updated water *Plan*. The latest census (2010) is the baseline for estimates of population and municipal/rural water demand projections. Groundwater and surface water availability models (GAMs and WAMs) have been developed as resource tools for use in evaluating water-supply source availability.

This current *Plan* continues to rely on environmental data on the more prominent watercourses in the Region as contributed by the Texas Parks & Wildlife Department, the National Parks Service, and the Texas Nature Conservancy. This data was useful in the assessment and consideration of environmental flow needs, springs, and ecologically unique stream segments.

The FWTWPG strongly encourages all entities to participate in the planning process so that their specific concerns can be recognized and addressed. The Group also encourages the participation of Groundwater Conservation Districts (GCDs) and recognizes their management plans and rules. District management plans are specifically respected when establishing groundwater availability estimates.

Water quality is recognized as an important component in this 50-year water plan. Water supplies can be diminished or made costlier to prepare for distribution if water quality is compromised (Section 1.8). To ensure that this *Plan* fully considers water quality, the Federal Clean Water Act and the State Clean Rivers Program were reviewed and considered when developing water-supply availability estimates (Chapter 3), water management strategies water quality impacts (Chapter 5), and recommendations (Chapter 8).

### 1.1.2 Interim Regional Water Supply Research Projects

Previous planning periods included research projects that provided important scientific data or water strategy analysis that was beyond the normal range of regional planning activities, but provided important insight and accuracy to the overall planning process. Reports of the results of these studies listed below are available at the Rio Grande Council of Governments website (http://westtexaswaterplanning.org/) or from the TWDB website (http://www.twdb.texas.gov/publications/reports/index.asp). Information gained from these projects is also incorporated in specific water-supply management strategies discussed in Chapter 5.

- Igneous Aquifer System of Brewster, Jeff Davis and Presidio Counties, Texas (2001)
- West Texas Bolsons and Igneous Aquifer System Groundwater Availability Model Data Collection (2003)
- Conceptual Evaluation of Surface Water Storage in El Paso County (2008)

- Far West Texas Climate Change Conference (2008)
- Groundwater Data Acquisition in Far West Texas (2009)
- Evaluation of Irrigation Efficiency Strategies for Far West Texas: Feasibility, Water Savings and Cost Considerations (2009)
- Water Conservation Conference for Far West Texas Water Plan Region E (2009)
- Groundwater Data Acquisition and Analysis for the Marathon and Edwards-Trinity (Plateau) Aquifers (2010)

### 1.1.3 State Water Plan

The Texas Water Development Board adopted *Water for Texas 2017* as the latest official Texas State Water Plan. The Texas Water Code directs the TWDB to periodically update this comprehensive water plan, which is used as a guide to State water policy. The 2017 State Water Plan is the fourth water plan to incorporate water management and policy decisions made at the regional level as expressed in the 16 approved regional water plans.

### 1.1.4 Groundwater Conservation Districts

The Texas Legislature has established a process for local management of groundwater resources through Groundwater Conservation Districts (GCDs). GCDs are charged to manage groundwater by providing for the conservation, preservation, protection, recharging and prevention of waste of groundwater within their jurisdictions. An elected or appointed board governs these districts and establishes rules, programs and activities specifically designed to address local problems and opportunities. Texas Water Code §36.0015 states, in part, "Groundwater Conservation Districts created as provided by this chapter are the State's preferred method of groundwater management." Six districts are currently in operation within Far West Texas (Figure 1-2) and their management goals are discussed in further detail in Chapter 6.

- Brewster County Groundwater Conservation District
- Culberson County Groundwater Conservation District
- Hudspeth County Underground Water Conservation District #1
- Jeff Davis County Underground Water Conservation District
- Presidio County Underground Water Conservation District
- Terrell County Groundwater Conservation District

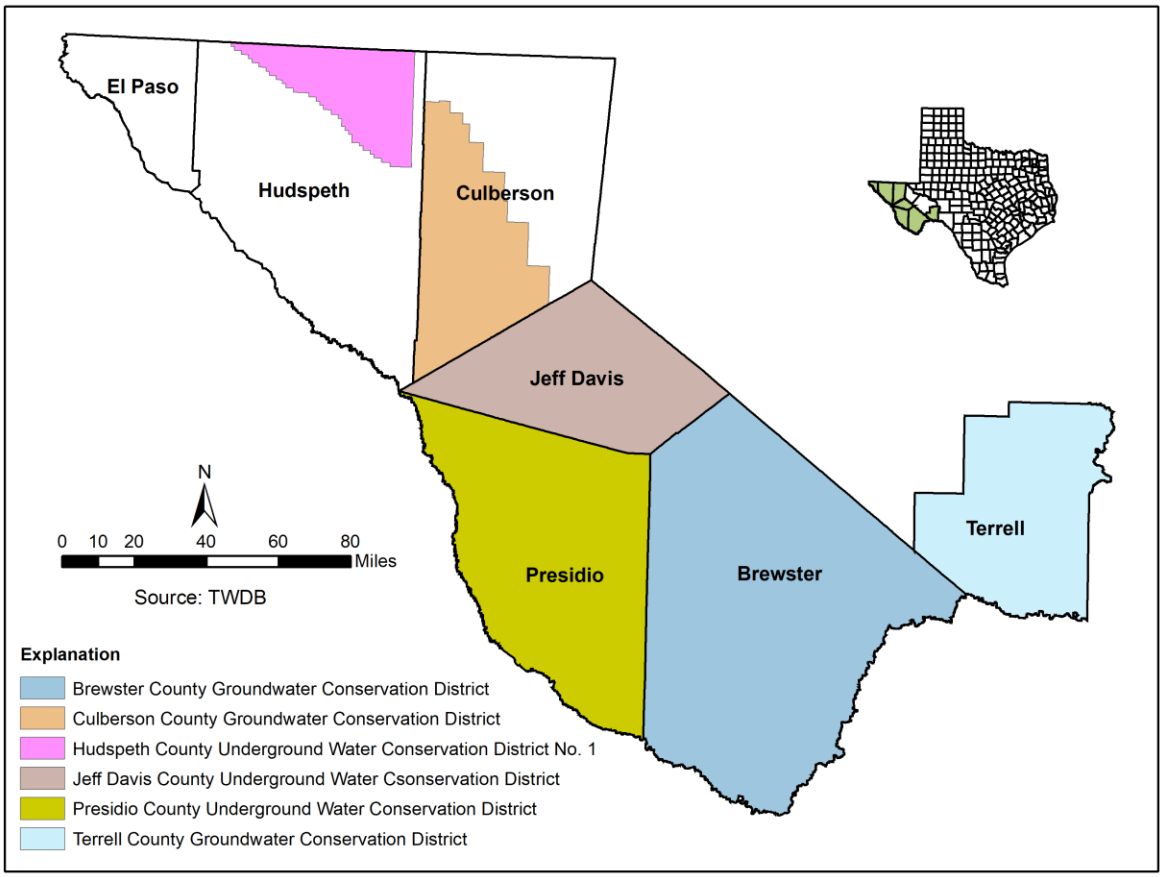



**Figure 1-2. Groundwater Conservation Districts**

### 1.1.5 Groundwater Management Areas

In recent sessions, the Texas Legislature has redefined the manner in which groundwater is to be managed (http://www.twdb.texas.gov/groundwater/management_areas/index.asp). Senate Bill 2 of the 77th Texas Legislature (2001) authorized:

- The Texas Water Development Board (TWDB) to designate Groundwater Management Areas that would include all major and minor aquifers of the State.
- The requirement of Groundwater Conservation Districts to share groundwater plans with other districts in the Groundwater Management Area.
- A Groundwater Conservation District to call for joint planning among districts in a Groundwater Management Area.

The objective was to delineate areas considered suitable for management of groundwater resources. A Groundwater Management Area (GMA) should ideally coincide with the boundaries of a groundwater reservoir (aquifer) or a subdivision of a groundwater reservoir, but it may also be defined by other factors, including the boundaries of political subdivisions. In December 2002, the TWDB designated 16 GMAs covering the entire state (http://www.twdb.texas.gov/mapping/maps.asp).

In 2005, the Legislature once again changed the direction of groundwater management. The new requirements, codified in Texas Water Code Chapter 36.108, required joint planning in management areas among Groundwater Conservation Districts. The new requirements indicate that,

> *"Not later than September 1, 2010, and every five years thereafter, the districts shall consider groundwater availability models and other data or information for the management area and shall establish desired future conditions for the relevant aquifers within the management area."*

Desired Future Conditions (DFCs) are a description of the aquifers at some time in the future. This description is a precursor to developing a volumetric number called Modeled Available Groundwater (MAG). The TWDB is responsible for providing each Groundwater Conservation District and regional water planning group, located wholly or partly in the management area, with MAG volumes. Once the MAG is determined, the districts begin issuing groundwater withdrawal permits to support the Desired Future Condition (DFC) of the aquifer up to the total amount of the MAG. These permits express DFCs by only allowing withdrawals that will support the conditions established by the groundwater management area. Regional water plans must also incorporate the MAG for each aquifer within their regions. The counties of Far West Texas are included in three Groundwater Management Areas:

- GMA 4 includes Brewster, Culberson, part of Hudspeth, Jeff Davis and Presidio
- GMA 5 includes El Paso and part of Hudspeth
- GMA 7 includes Terrell

This *2021Far West Texas Water Plan* includes a significant revision to groundwater source availability estimates based on MAG volumes generated from the GMA process for those aquifers that are managed by the Groundwater Conservation Districts.

### 1.1.6 El Paso Water as the Declared Regional Water Supply Planner

In 1995, the Texas Legislature passed Senate Bill 450 designating the El Paso Water Utilities/Public Service Board (now El Paso Water) as the regional water and wastewater planner for El Paso County. The purpose of the Bill is to improve regional water and wastewater planning for El Paso County and encourage increased consultation, coordination, and cooperation in the management of regional water resources. The City of El Paso serves a pivotal role in all future planning and expansion projects. The City, through El Paso Water, receives priority consideration for public funding for the planning, design, and construction of water supply and wastewater systems within the County. The intent of Senate Bill 450 is to address regional planning issues by the following seven actions:

- Coordinate water and wastewater management on a regional watershed basis
- Address water quality and quantity conditions adversely affecting the public health and the environment
- Provide efficient planning and management of water resources to mitigate existing and avoid future negative colonia conditions
- Participate in water and wastewater planning with adjacent counties and the border states of New Mexico and Chihuahua, Mexico, to address transboundary water issues

- Encourage conjunctive management for the protection and preservation of the limited surface water and groundwater resources
- Maximize the amounts and provide for the efficient use of public funding to implement the purposes of Senate Bill 450
- Provide intergovernmental cooperation with water utilities to encourage their planning to be consistent with the regional plan

### 1.1.7 El Paso County Priority Groundwater Management Area

In 1985, the 69th Texas Legislature recognized that certain areas of the State were experiencing or were expected to experience critical groundwater problems. House Bill 2 directed the Texas Department of Water Resources (later to become the Texas Water Commission (TWC) and the Texas Water Development Board (TWDB)) to identify the "critical" groundwater areas in the State, to conduct studies in those areas, and to make recommendations on whether a GCD should be established in critical areas. Senate Bill 1 changed the name of "Critical Area" to "Priority Groundwater Management Area" (PGMA) and mandated that the Texas Natural Resource Conservation Commission (TNRCC - successor agency to the TWC and later to be named TCEQ) complete reviews of all pending PGMA studies.

The PGMA process is initiated by TCEQ, who designates a PGMA when an area is experiencing critical groundwater problems, or is expected to do so within 25 years. These problems include shortages of surface water or groundwater, land subsidence resulting from groundwater withdrawal, or contamination of groundwater supplies. Once an area is designated a PGMA, landowners have two years to create a GCD. Otherwise, the TCEQ is required to create a GCD or to recommend that the area be added to an existing district. The TWDB works with the TCEQ to produce a legislative report every two years on the status of PGMAs in the State. The PGMA process is completely independent of the current Groundwater Management Area process as each process has different goals. The goal of the PGMA process is to establish GCDs in these designated areas so that there will be a regulating entity to address the identified groundwater issues. PGMAs are still relevant if there remain portions within these designated areas without GCDs. A statewide map of the declared PGMA areas is available at: https://www.tceq.texas.gov/groundwater/pgma.html.

The TWC and TWDB evaluated groundwater supply conditions in El Paso County in 1990 as part of the PGMA program. An overview evaluation (TWDB Report 324) recognized that the Hueco Bolson Aquifer had a long history of water-level decline and water-quality deterioration, and the expected life of the aquifer, under then current understanding, was about 60 years at best. However, rather than declaring the area "Critical," the TWC placed a moratorium over the declaration until after the completion of a 50-year City of El Paso water management plan.

The TNRCC requested a technical update study of El Paso County, which was completed in the spring of 1998 (TWDB Open-File Report, Preston, 1998; and TPWD Report, El-Hage and Moulton, 1998). The TWDB report concluded that water-level declines and quality deterioration are still present in the Hueco Bolson, but did not address El Paso's plans to remedy the problems and provide long-term management. The TPWD reported no known effect on wildlife as a result of water-level declines in the Hueco Bolson Aquifer. TNRCC staff then completed their analysis and recommended to their Commissioners that the area identified by the TWDB as the Hueco Bolson Aquifer in El Paso County be declared a PGMA (TNRCC File Report, Musick, 1998). The Commissioners, subsequently, declared "the area of El Paso

County overlying the Hueco Bolson Aquifer, including its subcrops and outcrops*"* as a PGMA. However, the Commissioners stated that,

> *"El Paso has clearly demonstrated a significant effort toward regional cooperation, planning, and voluntary implementation of actions to address water supply problems" and that "it is not clear that creating a groundwater conservation district for the area of El Paso County overlying the Hueco Bolson Aquifer would be in the public interest, meet a public need, or benefit the property therein at this time."*
>
> *(TNRCC Docket No. 98-0999-MLM, SOAH Docket No. 582-98-1540).*

Since the conclusion of this action, El Paso County Commissioner's Court has not promulgated any water availability requirements within the County.

### 1.1.8 Hudspeth County Priority Groundwater Management Area Consideration

In March 2005, Texas Commission on Environmental Quality (TCEQ) released a report titled Evaluation for the Hudspeth County Priority Groundwater Management Study Area. The purpose of this evaluation was to determine if the Hudspeth County area is experiencing, or is expected to experience within the next 25 years, critical groundwater problems, and whether a GCD should be created to address such problems. The study area included all of Hudspeth County; however only the area outside of the Hudspeth County Underground Water Conservation District No. 1 was considered for PGMA designation.

For this report, TCEQ staff considered comments, data, and information provided by several different sources including water stakeholders from within the study area, the TWDB, the TPWD, the FWTWPG, and independent research by the staff. The report discusses the available authority and management practices of existing groundwater management entities within and adjacent to the study area, and makes recommendations on appropriate strategies needed to conserve and protect local groundwater resources.

The water supply problems identified in the study area include widespread total dissolved solids concentrations in groundwater and the lack of firm alternative supplies for irrigation use in the Rio Grande Valley during drought-of-record conditions. Groundwater concerns expressed by area stakeholders included sustainability, water quality, availability, access to alternative water supplies, and the possibility of water exportation.

The TCEQ concluded that the identified water supply and water quality issues are not presently critical problems and are not anticipated to be critical during the next 25-year planning horizon, and that the Hudspeth County study area should not be designated as a PGMA at this time. However, the TCEQ also acknowledges that the creation of a GCD is a feasible and practicable groundwater management option for citizens of the study area to consider.

## 1.2 FAR WEST TEXAS GEOGRAPHIC SETTING

Located in the westernmost region of the State, Far West Texas is bounded on the north by New Mexico, on the south and west by the Rio Grande and the United Mexican States, and on the east by the Pecos River; and incorporates the counties of Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, Presidio and Terrell. These counties claim some of the most impressive topography and scenic beauty in Texas. The Region is home to the Guadalupe Mountains National Park, Big Bend National Park, and the contiguous Big Bend Ranch State Park. El Paso, the largest city in the Region, is also the nation's largest city on the U.S.-Mexico border. Ciudad Juarez, with an estimated population of over 1.5 million, is located across the Rio Grande from the City of El Paso and shares the same water sources with El Paso.

All seven counties that comprise the planning Region lie solely within the Rio Grande River Basin. The Rio Grande not only forms the border between the United States and Mexico but is also a vital water-supply source for communities, industries, and agricultural activities adjacent to the River. Above Fort Quitman, use of water from the Rio Grande is controlled primarily by the operations of the Rio Grande Project, which was established to supply agricultural water in southern New Mexico and Far West Texas. Other than along the Rio Grande corridor, the Region is dependent on groundwater resources derived from several aquifer systems.

The counties of Far West Texas are among the largest in the State, occupying 24,069 square miles ($mi^2$), or 9 percent of the total State area. Ranked by total area, the counties that make up the Region are Brewster (6,193 $mi^2$), Hudspeth (4,572 $mi^2$), Presidio (3,856 $mi^2$), Culberson (3,813 $mi^2$), Terrell (2,358$mi^2$), Jeff Davis (2,264 $mi^2$), and El Paso (1,013 $mi^2$).

### 1.2.1 Physiography

Far West Texas is in a topographically distinct area of North America known as the Basin and Range Physiographic Province and is characterized by higher elevations and greater local relief than is observed anywhere else in the State. Traversed from north to south by an eastern range of the Rocky Mountains, the Region contains all of Texas' true mountains (Figure 1-3). Widely spaced mountain ranges rise from 1,000 to more than 3,000 feet above the intervening basin lowlands.

Although most of Texas is generally flat and less than 2,500 feet above mean sea level, the floors of most of the basins in Far West Texas are at elevations greater than 3,000 feet. The basins (or bolsons) are filled with sediments eroded from the surrounding mountains. At the deepest points of the basins, deposits of basin-fill range in thickness from less than 1,000 feet to more than 9,000 feet. Except for the Rio Grande and its tributaries, the Rio Conchos (Chihuahua, Mexico) and the Pecos River (Texas), all surface water in the Region drains toward the lowest elevation within each basin. "Salt Flats" occur in northeastern Hudspeth and northwestern Culberson Counties where water, upwelling from shallow aquifers and collecting from rainfall runoff, rapidly evaporates leaving behind accumulations of mineral deposits. These lakes are dry during periods of low rainfall, exposing salt-incrusted basin flats. For years, this area was a source of commercial salt extraction.

Highest of the mountain ranges are the Guadalupe Mountains, which straddle the Texas-New Mexico state line. The highest elevations in the range are Guadalupe Peak (the highest surface elevation in Texas at 8,751 feet) and El Capitan, which overlook the Salt Basin to the west and south. Lying west of the Salt Basin and extending to the Hueco Mountains a short distance east of El Paso is the Diablo Plateau.

Other mountain ranges, including the Eagle, Quitman, Carrizo, Delaware, and Sierra Vieja Mountains, are located south and east of the Diablo Plateau in Culberson, Hudspeth, Jeff Davis, and Presidio Counties. These mountains overlook several intermountain basins from which there is no external drainage (e.g., Eagle Flat, Ryan Flat, Michigan Flat, and Wild Horse Flat). Two other basins, Red Light Draw and Green River Valley, are dissected by and drain to the Rio Grande.

The Davis Mountains are principally in Jeff Davis County; however, igneous rocks originating from volcanic vents that formed the Davis Mountains extend into Brewster, Hudspeth, and Presidio Counties. The Davis Mountains contain peaks with elevations greater than 7,000 feet, including Mount Livermore, which at 8,206 feet is one of the highest peaks in Texas. Mount Locke at 6,809 feet is home to the University of Texas McDonald Observatory. These peaks intercept moisture-bearing winds and receive more precipitation than other locations in West Texas. The Davis Mountains are greener than other mountains of the Region with the growth of grass and forest trees.

The Big Bend country, which lies southeast of the Davis Mountains, is bounded on three sides by a great eastward swing of the Rio Grande, which gives it its name. It is a sparsely populated mountainous country with scant rainfall. Its principal mountains, the Chisos, rise to an elevation of 7,825 feet. Along the Rio Grande are the Santa Elena, Mariscal, and Boquillas Canyons, with rim elevations of 3,500 feet to 3,775 feet. Because of its remarkable topography and plant and animal life, the southern part of this Region along the Rio Grande is home to Big Bend National Park and Big Bend Ranch State Park.

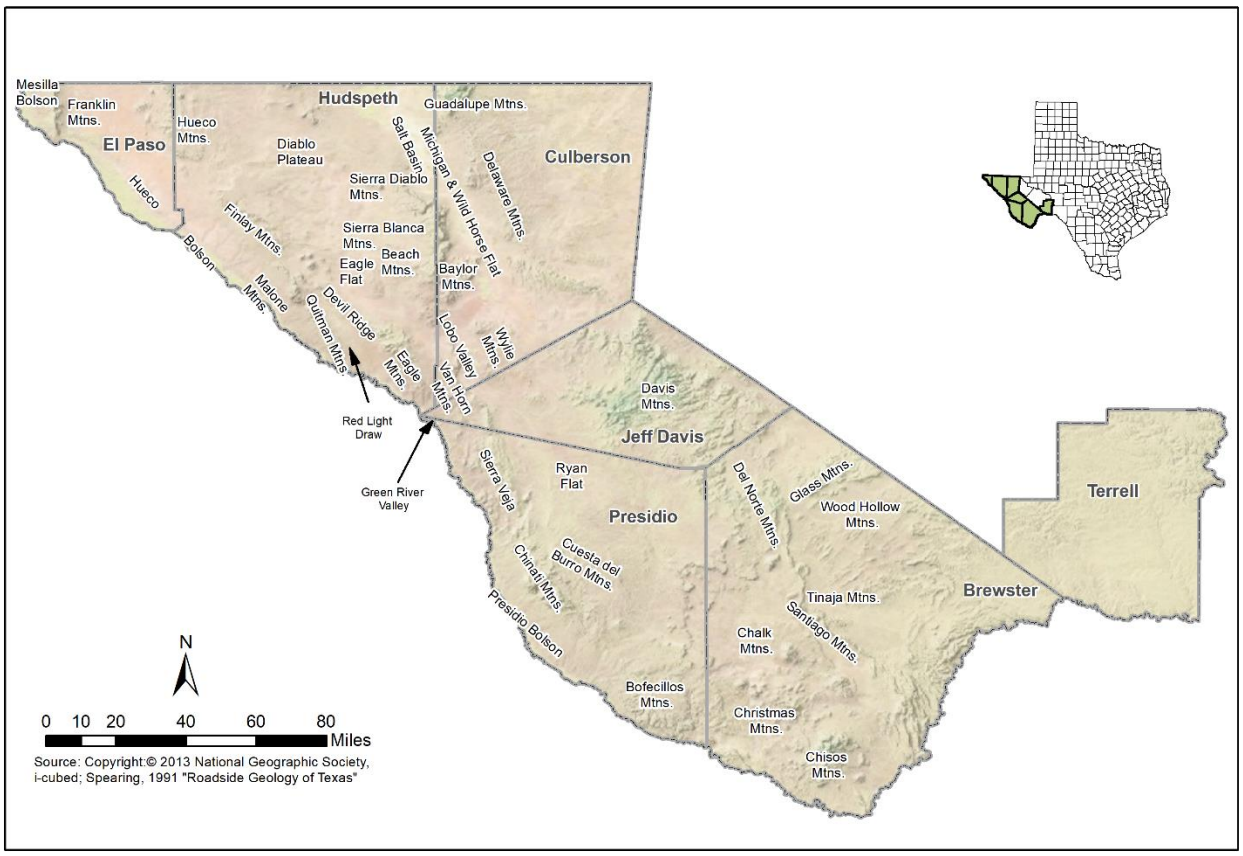



**Figure 1-3 Mountains and Basins**

In El Paso County, the Franklin Mountains rise 3,000 feet above the adjacent Rio Grande valley floor to an elevation of 7,192 feet, and separate the "Upper and Lower Valleys" of the Rio Grande, as well as the Mesilla and Hueco Bolsons. The historic towns and missions of Ysleta, Socorro and San Elizario are located along the Lower Valley.

### 1.2.2 Population and Regional Economy

Apart from El Paso County, the counties of Far West Texas are among the least populated in the State. In the year 2020, approximately 97 percent (925,565) of the Region's 954,035 residents are projected to reside in El Paso County, where the population density is 914 persons per square mile (Figure 1-4). The population density of the six rural counties is approximately one person per square mile. Approximately 75 percent of the residents in the Region are Hispanic or Latinos.

The City of El Paso, one of the fastest growing cities in Texas, is the largest city in the Region, with a year-2020 projected population of 734,031. This is 79 percent of the total population of El Paso County and 77 percent of the Region's total population.

The year-2020 projected populations of cities in the six rural counties are as follows: Alpine, Brewster County (6,066); Van Horn, Culberson County (2,319); Sierra Blanca, Hudspeth County (620); Fort Davis, Jeff Davis County (1,264); Marfa, Presidio County (2,203); Presidio, Presidio County (4,867); Sanderson, Terrell County (889). Population of other smaller communities such as Fort Hancock, Del City, Marathon and Valentine are included in the "County Other" (rural) population of each county. The "County Other" rural population of the Region is 48,664, or five percent of the total Regional population. The current and projected population growth in Far West Texas is further discussed in Chapter 2.

The regional economy is predominantly comprised of agriculture, agribusiness, manufacturing, tourism, wholesale and retail trade, government, and military. According to TWDB's socio-economic analysis (provided in Appendix 6A), the Far West Texas Regional economy generates about $35 billion in gross state product for Texas and supports roughly 435,000 jobs.

The dominant commercial land use throughout the rural areas of the Region is extensive cattle grazing. Aridity and historic land-tenure practices have combined to produce large ranches and low animal densities. Dairy operations in El Paso County represent the largest proportion of the market valuation for livestock, as El Paso County traditionally ranks in the top five dairy-production counties in Texas. Floodplain-irrigated agriculture is found along the Rio Grande extending above and below El Paso and into southern Hudspeth County. A much smaller irrigated strip also occurs along the River near Presidio. Currently, irrigated agriculture based on groundwater pumping is essentially limited to Dell Valley in northeastern Hudspeth County, Diablo Farms in northwestern Culberson County, and Wild Horse and Lobo Flats near Van Horn.

An innovative agricultural industry has developed in Jeff Davis and Presidio Counties where large greenhouse facilities have been constructed and successfully operated to produce hydroponically grown tomatoes. The Jeff Davis County and Presidio County Underground Water Conservation Districts permit well use for these two facilities and thus have records of their annual groundwater use. Although small compared to large-scale farming operations elsewhere in the Region, the Districts do strive to ensure that this innovative industry is recognized in the Regional Water Plan.

The new Tornillo-Guadalupe International Bridge border crossing in El Paso County was completed in 2014 and replaces the existing Fabens-Caseta International Bridge. The crossing, capable of handling modern day commercial, automobile and pedestrian traffic, supports the expansion of trade and economic growth on both sides of the border. In the El Paso area, the new crossing allows continued expansion of jobs in related industries such as trucking, warehousing, transshipping, and manufacturing; and according to the border economic plan for El Paso County also allows expansion of employment opportunities along IH-10 near the intersection of traffic from Tornillo and Fabens. In Mexico, the project provides an additional crossing that accommodates the expansion of maquiladora plants eastward from Juarez. By 2025, total annual vehicle crossings, both north and south, are expected to be over 900 thousand. Commercial truck traffic that previously traveled through downtown El Paso and Juarez is now able to move through the new crossing beyond the congested urban core, thus reducing air and noise pollution.

In the past several years, the Barnett Shale play has become the largest natural gas play in the State of Texas. This productive geologic formation has equivalent rock units (Woodford) that extend into West Texas. Although gas production from these formations in West Texas have not generally proven to be as prolific as those in the Fort Worth area, exploration interest has caused water planners to pay attention to an industry with potential high water needs. In a concerted effort to derive meaningful water use estimates for all mining applications, including the oil and gas industry, a TWDB report (*Current and Projected Water Use in the Texas Mining and Oil and Gas Industry, 2011 and 2012*) estimates water use for mining, (which includes water used for drilling operations such as rig supply), water flooding, and fracking in two reports. These estimates determined a water use volume per oil and gas well. Estimates from these reports indicate that Culberson and Terrell Counties had the greatest demand by the oil and gas industry within the Far West Texas Region. None of the other counties in the Region have reported any significant usage by the industry.

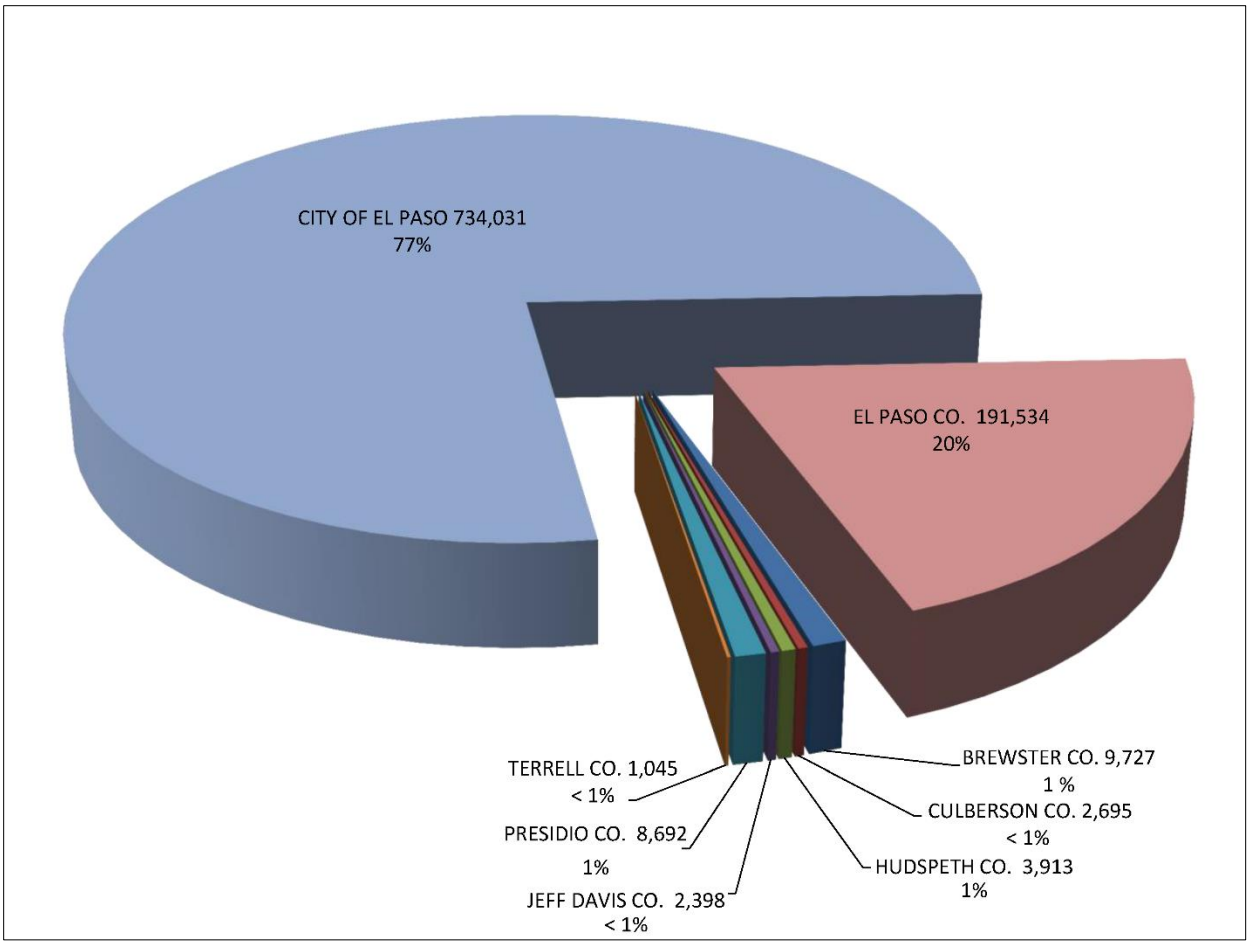



**Figure 1-4. Year 2020 Projected Population**

### 1.2.3 Land Use

Land use in the seven-county Region, as illustrated in Figure 1-5, is described here in terms of six categories:

- Urban (or developed)
- Cultivated agricultural
- Rangeland
- Forest
- Waterways and Wetlands
- Barren

Urban lands make up less than one percent of the total land area in Far West Texas. The largest concentration of urban land is in El Paso County, where 97 percent of the Region's residents live. Cultivated agricultural lands are identified as areas that support the cultivation of crops and occupy less than one percent of the total land area of the Region. These lands generally require access to high

volumes of groundwater or surface water. Together, urban and cultivated agricultural lands comprise the two most significant water consumptive land-use areas.

Rangeland is defined as all areas that are either associated with or are suitable for livestock production. Although this is the largest category of land use in the Region, rangeland accounts for one of the smallest sources of water demand. Forestland occurs where topography and climate support the growth of native trees. These are limited to highlands, such as the Davis, Guadalupe and Chisos Mountains. Forestlands rely exclusively on rainfall as a source of moisture.

Areas designated as either water or wetlands are mostly associated with the Rio Grande and the Pecos River and their tributaries. The Rio Grande is also a major source of irrigation water for agricultural lands in El Paso, Hudspeth and Presidio Counties. Most all other streams in the Region are ephemeral. In addition to the two rivers, wetlands formed by desert springs (cienegas) provide critical wildlife habitat. Finally, barren lands are defined as undeveloped areas with little potential for use for agriculture, rangeland, or forests.

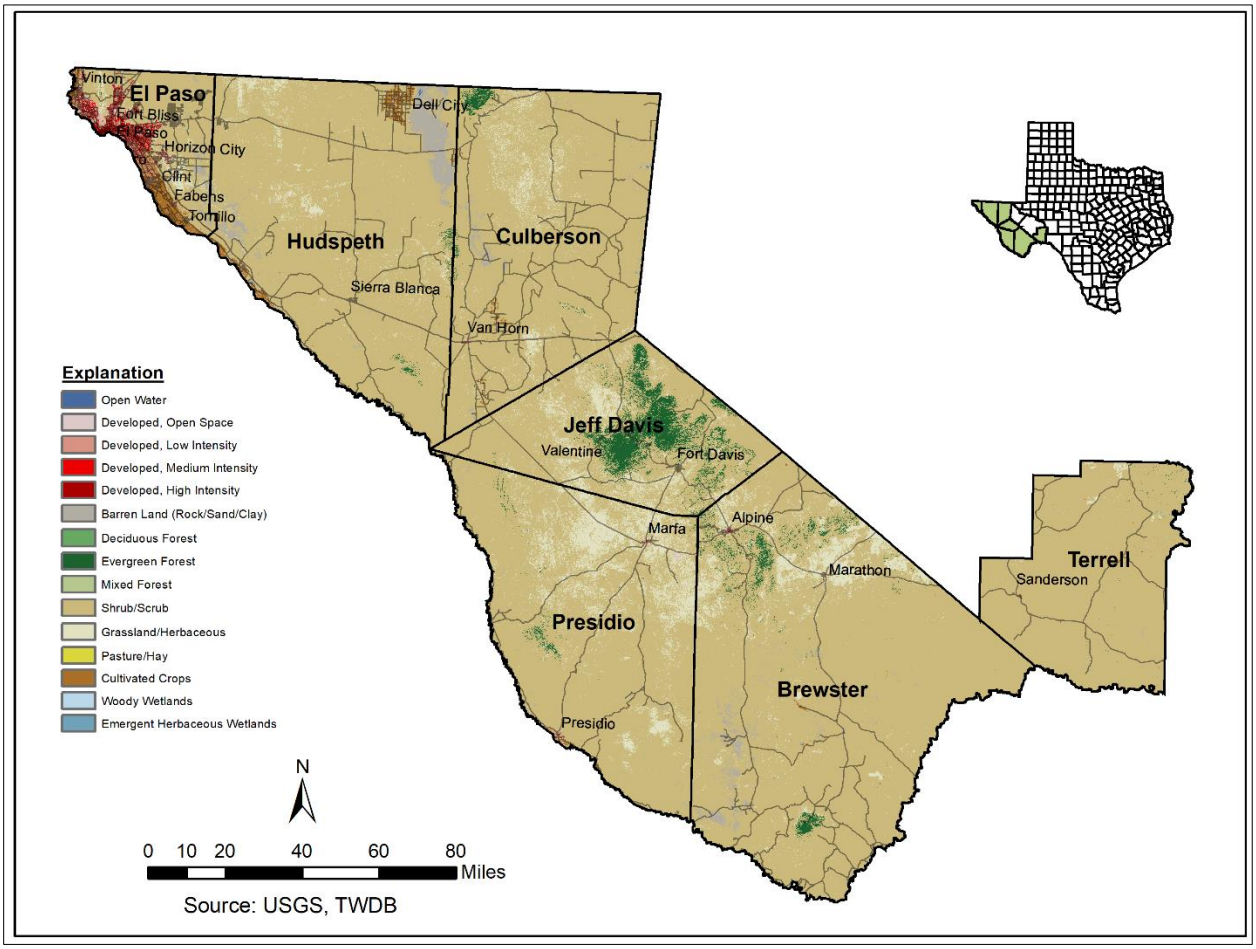



**Figure 1-5. Land Use**

### 1.2.4 Climate

Far West Texas, the most arid region in the State, is positioned in the northern part of the Chihuahuan Desert, a large arid zone that extends southward into Mexico. Only the highest altitudes occurring in the eastern part of the Region receive sufficient precipitation to be considered semiarid, rather than true desert.

The mean annual temperature of the Region is approximately 65°F. The average annual low temperature ranges between 45° F and 54° F, and the average high is 77°F to 80°F. During summer months, afternoon temperatures often exceed 100°F. In the winter, lows in the mountains and high desert plateaus can plummet to less than 10°F.

The Region usually reports the lowest annual precipitation (the regional average is 12.9 inches) and the highest lake-surface evaporation (the regional average is 70 inches) in Texas (Figure 1-6 and Figure 1-7). The combination of low rainfall and high evaporation creates what would be considered drought conditions in any other part of the State.

From highest to lowest values, average annual rainfall at selected locations is reported as follows:

- Mount Locke, Jeff Davis County (20.8 in)
- Alpine, Brewster County (16.9 in)
- Marfa, Presidio County (15.9 in)
- Sanderson, Terrell County (14.3 in.)
- Van Horn, Culberson County (13.1 in)
- Presidio, Presidio County (10.8 in)
- Hudspeth County (10 in)
- City of El Paso, El Paso County (8.8 in)

According to the National Climatic Data Center (NCDC), most rainfall occurs between the months of June and October, as indicated by a graph of average monthly rainfall for selected stations (Figure 1-8). Rainfall during the spring and summer months is dominated by widely scattered thunderstorms. Because of the convective nature of thunderstorms, the amount of spring and summer precipitation in the Region increases with elevation.

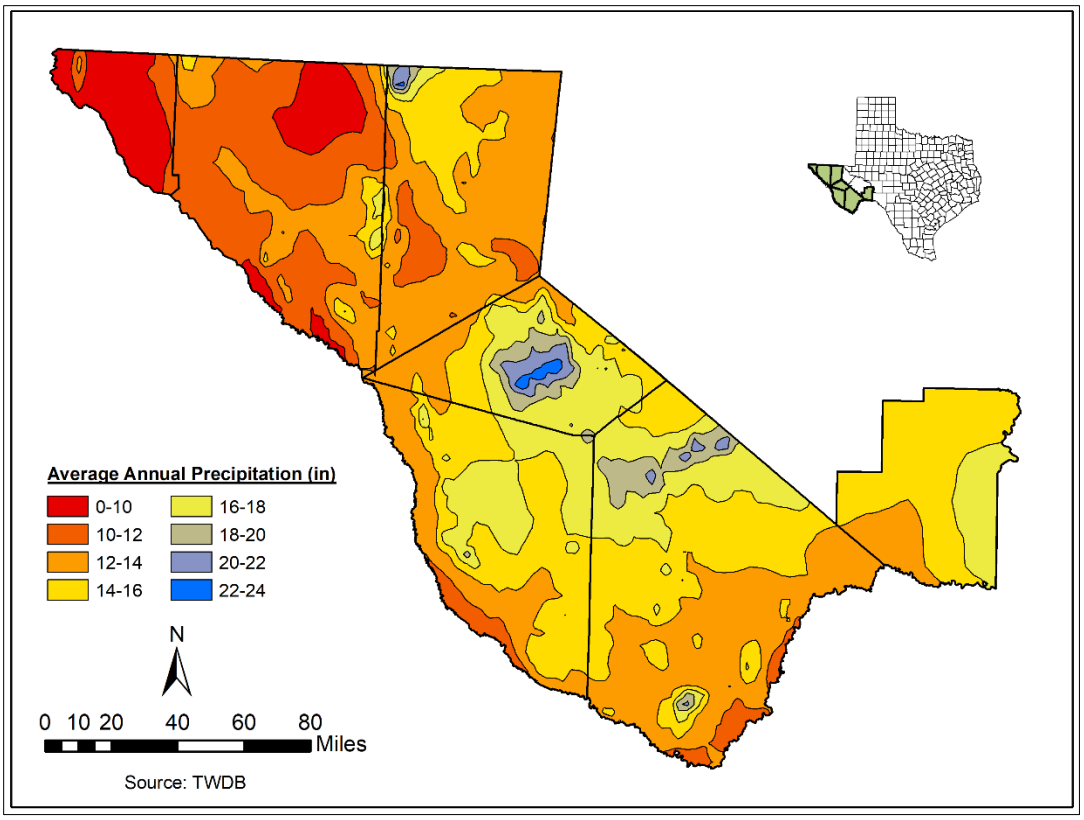



**Figure 1-6. Variation of Precipitation**

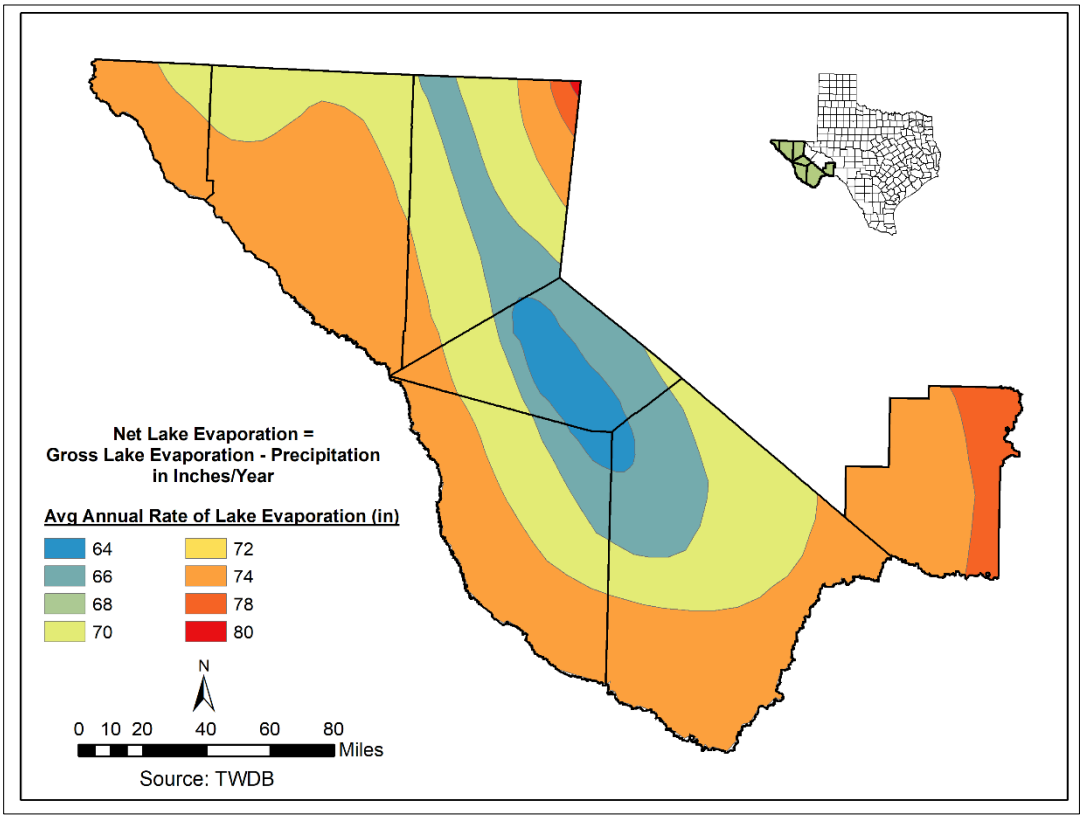



**Figure 1-7. Net Lake Evaporation**

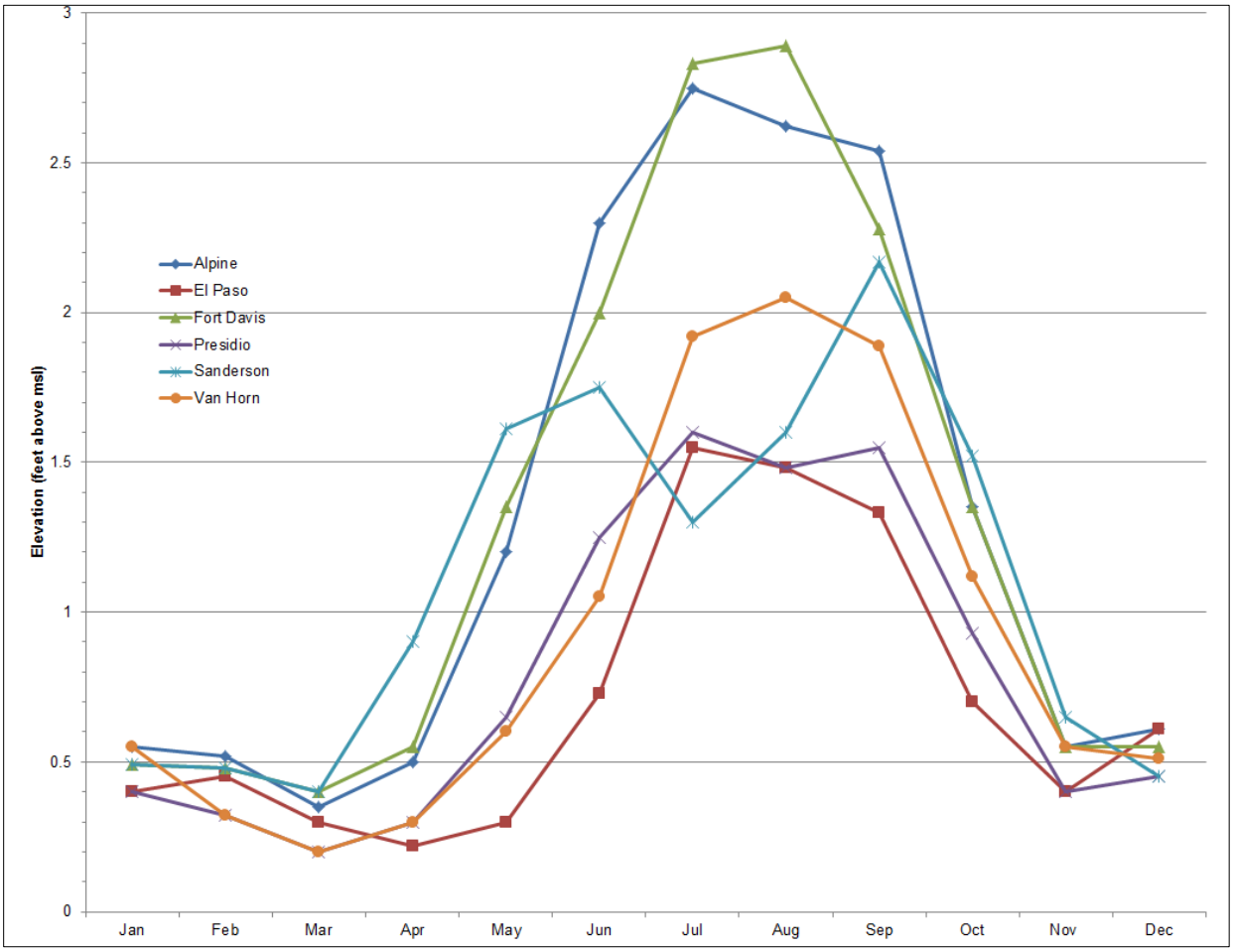



**Figure 1-8. Average Monthly Rainfall**
**Source: NCDC**

### 1.2.5 Far West Texas Climate Change Conference

Far West Texas, like much of the western United States, has historically relied on large-scale infrastructure to store and deliver surface water supplies. These surface water supplies are particularly vulnerable to changes in weather patterns. With the realization that the regional climate may have been more variable in the past than indicated by the historical record and may be even harsher and more variable in the future, several western states have taken on initiatives to address the potential impacts of climate change on their natural resources.

Because of these and other considerations, State Senator Eliot Shapleigh authored Senate Bill 1762 during the 80th Texas Legislative Session. The bill directed the Texas Water Development Board, in coordination with the FWTWPG, to conduct a study regarding the possible impact of climate change on surface water supplies from the portion of the Rio Grande in Texas subject to the Rio Grande Compact. Because of this legislation, the Texas Water Development Board hosted the Far West Texas Climate Change Conference June 17, 2008, at the Carlos M. Ramirez Water Resources Learning Center in El Paso. Along with other related issues, conference participants reviewed:

- Current analyses of potential impacts of climate change on surface water resources in Texas and other Western states; and
- Recommendations for incorporating potential impacts of climate change into the Far West Texas Water Plan, including potential impacts to the Rio Grande in Texas subject to the Rio Grande Compact, and identifying feasible water management strategies to offset any potential impacts.

The entire report "Far West Texas Climate Change Conference – Study Findings and Conference Proceedings" can be accessed at http://www.twdb.texas.gov/publications/reports/special_legislative_reports/doc/climatechange.pdf.

### 1.2.6 Drought

Drought conditions are assumed in the planning process to ensure that adequate infrastructure and planning is in place under severe water shortage conditions and is discussed in detail in Chapter 7 of this *Plan*. Drought in Far West Texas can be defined in the following operational definitions:

**Meteorologic drought** is an interval of time, usually over a period of months or years, during which precipitation cumulatively falls short of the expected supply.

**Agricultural drought** is that condition when rainfall and soil moisture are insufficient to support the healthy growth of crops and to prevent extreme crop stress. It may also be defined as a deficiency in the amount of precipitation required to support livestock and other farming or ranching operations.

**Hydrologic drought** is a long-term condition of abnormally dry weather that ultimately leads to the depletion of surface water and groundwater supplies, the drying up of lakes and reservoirs, and the reduction or cessation of springflow or streamflow.

Although agricultural drought and hydrologic drought are consequences of meteorologic drought, the occurrence of meteorologic drought does not guarantee that either one or both of the others will develop. Regarding the upper segment of the Rio Grande, drought is more significantly influenced by the amount of snowmelt in southern Colorado and northern New Mexico that affects the amount of water in storage in Elephant Butte Reservoir shown in Figure 1-9 (data provided by U.S Department of Interior, Bureau of Reclamation). For Far West Texas and particularly those who rely on the Rio Grande, an operational drought definition is more appropriate.

The westernmost part of Texas, as well as the headwaters of the Rio Grande in Colorado and New Mexico, has been experiencing drought conditions for much of the past two decades, with only 1997, 2005 and 2008 experiencing above average spring runoff into Elephant Butte reservoir. According to the U.S. Bureau of Reclamation El Paso Office, July 2013 Elephant Butte reservoir was at only three percent of capacity. 2013 was the shortest irrigation season (less than six weeks) and supplied the least amount of water in the almost 100-year history of the Rio Grande Project. After a short period of recovery, the reservoir was again back down to 3.3 percent of capacity by October 2018. Per the TWDB Water Data for Texas (http://www.waterdatafortexas.org/), in April 2019 Elephant Butte Reservoir is 14 percent of a full reservoir. Approximately one-fourth of the water currently in storage is Rio Grande Compact Credit water, which is owned by upstream users and is not available for use in southern New Mexico, Texas, or Mexico.

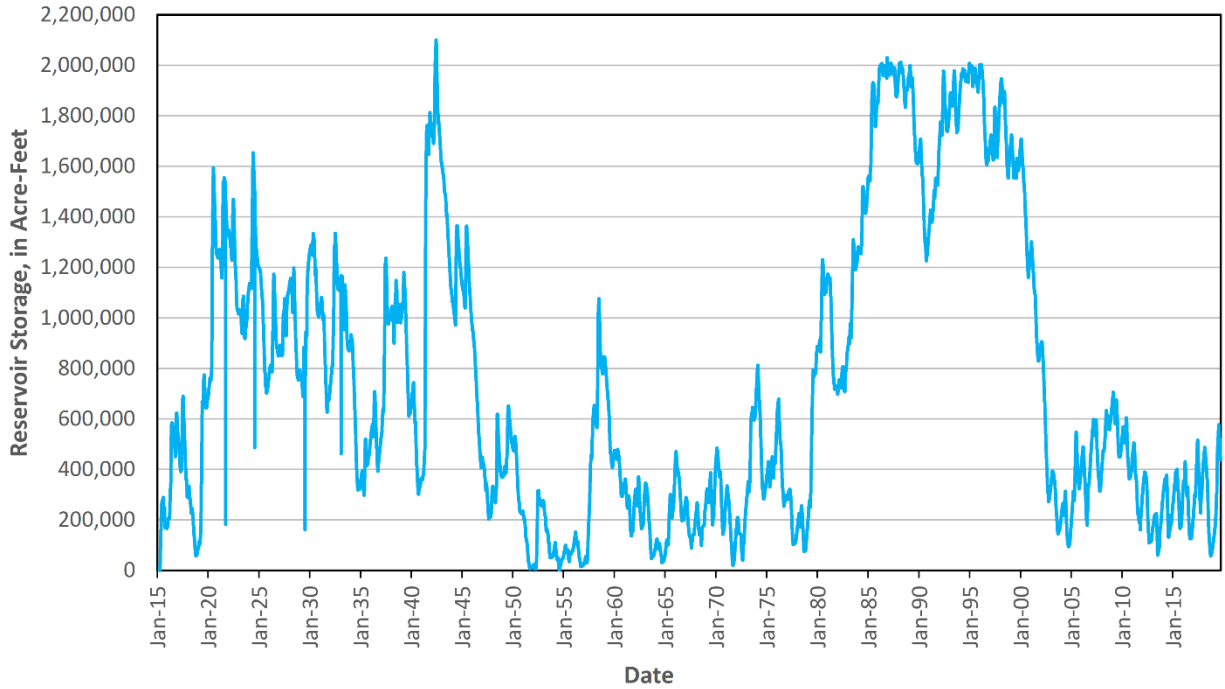



**Figure 1-9. Elephant Butte Reservoir**
**Source: U.S. Bureau of Reclamation**

**River drought above Fort Quitman** is a period when the Rio Grande and its storage facilities (reservoirs) have reached a stage where water deliveries are less than full allocation. There may be a drought in all other definitions, but if there is adequate storage in the local reservoir (Elephant Butte), there is no "river drought" and no reduction in surface water deliveries.

**River drought below confluence of Rio Conchos** may be defined as any time the combined flows of the Rio Grande and Rio Conchos falls below 250 cubic feet per second (cfs) for more than 90 consecutive days.

Consistent flows of less than 250 cfs below Presidio have reduced to bare remnants an agricultural economy on land that has been continuously cultivated longer than anywhere else in Texas. Consistent low water flow threatens important wildlife habitat and river recreation resources that are essential building blocks for rural economies downstream of El Paso.

The 1950s Drought of Record (DOR) and the current drought can be compared using historic precipitation, stream flow records, spring discharges and water level measurements in wells for locations that have accumulated data measurements since the 1940s. This is discussed further in Chapter 7. For this planning cycle, the drought of the 1950s is declared the DOR. However, it is the intent of the current *2021 Plan*, to illustrate in Chapter 7 that although the 1950s drought is the historic Drought of Record, drought conditions experienced over the past decade are significant. Although it is impossible to determine whether the current drought will become the new DOR, further evaluations will be made in future planning cycles to continuously assess the Region's drought conditions.

Far West Texas is perennially under drought or near-drought conditions compared with more humid areas of Texas. Although residents of the Region are generally accustomed to these conditions, the low rainfall

and the accompanying high levels of evaporation underscore the necessity of developing plans that respond to potential disruptions in the supply of groundwater and surface water caused by drought conditions. Those entities that rely on surface water are most vulnerable to the impact of drought. Irrigators along the Rio Grande rely on projected allocations provided by the U.S. Bureau of Reclamation to anticipate their crop potential each year. El Paso Water has developed a conjunctive use plan in which it can shift supply emphasis to groundwater sources during periods of low surface water availability. Water management and drought contingency plans for regional entities are discussed in detail in Chapter 7.

### 1.2.7 Native Vegetation and Ecology

Vegetation native to the arid Chihuahuan Desert is closely tied to the Region's precipitation and evaporation potential. This area typically receives most of its precipitation in the summer in the form of convective storms, which are typically characterized by intense rainfall concentrated in small areas. When it occurs, winter precipitation comes from frontal systems, which are generally soaking rains covering larger areas. Due to their nature, the summer precipitation generally wets only the shallow subsurface soil layer, whereas, winter rains are more likely to percolate deeper into the subsurface.

According to the Chihuahuan Desert Research Institute, vegetation native to Far West Texas can be classified into two groups, intensive water users and extensive water users. Intensive water users include short grasses and cacti, which have short root systems and respond quickly to small amounts of moisture that is available in the soil profile for only a limited time. Extensive water users have both shallow roots capable of capturing soil moisture as well as deep roots that penetrate further downward in the subsurface. Thus, summer rainfall favors grasslands, while winter rainfall favors scrubs. Although a shift in predominate precipitation patterns from summer to winter has not been clearly recognized, local observations indicate that scrubs are becoming more predominate. Likewise, it is becoming increasingly clear that ongoing drought conditions in Far West Texas are placing a serious strain on vegetation, especially the oak and conifer woodlands in the higher elevations.

### 1.2.8 Agricultural Resources

Agriculture, including both the beef industry and irrigated farming, is the most significant economic activity in Far West Texas. The raising of beef cattle occurs in all seven counties, with Brewster County accounting for the greatest number of range cattle. The dairy industry primarily occurs in El Paso County.

With an average annual rainfall of less than 13 inches, the raising of crops in this Region requires irrigation. Most irrigated farming occurs along the flood plains of the Rio Grande in El Paso, Hudspeth, and Presidio Counties, where water is diverted from the River to grow vegetables, cotton, various grain crops, and orchards. Inland, groundwater sources are pumped to the surface to irrigate crops and pastures primarily in Hudspeth (Dell Valley), Culberson (Diablo Farms, Wild Horse Flat, and Lobo Flat), and Jeff Davis (Ryan Flat and Lobo Flat) Counties.

Agricultural activities in the Region that rely on surface water are designed to accommodate the intermittent nature of the supply. In some cases, this means that agricultural water supply needs will be supplemented by groundwater sources, or that irrigation activities will cease until river supplies are replenished.

The only potential impacts to agricultural are identified with the possible change in water rights use from agricultural use to municipal use of Rio Grande water in El Paso County and groundwater in the Dell City and Diablo Farms areas of Hudspeth and Culberson Counties. As these strategies only potentially change the use of the water and not the volume of diversion, there is no significant impact to natural resources.

### 1.2.9 Natural Resources

Far West Texas boasts the highest and most scenic desert communities in Texas. The natural resources of the Region include the surface water and groundwater sources described in Sections 1.4 and 1.5 of this chapter, and in Chapter 3. Terrestrial and aquatic habitats that provide beautiful vistas, recreational opportunities, and unique wildlife habitats are also natural resources. Understandably, both residents and tourists make use of these resources in their enjoyment of the numerous public parks within the Region. Big Bend National Park, Guadalupe Mountains National Park, and Big Bend Ranch State Park are three of the largest protected areas in the Region.

Natural resources also include the great diversity of plant and animal wildlife that inhabit these environments. Texas Parks and Wildlife Department's Natural Diversity Database is a comprehensive source of information on species by county that are federally listed, proposed to be federally listed, have federal candidate status, are state listed, or carry a global conservation status indicating a species is critically imperiled, very rare, vulnerable to extirpation, or uncommon. TPWD suggests that due to continuing updates that readers access the most current listing at http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species.

Both plant and animal species endemic to Far West Texas have developed a tolerance for the intermittent nature of surface water availability; however, significantly long drought conditions can have a severe effect on these species. Riparian water needs for birding habitat are particularly critical. Springs (Cienegas) emanating from shallow groundwater sources often provide the most constant water supply available for aquatic habitat. "Major Springs" in the Region are listed in Section 1.6 of this chapter and are described in more detail in Appendix 1E of the *2011 Far West Texas Water Plan*, while "ecologically unique river and stream segments" are described in Chapter 8 of this *2021 Plan*.

Of recognized importance to the water planning process is the concern of the effect that future development of water supplies might have on the diversity of species in the Region. Water-supply deficit strategies developed in Chapter 5 of this *Plan* include an evaluation of each strategy's potential impact on the environment and natural resources.

# 1.3 REGIONAL WATER DEMAND

### 1.3.1 Major Demand Centers

Total projected year-2020 water consumptive use in Far West Texas is 480,424 acre-feet. The largest category of use is irrigation (310,403 acre-feet), followed by municipalities and county-other (142,507 acre-feet), manufacturing (7,033 acre-feet), steam-electric cooling (10,545 acre-feet), mining (7,835 acre-feet), and livestock (2,101 acre-feet) (Figure 1-10). Sixty-five percent of water used in the Region is by the agricultural sector in support of irrigation. Thirty percent is used by municipalities and county-other, and the remaining 5 percent supports manufacturing, steam-electric power generation, livestock, and mining. Current and projected water demand for all water-use types are discussed in detail in Chapter 2.

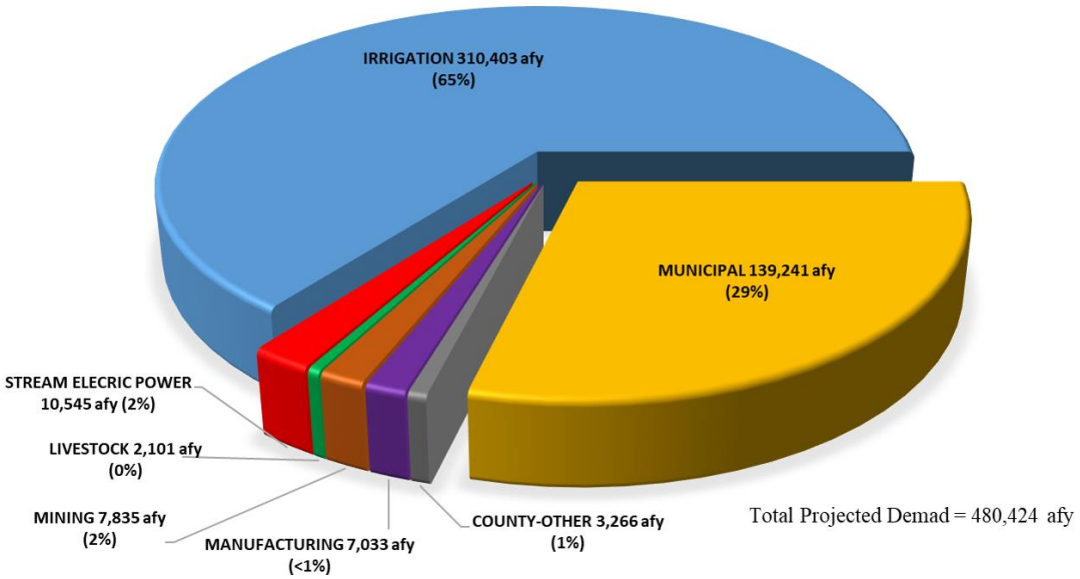



**Figure 1-10. Year 2020 Projected Water Demand by Water-Use Category**

### 1.3.2 Agriculture

The cultural and physical landscape of Far West Texas has more in common with the desert southwest than with other areas of Texas. The dominant commercial land use throughout the rural areas of the Region is extensive cattle grazing. Aridity and historic land-tenure practices have combined to produce large ranches and low animal densities. The projected total volume of water used in livestock production in the Region in the year 2020 is 2,101 acre-feet. Livestock water demand in 2020 ranges from a high of 437 acre-feet in Hudspeth County to a low of 151 acre-feet in Terrell County. The reduction of concentrated dairy farms has significantly reduced livestock water consumption in El Paso County. Cow and calf operations dominate the livestock industry in every county except Terrell, where sheep and goats predominate. In addition to livestock, many of the ranches supplement revenue through hunting leases.

There is virtually no rain-fed agriculture (dry-land farming) in Far West Texas, and even irrigated agriculture is confined to a small fraction of the Region. Floodplain-irrigated agriculture is found along the Rio Grande extending above and below El Paso (EPCWID#1) and into southern Hudspeth County

(HCCRD#1). A much smaller irrigated strip also occurs along the Rio Grande near Presidio from Candelaria to Redford.

Currently, irrigated agriculture based on groundwater pumping is essentially limited to Dell Valley in northeastern Hudspeth County, Diablo Farms in northwestern Culberson County, and Wild Horse and Lobo Flats near Van Horn. High quality cotton, pecans, alfalfa, and vegetables such as tomatoes, onions, and chilies are the major crops of the Region.

Total projected irrigation use in the Region in the year 2020 is 310,403 acre-feet. El Paso and Hudspeth Counties accounted for the greatest amount of irrigation with 149,570 and 115,542 acre-feet of use, respectively. Along the Rio Grande corridor in these two counties, irrigation water is diverted from the River, except during years when flow is significantly below normal. In northeastern Hudspeth County, the Dell Valley farming area irrigates cropland with groundwater pumped from the underlying Bone Spring-Victorio Peak Aquifer.

Irrigation in El Paso and Hudspeth Counties represents 85 percent of total irrigation water use in the Region. Most of the remaining 15 percent of irrigation demand is centered in Culberson County, where 37,863 acre-feet is projected to be used in 2020 to support irrigated agriculture. Greenhouse farming operations near Fort Davis and Marfa have the highest crop (tomatoes) yield per volume of water applied.

The area of land irrigated in the El Paso County Water Improvement District #1 in any given year varies from 40,000 to 50,000 acres. The total water rights acreage in the District, however, is 69,010. The City of El Paso currently owns or leases 13,075 acres of land within the District with water rights.

Crop production in Far West Texas is not sustainable without a source of irrigation water. A reduction in the quantity of water available for irrigation will cause a reduction in the number of acres that can be irrigated profitably. Similarly, cutbacks in the supply of water for livestock will cause a reduction in herd size. As water supplies are depleted, modifications will be required to use the available rangeland resource, and water hauling within a given ranch may be required to better distribute water to livestock.

Although drought-like conditions are a relative constant in the Region, extended periods of below-normal rainfall can have significant and long-lasting harmful effects on the rangeland resource. Reduction of livestock numbers because of drought usually lags the impact of drought on the range-grass ecosystem. Extended periods of drought can lead to the depletion of grass species and to an increase in shrub species. This leads to a decrease in soil cover and increases the potential for erosion by water and wind.

A decrease in water quality has a greater impact on crop production than on livestock output. As the salinity of irrigation water increases, the amount of irrigation water applied must also increase. This satisfies the leaching requirement, and keeps the root zone salinity at levels that allow for economic crop production. If salinity levels increase, the mixture of crops may change to include crops with greater tolerance to soil salinity.

Groundwater use for irrigated farming principally occurs in Dell Valley, Diablo Farms, and along the various flats that comprise the Salt Basin bolson valley. Principal aquifers from which irrigation water is withdrawn include the Rio Grande Alluvium, Bone Spring-Victorio Peak, Capitan Reef, and the Wild Horse/Michigan, Lobo, and Ryan Flats of the West Texas Bolson Aquifers. Characteristics of these aquifers are described in Chapter 3.

Future availability of water for agricultural use from these aquifers varies. During times of insufficient river flow farmers may use groundwater from the Rio Grande Alluvium to sustain crops. However, because of its high mineral content, this water can only be used on a short-term basis. In Dell Valley, groundwater from the Bone Spring-Victorio Peak Aquifer has deteriorated in quality particularly in the central part of the valley as a result of repeated irrigation water return flow. The aquifer should remain viable in the future as the Hudspeth County Underground Water District #1 limits permitted withdrawals to 101,400 acre-feet or less annually (MAG aquifer limit). Water levels have declined in the past in most parts of the Salt Basin aquifers but have generally recovered due to a decrease in pumpage in recent years.

### 1.3.3 Municipal and County-Other

The municipal and county-other category of demand consists of both urban residential, rural-domestic, and commercial water uses. Commercial water consumption includes business establishments, public offices, and institutions, but does not include industrial water use. Residential and commercial uses are categorized together because they are similar types of uses, i.e.; they both use water primarily for drinking, cleaning, sanitation, air conditioning, and landscape watering. Total projected municipal and county-other water demand in the seven counties in the year 2020 is projected to be 142,507 acre-feet.

The City of El Paso, with a projected water use of 110,572 acre-feet in the year 2020, represents 78 percent of the total municipal and county-other water use in the Region. The City's water demand has remained in check over the last several years due to diligent enforcement of conservation measures. Total projected municipal and county-other water use in El Paso County (136,508 acre-feet in 2020), which includes the City of El Paso, other communities, and rural domestic supply, represents 96 percent of the Regional total.

El Paso Water (EPW), which serves the City of El Paso, obtains approximately half of its water from the Rio Grande in full river water supply allocation conditions. The remainder is groundwater pumped from wellfields in the Mesilla Bolson and Hueco Bolson Aquifers. The Utility also supplies water to other incorporated areas and to businesses within El Paso County. Other entities in El Paso County not served by EPW rely exclusively on groundwater resources. All the cities and unincorporated areas of the six rural counties likewise depend entirely on groundwater resources from aquifers located in their respective areas.

Following necessary treatment, water supplies developed for municipal consumption are expected to meet "primary" and "secondary" safe drinking-water standards mandated by the U.S. Environmental Protection Agency and the Texas Commission on Environmental Quality. "Primary standards" address dissolved particulates (e.g., heavy metals and organic contaminants) that are known to have adverse effects on human health. "Secondary standards" address factors that affect the aesthetic quality (e.g., taste and odor) of drinking water.

Water quality varies widely within the Region. In much of the rural counties, groundwater is of sufficient quality that only chlorination is required as a means of treatment. In other areas, various methods of treatment are required to bring the water into compliance with primary and secondary standards. For example, Dell City, El Paso, and Horizon Regional MUD operate desalination plants or wellhead facilities to reduce the concentration of total dissolved solids (TDS) in groundwater extracted from local aquifers.

El Paso Water (EPW) actively treats available water supplies to meet drinking-water standards. These operations include the blending of fresh water with marginally elevated TDS water to increase available supplies, and the tertiary treatment of wastewater to generate supplies for reuse. EPW has updated its treatment facilities to accommodate the recently lowered arsenic concentration standard. EPW and Fort Bliss have jointly constructed the Kay Bailey Hutchison Desalination Facility, a 27.5 MGD desalination plant that makes use of brackish groundwater in the Hueco Bolson Aquifer, thus preserving fresh water in the aquifer for drought protection and emergency use.

County-other is an aggregation of residential, commercial, and institutional water users in cities with less than 500 people or non-city utilities that provide less than an average of 250,000 gallons per day, as well as unincorporated rural areas in each county. The 2020 county-other total water demand for the Region is 3,266 acre-feet/year (Figure 1-10).

### 1.3.4 Major Water Providers

A major water provider is defined as any entity that had contracts to sell more than 1,000 acre-feet of water wholesale in any one year during the five years immediately preceding the adoption of the last regional water plan (2016), or that is expected to enter contracts to sell more than 1,000 acre-feet of water per year wholesale during the period covered by this 2021 *Plan*. Entities meeting this definition and entities to which they contract are as follows:

El Paso County Water Improvement District #1

- El Paso Water

El Paso Water

- City of El Paso
- Lower Valley Water District
- Fort Bliss
- Vinton Hills
- Paseo Del Este MUD#1
- East Montana Water System
- Haciendas Del Norte WID
- County Other
- El Paso Steam Electric
- Manufacturing
- Mining

Lower Valley Water District

- Socorro
- San Elizario

- Clint

Horizon Regional MUD

- Horizon City
- County Other

The El Paso County Water Improvement District #1 primarily delivers water from the Rio Grande to irrigators in El Paso County and sells water to El Paso Water (EPW). EPW obtains raw surface water from the El Paso County Water Improvement District #1 and groundwater from its own wells in the Hueco and Mesilla Bolson Aquifers. While most of this water is used within the City of El Paso, significant volumes are also provided to manufacturing and power generating entities, as well as other public suppliers outside of the city. The Lower Valley Water District is a significant supplier of water to Socorro, San Elizario, Clint, and other retail customers and receives all its supply from EPW. Horizon Regional MUD supplies water to Horizon City and other local retail customers.

### 1.3.5 Industrial, Manufacturing, Electric Power Generation, and Mining

Industrial and manufacturing companies, which represent a significant component of the economy of Far West Texas, are mostly located in El Paso County where all but 56 acre-feet of the total 7,033 acre-feet of water projected to be used in the Region in the year 2020 is used in El Paso County. The industrial, manufacturing and power generation sectors purchase water from EPW, or are self-supplied by water wells. In some cases, companies use treated wastewater provided by EPW through the Utility's purple-pipe program.

El Paso Electric Company located in El Paso County is the only facility within the Region that uses water in the form of steam to generate electricity (10,545 acre-feet in 2020). Anticipated local population growth, as well as increasing commercial and manufacturing power needs, means that the quantity of water needed to produce electricity will likewise increase. El Paso Electric currently purchases most of its water supply from EPW.

Chemical quality standards for water used for industrial purposes vary greatly with the type of industry utilizing the water. The primary concern with many industries is that the water does not contain constituents that are corrosive or scale forming. Also of concern are those minerals that affect color, odor, and taste; therefore, water with a high concentration of dissolved solids is avoided in many manufacturing processes.

The mining sector accounts for the smallest area of demand, with 7,835 acre-feet of projected total use in the Region in 2020.

### 1.3.6 Environmental and Recreational Water Needs

Environmental and recreational water use in Far West Texas is recognized as being an important consideration as it relates to the natural community in which the residents of this Region share and appreciate. In addition, for rural counties, tourism activities based on natural resources offer perhaps the best hope for modest economic growth to areas that have seen a long decline in traditional economic activities such as agriculture and mining.

Natural and environmental resources are often overlooked when considering the consequences of prolonged drought conditions. All living organisms require water. The amount and quality of water required to maintain a viable population, whether it be plant or animal, is highly variable. As water supplies diminish during drought periods, the balance between both human and environmental water requirements becomes increasingly competitive. A goal of this *Plan* is to provide for the health, safety, and welfare of the human community, with as little detrimental effect to the environment as possible. To accomplish this goal, the evaluation of strategies to meet future water needs includes a distinct consideration of the impact that each implemented strategy might have on the environment.

Recreation activities involve human interaction with the outdoor environment. Many of these activities are directly dependent on water resources such as fishing, swimming, and boating; while a healthy environment enhances many others, such as hiking and bird watching. Thus, it is recognized that the maintenance of the regional environmental community's water supply needs serves to enhance the lives of citizens of Far West Texas as well as the tens of thousands of annual visitors to this Region. Environmental and recreational water needs are further discussed throughout the *Plan*.

# 1.4 SURFACE WATER SUPPLY SOURCES

### 1.4.1 Rio Grande

The Rio Grande originates in southwestern Colorado and northern New Mexico, where it derives its headwaters from snowmelt in the Rocky Mountains (Figure 1-11). The Elephant Butte Dam and Reservoir in New Mexico is approximately 125 miles north of El Paso and can store over two million acre-feet of water. Water in the reservoir is stored to meet irrigation demands in the Rincon, Mesilla, El Paso, and Juarez Valleys and is released in a pattern for power generation. Above El Paso, flow in the River is largely controlled by releases from Caballo Reservoir located below Elephant Butte; while downstream from El Paso to Fort Quitman, flow consists of treated municipal wastewater from El Paso, untreated municipal wastewater from Juarez, and irrigation return flow. Below the El Paso-Hudspeth County line, flow consists mostly of return flow and occasional floodwater and runoff from adjacent areas. Channel losses are significant enough that the Rio Grande is often dry from below Fort Quitman to the confluence with the Mexican river, the Rio Conchos, upstream of Presidio. The Rio Conchos is the only significant perennial tributary in the 350 miles between Elephant Butte Reservoir and Presidio.

The Rio Grande is unique in its complexity of distribution management. Because the waters of the River must be shared between three U.S. states and the nation of Mexico, a system of federal, state and local programs has been developed to oversee the equitable distribution of water. The compacts, treaties and projects that currently provide the River's management framework are discussed in Chapter 3.

### 1.4.2 Pecos River

The Pecos River forms the eastern boundary of Far West Texas only for a short distance at the northeast corner of Terrell County (Figure 1-11). As a major tributary to the Rio Grande, the headwaters of the Pecos River originate as snowmelt east of Santa Fe, New Mexico in the Sangre de Cristo Mountains. The River flows southward through eastern New Mexico, where Red Bluff Lake impounds it at the Texas-New Mexico border. The Pecos River Compact provides the apportionment and division of Pecos River waters between New Mexico and Texas and is administered by the Pecos River Compact Commission. Although Pecos River water is typically too salty for human consumption, it has been a source for irrigation in Pecos, Reeves and Ward Counties. Downstream in Terrell County, water in the Pecos is mostly relegated to livestock use.

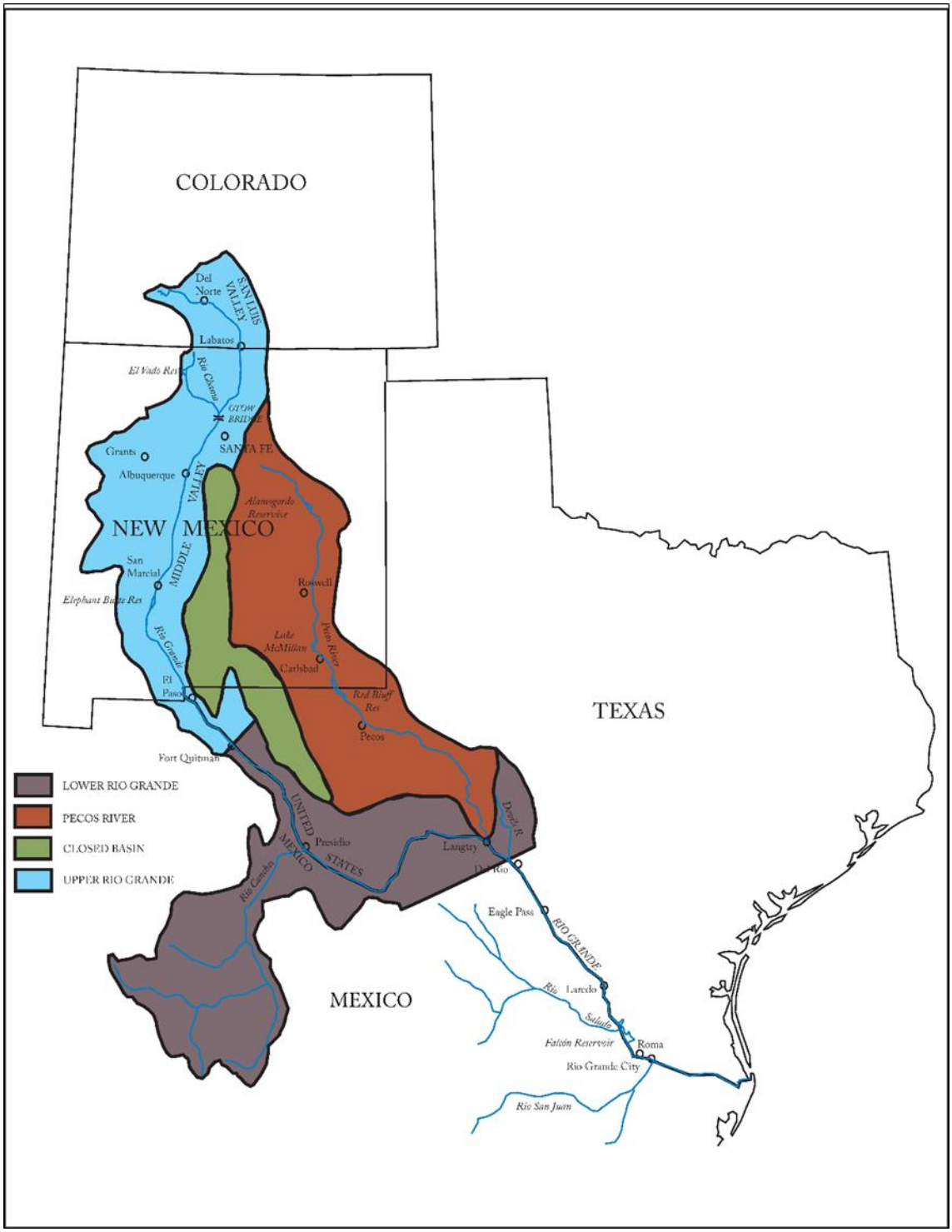



**Figure 1-11. Rio Grande and Pecos River**
(USGS Professional Paper 372-D)

### 1.4.3 Ecologically Unique River and Stream Segments

As a part of the planning process, regional planning groups may include recommendations of ecologically unique river and stream segments in their adopted regional water plans (31 TAC 357.8). The Texas Legislature may designate a river or stream segment of unique ecological value following the recommendations of a regional water planning group. As per §16.051(f) of the Texas Water Code, this designation solely means that a state agency or political subdivision of the State may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under this subsection.

The FWTWPG chooses to respect the privacy of private lands and therefore recommends as "Ecologically Unique River and Stream Segments" (Figure 1-12) three streams that lie within the boundaries of state-managed properties, four within National Park boundaries, and specified streams managed by the Texas Nature Conservancy and the Trans Pecos Water Trust. These stream and river segments are described in Chapter 8.

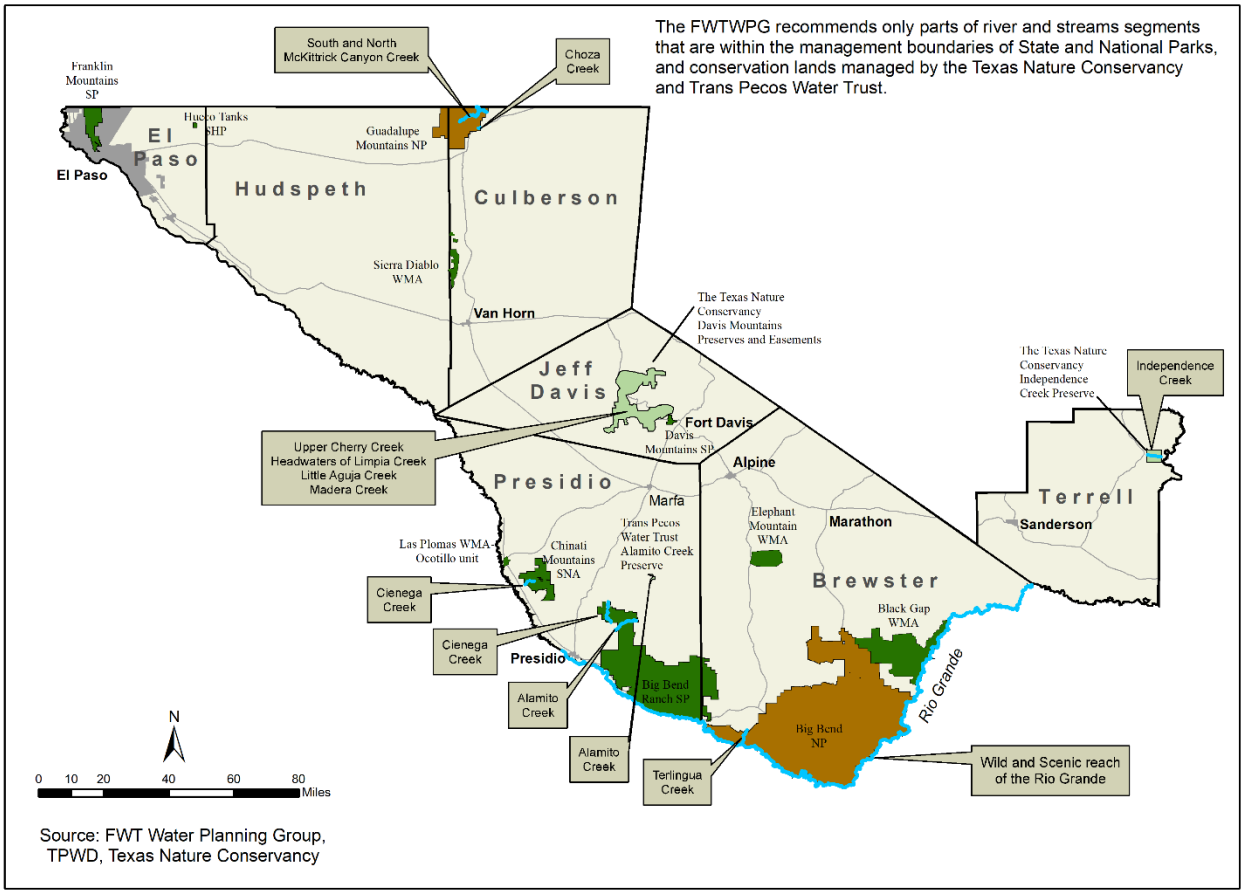



**Figure 1-12. Recommended Ecologically Unique River and Stream Segments**

## 1.5 GROUNDWATER SUPPLY SOURCES

Outside of the Rio Grande corridor, almost all water supply needs are met with groundwater withdrawn from numerous aquifers in the Region (Figure 1-13). Depth to water, well yields, and chemical quality dictate how these resources are used. A more thorough discussion of the aquifers, especially as it relates to water supply availability, can be found in Chapter 3. Aquifers recognized in the Region include the following:

- Hueco and Mesilla Bolson
- West Texas Bolsons
    - Salt Basin
        - Upper Salt Basin
        - Wild Horse and Michigan Flats
        - Lobo Flat
        - Ryan Flat
    - Presidio / Redford
    - Green River Valley
    - Red Light Draw
    - Eagle Flat
- Bone Spring-Victorio Peak
- Igneous (Davis Mountains Igneous)
- Edwards-Trinity (Plateau)
- Capitan Reef Complex
- Marathon
- Rustler
- Pecos Valley (Balmorhea Alluvium)

Other locally recognized groundwater sources:

- Rio Grande Alluvium
- Edwards-Trinity of Brewster County (Brewster Cretaceous)
- Diablo Plateau

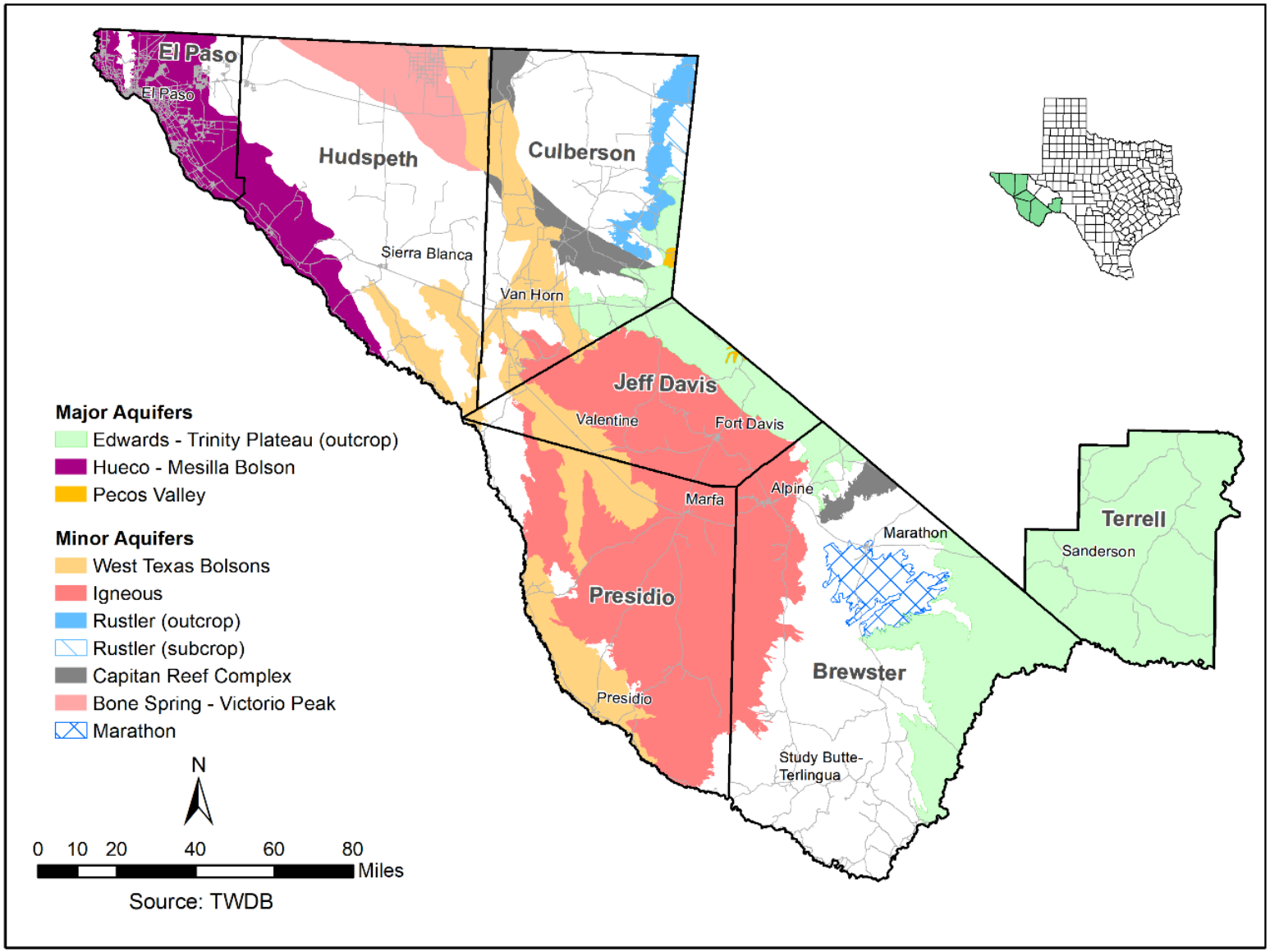



**Figure 1-13. Major and Minor Aquifers of Far West Texas**

### 1.5.1 Hueco and Mesilla Bolson Aquifers

The Hueco Bolson Aquifer extends from east of the Franklin Mountains in El Paso County southeastward into southern Hudspeth County, and continues a short distance north into New Mexico and south into Mexico. The Hueco Bolson along with the Mesilla Bolson Aquifer provides approximately half of the municipal supply for the City of El Paso and is the principal source of municipal supply for Ciudad Juarez, Mexico.

The Mesilla Bolson Aquifer lies in the Upper Rio Grande Valley west of the Franklin Mountains and extends to the north into New Mexico where it is primarily used for agricultural and public supply purposes. In Texas, the agricultural use of this aquifer is much less than in New Mexico. EPW's Canutillo Wellfield is located in the Mesilla Bolson.

### 1.5.2 West Texas Bolsons Aquifer

Several deep bolsons, or basins, filled with sediments eroded from the surrounding highlands underlie Far West Texas. In places, the bolsons contain significant quantities of groundwater. These bolsons are referred to as Red Light Draw, Eagle Flat, Green River Valley, Presidio-Redford, and the Salt Basin. The Salt Basin is subdivided from north to south into the Upper Salt Basin and Wild Horse, Michigan, Lobo, Ryan Flats. The bolson aquifers provide variable amounts of water for irrigation and municipal water supplies in parts of Culberson, Hudspeth, Jeff Davis and Presidio Counties. The communities of Presidio, Sierra Blanca, Valentine and Van Horn rely on the bolson aquifers for municipal water supplies.

### 1.5.3 Bone Spring-Victorio Peak Aquifer

The Bone Spring-Victorio Peak Aquifer is in northeast Hudspeth County along the eastern edge of the Diablo Plateau, west of the Guadalupe Mountains, and extends northward into the Crow Flats area of New Mexico. The aquifer is used primarily as a source of irrigation water. Dell City is the only municipality that relies on the aquifer as a source of public supply; however, the City must filter the water through a desalination process to render the water supply potable. The Hudspeth County Underground Water Conservation District #1 regulates the quantity of water withdrawn from the aquifer. The boundary of the district was recently extended to include the TWDB revised extent of the aquifer. EPW is in the process of purchasing properties overlying this aquifer as a potential future water-supply source (see EPW strategies in Chapter 5).

### 1.5.4 Igneous Aquifer

The Igneous Aquifer occurs in the Davis Mountains of Jeff Davis County and extends outward into Brewster and Presidio Counties. The Cities of Alpine, Fort Davis and Marfa rely on the aquifer as a source of municipal supply.

### 1.5.5 Edwards-Trinity (Plateau) Aquifer

The Edwards-Trinity (Plateau) Aquifer underlies the Edwards Plateau east of the Pecos River and the Stockton Plateau west of the Pecos River, and provides water to all or parts of 38 Texas counties. The aquifer extends from the Hill Country of Central Texas to the Trans-Pecos region of Far West Texas, where it is a source of water in Brewster, Culberson, Jeff Davis and Terrell Counties. There is relatively little pumpage from the aquifer over most of its extent in Far West Texas, with the City of Sanderson in

Terrell County being the only municipality in the Region that pumps water from the State-designated potion of this aquifer.

### 1.5.6 Capitan Reef Aquifer

The Capitan Reef Aquifer is contained within a relatively narrow strip of limestone formations (10 to 14 miles wide) that formed along the shelf edge of the ancestral Permian Sea. In Texas, the reef formations are exposed in the Guadalupe, Apache, and Glass Mountains and trend northward into New Mexico, where the aquifer is a source of abundant fresh water for the City of Carlsbad. Within Far West Texas, the aquifer underlies sections of Culberson County and a small area of northern Brewster County. EPWU owns approximately 29,000 acres overlying the Capitan Reef aquifer in northwestern Culberson County and may tap this aquifer for future needs (*see EPW strategies in Chapter 5*).

### 1.5.7 Marathon Aquifer

The Marathon Aquifer is located entirely within north-central Brewster County and is used primarily as a municipal water supply by the Community of Marathon and for rural domestic and livestock purposes.

### 1.5.8 Rustler Aquifer

The Rustler Formation is exposed in eastern Culberson County and plunges eastward into the subsurface of adjacent counties. The aquifer is principally located beneath Loving, Pecos, Reeves and Ward Counties, where it yields water for irrigation, livestock and water-flooding operations in oil-producing areas. No communities in Far West Texas rely on this aquifer as large concentrations of dissolved solids render the water unsuitable for human consumption.

### 1.5.9 Pecos Valley (Balmorhea Alluvium) Aquifer

The Pecos Valley Aquifer, locally referred to as the Balmorhea Alluvium Aquifer, is located in a small area along the Jeff Davis and Reeves county line and is composed of a relatively shallow layer of gravel that overlies Cretaceous limestone. The Balmorhea Alluvium Aquifer is recognized in this *Plan* due to its use as a municipal supply source for the City of Balmorhea and the Madera Valley WSC, both located in Reeves County in the adjacent Region F.

### 1.5.10 Other Groundwater Resources

Also shown in Figure 1-13 are large areas of Far West Texas that are not underlain by designated major or minor aquifers. The map, however, should not be interpreted as an indication that such areas are devoid of groundwater, but rather as a reflection of the current level of understanding of the extent of known groundwater resources in the Region.

**Rio Grande Alluvium Aquifer**

The Rio Grande Alluvium Aquifer consists of Quaternary floodplain sediments laid down by the Rio Grande as the river cut into the surface of the Hueco Bolson. The floodplain forms a narrow valley within the topographically lowest part of the Hueco Bolson and extends nearly 90 miles from El Paso to Fort Quitman, where the valley is constricted between the Sierra de la Cienguilla of Chihuahua and the Quitman Mountains of Hudspeth County. The aquifer is hydrologically connected with the underlying

Hueco Bolson, and is occasionally a source of irrigation water for farms in El Paso and Hudspeth Counties.

**Edwards-Trinity (Plateau) Aquifer of Brewster County**

In southern Brewster County, the communities of Lajitas, Study Butte, and Terlingua, as well as much of Big Bend National Park, withdraw their municipal supplies from Cretaceous limestone aquifers that are equivalent to the Edwards-Trinity (Plateau) Aquifer. Further evaluation is needed to arrive at a better understanding of the water-resource development potential in these areas.

**Diablo Plateau Aquifer**

Thick limestone beds that make up the subsurface of the Diablo Plateau of central and northern Hudspeth County (west of Dell City) may have significant volumes of groundwater in storage. Although relatively few exploration wells have been drilled on the Plateau, the aquifer likely contains sufficient water to be considered as a potential source of groundwater.

## 1.6 MAJOR SPRINGS

Springs and seeps are found in all seven of the Far West Texas counties and have played an important role in the development of the Region. Springs were important sources of water for Native Americans as indicated by the artifacts and petroglyphs found near many of the springs. In the 18th and 19th centuries, locations of transportation routes including supply and stage coach lines, railroads, military outposts, and early settlements and ranches were largely determined by the occurrence of springs that issued from locations in the mountains and along mountain fronts. Figure 1-14 shows the regional distribution of documented springs in the Region that are currently in existence or are of historical significance.

Springs contribute to the esthetic and recreational value of private land and parkland in Far West Texas, especially in the Big Bend area where thermal springs discharge along the banks of the Rio Grande. Springs are significant sources of water for both aquatic and terrestrial wildlife as they form small wetlands that attract migratory birds and other fowl that inhabit the Region throughout the year. As documented by the Texas Parks and Wildlife Department, springs also provide habitat for threatened and endangered species of fish (such as the Pecos and the Big Bend Gambusia).

The FWTWPG recognizes the importance of all springs in this desert community for their contribution as a water supply source and as natural habitat. However, the FWTWPG chooses to respect the privacy of private lands and therefore specifically identifies the following "Major Springs" occurring only on state, federal, or privately owned conservation managed lands (Figure 1-15). Many of these springs also are the primary source of flow to the "ecologically unique river and stream segments" described in Chapter 8. Descriptions of these springs are provided in Appendix 1A of this *Plan*.

La Baviza Spring, Chinati Mountains State Natural Area – Presidio County

Big Bend National Park / Rio Grande Wild and Scenic River Springs – Brewster County

- Gambusia Hot Springs Complex
- Outlaw Flats Spring Complex
- Las Palmas Spring Complex
- Madison Fold Spring Complex

Guadalupe Mountains National Park – Culberson County

- Bone Spring
- Dog Canyon Spring
- Frijole Spring
- Goat Seep
- Guadalupe Spring
- Juniper Spring
- Manzanita Spring

- Smith Spring
- Upper Pine Spring

Texas Nature Conservancy – Independence Creek Preserve – Terrell County

- Caroline Spring

Texas Nature Conservancy – Davis Mountains Preserve – Jeff Davis County

- Tobe Spring
- Bridge Spring
- Pine Spring
- Limpia Spring

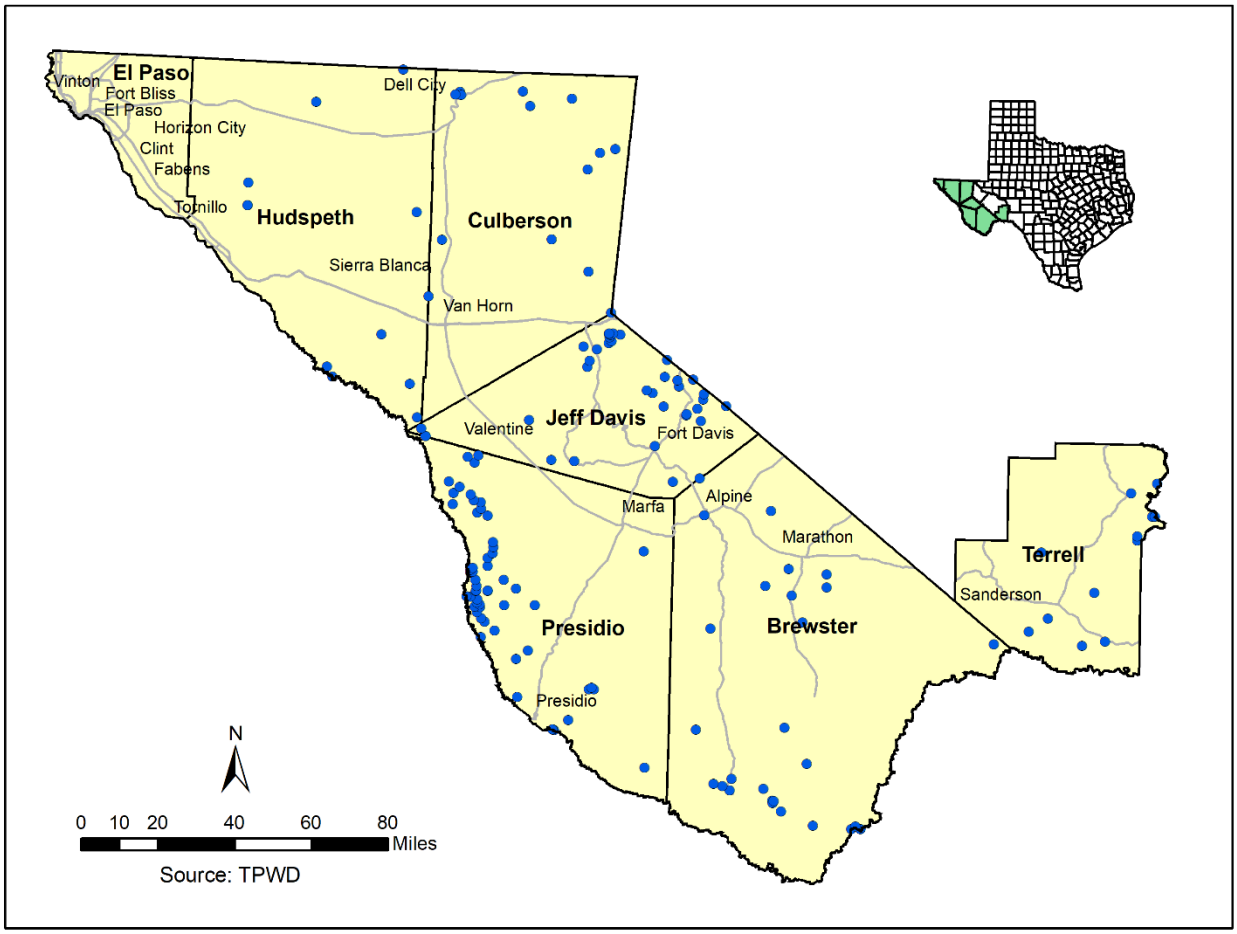



**Figure 1-14. Location of Documented Springs**

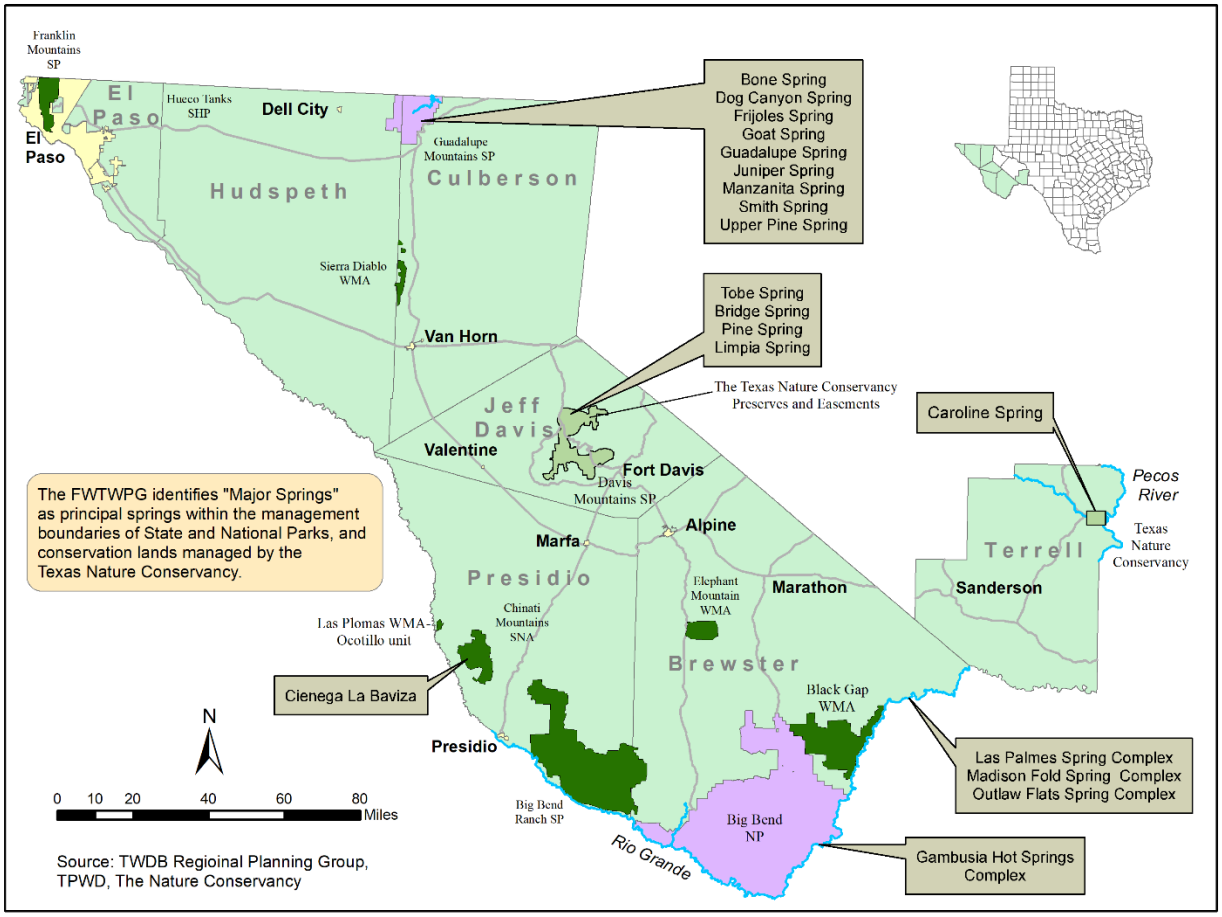



**Figure 1-15. Location of Identified Major Springs**

## 1.7 REUSE

El Paso water has nearly 50 miles of reclaimed-water (purple) pipelines throughout all areas of the City. Reclaimed (non-potable) water serves the landscape irrigation demand of golf courses, parks, schools, and cemeteries, and provides water supplies for steam-electric plants and industries within the City. EPW does not plan on extending or growing the purple pipe infrastructure, but will focus on maintaining existing purple pipe customers and work towards increasing the use of reclaimed water through additional purified water projects. EPW also develops direct reuse supplies through its advanced water purification process producing potable public supply water. The City of Alpine in Brewster County is also reusing treated wastewater to irrigate city-owned park land.

Indirect reuse of treated non-potable municipal wastewater discharged into the Rio Grande occurs in El Paso and Hudspeth Counties where it is reapplied for irrigation use by the El Paso County Water Improvement District No. 1 and the Hudspeth County Conservation and Reclamation District No.1.

# 1.8 IDENTIFIED WATER QUALITY PROBLEMS

Water quality plays an important role in determining the availability of water supplies to meet current and future water needs in the Region. The quality of groundwater and surface water is evaluated to help determine the suitability of each source for use and the potential impacts on these sources that might result from the implementation of recommended water management strategies.

### 1.8.1 Water Quality Issues

Groundwater quality issues in the Region are generally related to naturally high concentrations of total dissolved solids (TDS) or to the occurrence of elevated concentrations of individual dissolved constituents. High concentrations of TDS are primarily the result of the lack of sufficient recharge and restricted circulation. Together, these retard the flushing action of fresh water moving through the aquifers. Some aquifers, however, have a low TDS but may contain individual constituent levels that exceed safe drinking-water standards. For example, some wells in the Davis Mountains Igneous Aquifer have exceptionally low TDS but contain unsatisfactory levels of fluoride. Also, fresh-water wells in the Study Butte-Terlingua- Lajitas area have elevated levels of radioactivity.

Groundwater quality changes are often the result of man's activities. In agricultural areas, aquifers such as the Bone Spring-Victorio Peak have increased in TDS. Irrigation water applied on the fields percolates back to the aquifer carrying salts leached from the soil. Beneath El Paso and Ciudad Juarez, the average concentration of dissolved solids in the Hueco Bolson Aquifer has increased as the fresher water in the aquifer is being consumed. Although local instances of groundwater quality degradation have occurred in the Region, there are no major trends that suggest a widespread water-quality problem due to the downward percolation of surface contaminants.

The Rio Grande and the Pecos River are the principal surface water sources in Far West Texas. Unlike groundwater, surface water quality can vary significantly depending on the amount of flow in the streambed and the rate and source of runoff from adjacent lands. Salinity is an issue associated with the Rio Grande, especially during drought conditions. River flows arriving at El Paso contain a substantial salinity contribution from irrigation return flow and municipal wastewater return in New Mexico. Under current conditions, approximately 25 percent of the applied irrigation water is needed to move through the project in El Paso County to keep the salt loading at reasonable and manageable levels given average surface flow rates. Studies have shown that salinities in the Rio Grande can increase to over 1,000 mg/l during May and September, depending on actual irrigation demands and releases from reservoirs. Prolonged low flow increase salt storage in riverbanks and riparian zones, which can then be flushed out during high flows.

Downstream from El Paso, most of the flow consists of irrigation return flow, and small amounts of treated and untreated municipal wastewater. Heavy metals and pesticides have been identified along this segment of the Rio Grande. Flow is intermittent downstream to Presidio, where the Rio Conchos augments flow. Fresh water springs contribute to the Rio Grande flow in the Big Bend and enhance the overall quality of the River through this reach.

The Pecos River is not a source of drinking water for communities in Far West Texas; however, it is the most prominent tributary to the Rio Grande on the Texas side of the River above Amistad Reservoir. Per IBWC data, the Pecos River contributes an average of 11 percent of the annual stream flow in the Rio Grande above the Reservoir and 29 percent of the annual salt load. Independence Creek's contribution in

Terrell County increases the Pecos River water volume by 42 percent at the confluence and significantly reduces the total suspended solids, thus improving both water quantity and quality.

### 1.8.2 Supply Source Protection

According to the 1996 Safe Drinking Water Act Amendments, the Texas Commission on Environmental Quality (TCEQ) is required to assess every public drinking water source for susceptibility to certain chemical constituents. The Source Water Protection Program is a voluntary program designed to help public water systems identify and implement measures that will protect their sources of water from potential contamination. Assessment reports are provided to the public water systems and are often used to implement local source water protection projects. Table 1-1 lists Far West Texas public water systems currently involved in the TCEQ's Source Water Protection Program.

**Table 1-1. Far West Texas Source Water Protection Participants**

| Utility Name | County | Report Date |
|---|---|---|
| Castolon Paint Area BBNP | Brewster | 5/30/2000 |
| Panther Junction PLT | Brewster | 7/30/2000 |
| Rio Grande Village BBNP | Brewster | 5/31/2000 |
| Big Bend National Park Chisos Basin Water | Brewster | 5/31/2000 |
| City of Van Horn | Culberson | 7/31/1994 |
| El Paso Water Utilities Public Service Board | El Paso | 5/31/1990 |
| El Paso County WCID 4 Fabens | El Paso | 7/31/1999 |
| El Paso County Tornillo WID | El Paso | 7/31/1999 |
| Fort Bliss Main Post Area | El Paso | 7/31/1990 |
| Dell City | Hudspeth | 7/31/1994 |
| For Davis WSC | Jeff Davis | 7/31/1994 |
| City of Marfa | Presidio | 1/31/1995 |

### 1.8.3 Water-Supply Source Vulnerability

Following the events of September 11th 2001, Congress passed the Bio-Terrorism Preparedness and Response Act. Drinking water utilities serving more than 3,300 people were required and have completed vulnerability preparedness assessments and response plans for their water, wastewater, and stormwater facilities. The U.S. Environmental Protection Agency (EPA) funded the development of three voluntary guidance documents, which provide practical advice on improving security in new and existing facilities of all sizes. The documents include:

- In*terim Voluntary Security Guidance for Water Utilities* www.awwa.org
- *Interim Voluntary Security Guidance for Wastewater/Stormwater Utilities* www.wef.org
- *Interim Voluntary Guidelines for Designing an Online Contaminant Monitoring System* www.asce.org

## 1.9 WATER LOSS AUDITS

In 2003, the 78th Texas Legislature, Regular Session, enacted House Bill 3338 to help conserve the State's water resources by reducing water loss occurring in the systems of drinking water utilities. This statute requires that retail public utilities providing water within Texas file a standardized water audit once every five years with the Texas Water Development Board (TWDB). In response to the mandates of House Bill 3338, TWDB developed a water audit methodology for utilities that measures efficiency, encourages water accountability, quantifies water losses, and standardizes water loss reporting across the State. This standardized approach to auditing water loss provides utilities with a reliable means to analyze their water loss performance. By reducing water loss, utilities can increase their efficiency, improve their financial status, minimize their need for additional water resources, and assist long-term water sustainability.

Any retail water supplier that has an active financial obligation with the TWDB is required to submit a water loss audit annually. Additionally, retail water suppliers with more than 3,300 connections are now required to submit an audit annually. In addition, all retail public water suppliers are required to submit a water loss audit once every five years.

Utilizing a methodology derived from the American Water Works Association (AWWA) and the International Water Association (IWA), the TWDB has published a manual that outlines the process of completing a water loss audit: Water Loss Audit Manual for Texas Utilities – TWDB Report 367 (2008), which can be viewed at http://www.twdb.texas.gov/publications/brochures/conservation/doc/WaterLossManual_2008.pdf. Table 1-2 provides a listing of reported utility audits performed in Far West Texas. The link provided below accesses a more detailed water loss audit report maintained by the TWDB (http://www.twdb.texas.gov/conservation/municipal/waterloss/index.asp).

**Table 1-2. Far West Texas 2015-2016 Public Water System Real Water Loss Report (gallons per year)**

| PWS Name | Report Year | Reported Breaks Leaks | Unreported Loss | Total Real Losses | Cost of Real Losses ($) | Total Loss Percent |
|---|---|---|---|---|---|---|
| City of Presidio | 2015 | 5,000,000 | 26,854,879 | 31,854,879 | 31,855 | 21.5 |
| East Montana Water System | 2016 | 2,385,000 | 48,009,515 | 50394515 | 349,688 | 19.2 |
| Haciendas Del Norte WID | 2015 | 5,000,000 | 3,689,434 | 8,689,434 | 14,772 | 20.5 |
| Horizon Regional MUD | 2015 | 0 | 224,268,829 | 224,268,829 | 201,842 | 14.9 |
| Lajitas On The Rio Grande | 2016 | 0 | 31,774,172 | 31,774,172 | 63,548 | 60.3 |
| Marathon WSC | 2016 | 150,000 | 6,140,301 | 6,290,301 | 1,635 | 27.7 |
| Study Butte Terlingua Water System | 2015 | 1,370,000 | 8,797,639 | 10,167,639 | 17,285 | 51.3 |

* American Water Works Association (AWWA) recommends entities with more than 10% water loss take corrective action.

# 1.10 COLONIAS

### 1.10.1 Far West Texas Colonias

Colonias represent a special and growing subset of municipal water demand in the Region, and present a challenge to water suppliers. While some colonias in the Region are centuries-old historic settlements, most are substandard subdivisions in unincorporated areas located along the United States/Mexico international border that have been illegally subdivided into small parcels characterized by a lack of basic services. These small parcels do not have a drinking water supply, wastewater services, paved roads, or proper drainage, and are typically sold to individuals of modest means who may be unaware of the negative consequences of purchasing illegally subdivided property. Public health problems are often associated with these colonias.

The office of the Attorney General of Texas recognizes 312 subdivisions that qualify as colonias in the counties that make up the Far West Texas region (Table 1-3). Of these 312 colonias, 292 are concentrated in El Paso County.

**Table 1-3. Far West Texas Colonia**

| Brewster County | Culberson County | El Paso County | Hudspeth County | Jeff Davis County | Presidio County | Terrell County |
|---|---|---|---|---|---|---|
| Marathon | Ranch Estates | 292 Individual Colonias | Acala | Valentine | Candelaria | Dryden |
| Study Butte | Van Horn | | Sierra Blanca | | Pueblo Nuevo | Sanderson |
| Terlingua | | | Fort Hancock East | | Shafter | |
| | | | Villa Alegre | | Las Pamps | |
| | | | Loma Linda Estates | | Redford | |
| | | | | | Loma Pelona | |
| | | | | | Ruidosa | |

### 1.10.2 TWDB Economically Distressed Area Program

The Economically Distressed Area Program (EDAP) was created by the Texas Legislature in 1989 and is administered by the TWDB. The intent of the program is to provide local governments with financial assistance for bringing water supply and wastewater services to the colonias. An economically distressed area is defined as one in which water supply or wastewater systems are not adequate to meet minimal State standards, financial resources are inadequate to provide services to meet those needs, and there was an established residential subdivision on June 1, 2005. Affected areas are counties adjacent to the Texas/Mexico border, or that have per capita income 25 percent below the State median and unemployment rates 25 percent above the State average for the most recent three consecutive years for which statistics are available. Additional information pertaining to eligibility and requirements for this program are available on the TWDB web site http://www.twdb.texas.gov/financial/programs/EDAP/index.asp.

EDAP projects in Far West Texas are in Brewster, El Paso, Hudspeth, and Terrell Counties and are described in Table 1-44. Data pertaining to all EDAP projects in the State can be accessed through the TWDB web site http://www.twdb.texas.gov/publications/reports/edap_reports/doc/Status.pdf.

**Table 1-4. Economically Distressed Area Program Projects (February 28, 2019)**

| County | Sponsor | Project | Cost | Status |
|---|---|---|---|---|
| Brewster | City of Alpine | Collection System Improvements | $290,000 | Completed |
| El Paso | City of El Paso | Canutillo Project | $7,432,879 | Completed Facility Planning and Construction |
| El Paso | City of El Paso | Westway Water Supply | $1,437,540 | Completed Facility Planning and Construction |
| El Paso | City of El Paso | Montana Vista Wastewater Planning | $15,703,016 | Active Planning |
| El Paso | El Paso County | East Montana Water System (Phase 1) | $6,321,453* | Completed Construction |
| El Paso | El Paso County | East Montana Water System (Phase 2&3) | $10,653,496* | Completed Construction |
| El Paso | El Paso County | Turf Estates Water Line | $895,919 | Completed Facility Planning and Construction |
| El Paso | El Paso County | Canutillo Area Water & Wastewater | $412,730 | Completed PAD |
| El Paso | El Paso County | Canutillo Water (Norma & Georgia) | $90,000 | Completed PAD |
| El Paso | El Paso County | Colonia Plumbing Fixtures | $1,368,392 | Completed Construction |
| El Paso | El Paso County | Colonia Assistance & Management Support | $213,250 | Completed Facility Planning |
| El Paso | El Paso WCID | Westway II | $5,459,674* | Completed Construction |
| El Paso | Lower Valley Water District | Phase 1 – Bauman Water Project | $1,800,608 | Completed Construction |
| El Paso | Lower Valley Water District | Phase 2 - Socorro | $17,793,361* | Completed Facility Planning and Construction |
| El Paso | Lower Valley Water District | Phase 3 - San Elizario | $88,947,685* | Completed Facility Planning and Construction |
| El Paso | Lower Valley Water District | Las Azaleas Planning | $50,000 | Completed Facility Plan |
| El Paso | Lower Valley Water District | Cultural Resource Management - Socorro | $1,200 | Completed Construction |
| El Paso | Vinton | Water & Wastewater Planning | $39,100 | Completed Facility Planning |
| El Paso | El Paso County Tornillo WID | Tornillo Wastewater System | $13,157,652 | Completed Facility Planning and Construction |
| Hudspeth | Hudspeth County WCID #1 | Sierra Blanca Wastewater System | $2,146,966 | Completed PAD and Construction |
| Hudspeth | Ft. Hancock WCID | Water Well and RO Treatment Facility | $3,012,989 | Completed Construction |
| Terrell | Terrell County WCID #1 | Sanderson Wastewater System | $4,232,175 | Completed Facility Planning and Construction |

*Cost * - Projects also receiving other TWDB funds.*

### 1.10.3 El Paso County Colonias

Over the past two decades, EPW has served as a program manager to assist outlying water districts in applying for funding, master planning, design, and construction management. As regional water planner for El Paso County, EPW continues to work with various water districts and colonia residents to consolidate efforts in securing adequate water supplies and to capitalize on economies of scale. Efforts to provide water service to outlying areas have resulted in approximately 97 percent of the population within El Paso County having access to clean potable water.

Projects shown in Table 1-4 are in different stages of consideration. Funding has, and continues to be, the greatest challenge in moving forward with these projects. Given the limited number of residents (connections) and the large construction costs associated with each project, there are many areas where it is simply not feasible to construct needed facilities until either an increased number of connections are made and/or most importantly, increased amounts of state and federal grant funding are available. In certain areas, it may be feasible to consider small onsite treatment systems, such as wellhead reverse osmosis systems. Such systems could be less expensive and allow for residents to obtain water until a more direct municipal supply is available. EPW continues to take the lead in identifying funding and in managing the projects within and/or on behalf of El Paso County. Title 30, Texas Administrative Code, Chapter 285 and the Texas Health and Safety Code, Chapter 366, §366.032 requires residents in rural areas of the county who do not have piped sewer infrastructure to comply with septic tank installation standards and receive a certificate of compliance prior to receiving water, gas, and electric utility service. Known as the On Site Septic Facility (OSSF) program, this program is intended to prevent unhealthy conditions and protect underground water, and is enforced by the El Paso City/County Health and Environmental District.

# 1.11 INTERNATIONAL WATER ISSUES

### 1.11.1 Ciudad Juarez

Ciudad Juarez is located across the Rio Grande from the City of El Paso and currently is 100 percent dependent on the Hueco Bolson and Conejos Medanos Aquifers to satisfy all its municipal and industrial demands. Pumping from the Hueco by Ciudad Juarez since 2000 is summarized in Table 1-5.

**Table 1-5. Ciudad Juarez Hueco Groundwater Pumping (Acre-Feet/Year)**

| Year | Groundwater Pumping |
|---|---|
| 2000 | 126,172 |
| 2001 | 124,735 |
| 2002 | 124,676 |
| 2003 | 125,144 |
| 2004 | 119,234 |
| 2005 | 122,315 |
| 2006 | 126,655 |
| 2007 | 129,193 |
| 2008 | 132,889 |
| 2009 | 130,735 |
| 2010 | 131,055 |
| 2011 | 119,137 |
| 2012 | 117,709 |
| 2013 | 122,596 |
| 2014 | 128,823 |
| 2015 | 132,899 |
| 2016 | 135,844 |
| 2017 | 137,286 |
| 2018 | 141,896 |

Pumping continues to increase each year in response to the population rise. However, water conservation efforts in Ciudad Juarez have somewhat offset increased population and service connections. With a growing population that is currently estimated to be over 1.5 million, Ciudad Juarez recognizes the limitations of the Hueco Bolson to supply future demands. Future supplies are anticipated from the following “imported” groundwater sources:

- Bismark Mine (26,000 acre-feet/year)
- Mesilla (26,000 acre-feet/year)
- Somero (28,000 acre-feet/year)
- Profundo (31,000 acre-feet/year)

In addition, plans are also being developed to convert 38,000 acre-feet/year of surface water from the Rio Grande (Rio Bravo) for use as municipal supply. Currently, Mexico’s allocation from the Rio Grande Project of 60,000 acre-feet/year is used for irrigated agriculture. The conversion would involve supplying wastewater effluent to farmers in exchange for surface water.

### 1.11.2 City of El Paso

The City of El Paso, through their water utility, El Paso Water, manages groundwater from the Hueco and Mesilla Bolson Aquifers as a drought supply. When surface water is not available (typically the winter and spring months) the Hueco Bolson Aquifer specifically is heavily pumped, becoming a major source of water for the east side of El Paso. However, when surface water is available, pumping from the Hueco decreases.

EPW has consistently decreased its groundwater dependence on the Hueco Bolson with its increased use of surface water (Rio Grande), reclaimed water, and water conservation. However, during periods of severe river drought, groundwater pumpage from the Hueco Bolson including the KBH desalination plant will be increased dramatically to offset the limited river supply.

In 2013, surface water availability was only 10,000 acre-feet (from the Rio Grande) due to severe drought conditions. As a result, the Hueco production was maximized. Although drought conditions have improved, surface water is limited, causing the Hueco Bolson Aquifer, along with the Mesilla Bolson Aquifer, to remain a critical groundwater supply source.

### 1.11.3 Transboundary Effects of Groundwater Pumpage

Prior to 1960, up to 5,000 acre-feet/year of groundwater flowed underground from Mexico to Texas as a result of higher pumping in El Paso than in Ciudad Juarez. However, since 1960, groundwater has generally flowed from Texas into Mexico due to increases in Ciudad Juarez pumping. The rate of flow has been about 33,000 acre-feet/year over the last decade. With continuous pumping from both Ciudad Juarez and El Paso, both cites have experienced extensive water-level drawdowns and water-quality degradation due to lateral brackish water intrusion into the fresh water zones. Brackish water intrusion from irrigation return flow drains continues to expand laterally and vertically, and to degrade water quality in the shallow alluvium along the Rio Grande.

### 1.11.4 Transboundary Aquifer Assessment Program

The Transboundary Aquifer Assessment Program (TAAP) is a joint effort between Mexico and the United States to evaluate shared priority aquifers is the product of US Public Law 109-448 (United States-Mexico Transboundary Aquifer Assessment Act of 2006). Parties involved included the International Boundary and Water Commission (IBWC/CILA), the Mexican National Water Commission (CONAGUA), the US Geological Survey (USGS), New Mexico State University and the Universities of Sonora, Texas, and Arizona. Project and research management in the Far West Texas region is conducted by Texas A&M AgriLife of El Paso.

The overall goal of the Program includes:

- Develop binational information and shared databases on groundwater quantity and quality;
- Identify and delineate transboundary aquifers of importance;
- Develop binational criteria for determination of priority transboundary aquifers;
- Assess the extent, availability, and movement of water in transboundary aquifers and the interaction with surface water;
- Develop and improve groundwater-flow information for binational aquifers to facilitate water-resource assessment and planning;
- Analyze trends in groundwater quality, including salinity and nutrients;

- Apply new data, models, and information to evaluate strategies to protect water quality and enhance supplies; and
- Provide useful information to decision makers, including assessments of groundwater management institutions and policies.

Fifteen transboundary aquifers have been identified between Mexico and Texas, though the mechanisms for hydrogeologic connection across the international boundary are known only for five. The transboundary groundwater resources shared by the two countries are largely uncharacterized due to lack of data, differences in aquifer boundary delineations and methodologies, and the limited cooperation and coordination among federal, state, and local agencies within and between these countries to address groundwater issues from a binational perspective.

Four identified transboundary aquifers are categorized as priority aquifers: Hueco Bolson/Valle de Juarez, Mesilla/Conejos- Medanos, Santa Cruz, and San Pedro. In the general area of Far West Texas, the region of the bolsons (aquifers located southeast of the Conejos-Medanos/Mesilla Bolson, Valle de Juarez/Hueco-Tularosa Bolson Aquifer in northern Chihuahua, in southern New Mexico and western Texas) appear to be the most important areas for transboundary aquifer development.

Overall, the hydrogeological units along the Texas-Mexico border cover around 182,000 $km^2$ (approximately 110,000 $km^2$ on the Texas side and 72,000 $km^2$ on the Mexico side) (Sanchez et al. 2018). The total area considered to have good aquifer potential (defined as the favorable lithological properties that allow sustained and significant rates of pumpage) as well as good water quality ranges between 50% and 60% (60% of this in Texas). Some 20 to 25% of the hydrogeological units that cross the border area are considered to have poor aquifer potential and poor water quality, with the proportion of land being approximately equal on both sides of the border.

# 1.12 STATE AND FEDERAL AGENCIES WITH WATER RESPONSIBILITIES

### Texas Water Development Board (TWDB)

The TWDB (http://www.twdb.texas.gov/), especially the Water Resources Planning and Information Division, is at the center of the Senate Bill 1 regional water planning effort. The agency has been given the responsibility of directing the effort to ensure consistency and to guarantee that all regions of the State submit plans in a timely manner. Results of the 16 regional water plans are then incorporated by the TWDB into a State Water Plan. The TWDB also administers financial grant and loan programs that provide funding for water research and facility planning projects.

### Texas Commission on Environmental Quality (TCEQ)

The TCEQ (http://www.tceq.texas.gov/) strives to protect the State's natural resources, consistent with a policy of sustainable economic development. TCEQ's goal is clean air, clean water, and the safe management of waste, with an emphasis on pollution prevention. The TCEQ is the major State agency with regulatory authority over State waters in Texas. The TCEQ is also responsible for ensuring that all public drinking-water systems are in compliance with the strict requirements of the State of Texas.

### Texas Parks and Wildlife Department (TPWD)

The TPWD (http://www.tpwd.state.tx.us/) mission is to manage and conserve the natural and cultural resources of Texas and to provide hunting, fishing and outdoor recreation opportunities for the use and enjoyment of present and future generations. The agency currently has six program divisions: Wildlife, Coastal Fisheries, Inland Fisheries, Law Enforcement, State Parks, and Infrastructure.

### Texas Department of Agriculture (TDA)

The TDA (http://www.texasagriculture.gov/Home.aspx) was established by the Texas Legislature in 1907. The TDA has marketing and regulatory responsibilities and administers more than 50 separate laws. The current duties of the department include: (1) promoting agricultural products locally, nationally, and internationally; (2) assisting in the development of the agribusiness in Texas; (3) regulating the sale, use and disposal of pesticides and herbicides; (4) controlling destructive plant pests and diseases; and (5) ensuring the accuracy of all weighing or measuring devices used in commercial transactions. The department also collects and reports statistics on all activities related to the agricultural industry in Texas.

### Texas State Soil and Water Conservation Board (TSSWCB)

The TSSWCB (http://www.tsswcb.texas.gov/) is charged with the overall responsibility for administering the coordination of the State's soil and water conservation program with the State's soil and water conservation districts. The agency is responsible for planning, implementing, and managing programs and practices for abating agricultural and forest nonpoint source pollution. Currently, the agricultural/forest nonpoint source management program includes problem assessment, management program development and implementation, monitoring, education, and coordination.

### International Boundary and Water Commission (IBWC) and Comisión Internacional de Límites y Aquas (CILA)

The IBWC (http://ibwc.state.gov/) and CILA provide binational solutions to issues that arise during the application of United States – Mexico treaties regarding boundary demarcation, national ownership of waters, sanitation, water quality, and flood control in the border region; the treaties are discussed in Chapter 3.

### United States Bureau of Reclamation (USBR)

The stretch of the Rio Grande from Elephant Butte Dam (approximately 100 miles north of El Paso) to Fort Quitman, Texas, is within a federal reclamation project known as the Rio Grande Project. The Bureau of Reclamation manages (http://www.usbr.gov/ ) the Elephant Butte Dam and the Caballo Reservoir in New Mexico, and determines the amount and timing of all water releases to Texas, with the input of the El Paso County Water Improvement District #1. The Bureau is guided by the terms of the Rio Grande Compact. The Bureau has asserted title to all the water in the Project in a lawsuit styled United States v. EBID, et al, which is currently being litigated.

### United States Geological Survey (USGS)

The USGS (http://www.usgs.gov/) is responsible for fulfilling the Nation's needs for reliable, impartial scientific information to describe and understand the Earth. This information is used to minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect the quality of life. The USGS is the Federal Government's principal civilian map-making agency; the primary source of its data on the quality and quantity of the Nation's water resources; the Nation's primary provider of earth-science information on natural hazards, mineral and energy resources, and the environment; and the major partner in developing the Nation's understanding of the status and trends of biological resources and the ecological factors affecting living resources.

### United States Environmental Protection Agency (EPA)

The mission of the EPA (http://www.epa.gov/) is to protect human health and the environment. Programs of the EPA are designed to (1) promote national efforts to reduce environmental risk, based on the best available scientific information; (2) ensure that federal laws protecting human health and the environment are enforced fairly and effectively; (3) guarantee that all parts of society have access to accurate information sufficient to manage human health and environmental risks; and (4) guarantee that environmental protection contributes to making communities and ecosystems diverse, sustainable and economically productive.

### United States Fish and Wildlife Service (USFWS)

The USFWS (http://www.fws.gov/) enforces federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores vital wildlife habitat, protects and recovers endangered species, and helps other governments with conservation efforts. It also administers a federal aid program that distributes money for fish and wildlife restoration, hunter education, and related projects across the country.

## 1.13 LOCAL ORGANIZATIONS AND UNIVERSITIES

The public and even those involved in water planning and management find it difficult to know about or keep track of the large number and wide array of organizations involved with water resource issues in Far West Texas. Following is a list of many these organizations. Because of the hydrologic, cultural and economic connections of Far West Texas with Southern New Mexico and Mexico, this list includes water organizations in this expanded region. The list is likely incomplete as there are certainly other organizations deserving of being included.

Alliance for the Rio Grande Heritage

Border Environmental Cooperation Commission

City of El Paso

- Water Conservation Advisory Board
- Rio Grande Riverpark Task Force
- El Paso Water – Consortium for Hi-Technology Investigations in Water and Wastewater
- El Paso water – TecH2O Learning Center

City of Las Cruces

- Rio Grande Riparian Ecological Corridor Project

Consortium for Hi-Technology Investigations in Water and Waste Water

Environmental Defense

Forest Guardians

Hudspeth Directive for Conservation

New Mexico State University

New Mexico Lower Rio Grande Regional Water Users Organization

New Mexico Water Conservation Alliance

New Mexico Water Resources Research Institute

New Mexico Water Task Force

New Mexico Water Trust Board

New Mexico-Texas Water Commission

North American Commission for Environmental Cooperation

North American Development Bank

Paso Del Norte Watershed Council

Paso Del Norte Water Task Force

Project Del Rio

Rio Grande/Rio Bravo Basin Coalition

Rio Grande Council of Governments

Rio Grande Institute

Rio Grande Watershed Federal Coordinating Committee

Southwest Environmental Center

The Texas A&M University System

- Texas AgriLife Research Center in El Paso
- Transboundary Aquifer Assessment Program
- Texas Cooperative Extension
- Rio Grande Basin Initiative
- Texas Water Resources Institute

Texas State University System

- Sustainable Agricultural Water Conservation in the Rio Grande
- Basin Project

Texas Water Matters

- Lone Star Chapter of the Sierra Club
- National Wildlife Federation
- Environmental Defense

Tularosa Basin National Desalination Research Facility

University of Texas at El Paso

- Center for Environmental Resource Management
- Rio Bosque Wetlands Park
- Southwest Consortium for Environmental Research and Policy of the Southwest

U. S. Mexico Border Coalition of Resource Conservation and Development Councils

WERC: A Consortium for Environmental Education and Technology Development

World Wildlife Fund – Chihuahuan Desert Program

# APPENDIX 1A
# MAJOR SPRINGS

# MAJOR SPRINGS

The Far West Texas Water Planning Group recognizes the following "Major Springs" occurring on state, federal, or privately owned conservation-managed lands for their importance for natural resource protection.

## CHINATI MOUNTAINS STATE NATURAL AREA – CIENEGA LA BAVIZA SPRING

Cienega Creek flows downstream from the spring-fed spring, La Baviza, in the 38,187-acre Chinati Mountains State Natural Area in west-central Presidio County. The spring (cienega) forms a fresh to slightly saline marsh with waters that are slightly geothermal. The habitat supports an intact, diverse marsh with saline grasses, rushes, sedges, and perennials. A high diversity of desert bats also use the area for feeding and watering. The adjacent Cienega Creek has very good examples of saline marsh and cottonwood gallery woodlands. It is an important wildlife area and is in the low Chihuahuan Desert where intact wetlands and riparian habitat are quite rare. Cienega Creek is recommended as an "Ecologically Unique River or Stream Segment" in Chapter 8.

## BIG BEND NATIONAL PARK / RIO GRANDE WILD AND SCENIC RIVER SPRING COMPLEXES

River regulation, agricultural and municipal withdrawals and drought have diminished and altered the discharge patterns for the lower Rio Grande in Far West Texas. The physical and ecological system, once adapted to large and rapid fluctuations in flow, is now adapted to lower and more constant flows. The 250-mile reach of the Rio Grande managed by the National Park Service is the only free flowing reach in the lower Rio Grande. A significant portion of the base flows are provided by groundwater contributions from four spring complexes located in Big Bend National Park and along the Rio Grande Wild and Scenic River. Management Plans for both NPS entities list the protection of springs as critical management concerns. A portion of the Rio Grande Wild and Scenic River is recommended by the planning group as an "Ecologically Unique River and Stream Segment" and is discussed in Chapter 8. NPS staff has identified the following four spring complexes.

### Gambusia Hot Springs Complex

| | | |
|---|---|---|
| River miles | 804 | 814 |
| UTM Coordinates N | 3233835 | 3226468 |
| UTM Coordinates E | 702647 | 694388 |
| Zone 13 | | |

This reach includes hot springs between Mariscal Canyon and Boquillas Canyon. Easily delineated orifices with significant flow include: Gravel Pit, Langford Hot Springs, Lower Hot Springs (a.k.a. VD Springs or Leper Springs), Rio Grande Village Springs 3 and 4, and numerous unnamed springs. Springs on the Mexican side include Ojo Caliente and Boquillas Hot Springs. These springs issue from the upper Cretaceous rock units, the Boquillas and Santa Elena Limestones. Rio Grande Village currently gets its water supply from one of these springs. In addition, this same spring and another nearby spring feed two ponds that contain the world's only population of *Gambusia gaigei*.

## Outlaw Flats Spring Complex

| | | |
|---|---|---|
| River miles | 748 | 762 |
| UTM Coordinates N | 3292773 | 3296392 |
| UTM Coordinates E | 725582 | 716672 |
| Zone 13 | | |

Springs issue from the Glen Rose Limestone. Although generally of low volume, there is evidence of historical use at a spring on the Texas side near the confluence with Big Canyon. Historical use includes the remains of a spring box.

## Las Palmas Spring Complex

| | | |
|---|---|---|
| River miles | 735 | 742 |
| UTM Coordinates N | 3293228 | 3293608 |
| UTM Coordinates E | 737565 | 732013 |
| Zone 13 | | |

Large volume springs in Del Carmen Limestone. Historical use at Asa Jones waterworks, a withdrawal and distribution system for a candelilla wax camp located on the canyon rim east of Silver Canyon. The system includes pumps, piping, and several rock tanks, one of which is located over a spring emanating from a rock joint. Park Service personnel estimated the spring discharge at 300 gpm. This joint can be followed in both directions beyond the rock walls where additional water discharges. Water enters the river on both sides along a reach approximately 200 feet long. Undocumented Mexican emigrants use this area frequently, as indicated by the presence of discarded clothing and bedrolls. Directly below the Asa Jones Waterworks, on the Texas side is Spigot Spring. River runners use this spring as a water source. Two miles downstream on the Coahuila Mexico, side is Hot Springs, a very popular river camp due to the presence of several warm pools. A road on the Mexican side provides access to the area for the Mexican Army (reports from River District Ranger). Another spring below and on the Texas side is commonly used as a water source for river runners.

### Madison Fold Spring Complex

| | | |
|---|---|---|
| River miles | 720 | 723 |
| UTM Coordinates N | 3298065 | 3296092 |
| UTM Coordinates E | 753147 | 751786 |
| Zone 13 | | |

Low volume springs discharging from the Del Carmen Limestone and the Maxon Sandstone. As these are the last discharges along the river, river runners commonly use the spring on the Texas side and below Lower Madison Falls as a water source.

## GUADALUPE MOUNTAINS NATIONAL PARK SPRINGS COMPLEX

Springs in the Guadalupe Mountains National Park are crucial for maintenance of ecological stability and wildlife health within the Chihuahuan Desert environment. Loss or failure of any of these springs would cause significant environmental stress, even though discharge rates of most are relatively small. Most springs are also historic areas used by pioneers, early ranchers, and settlers. Remains of their homesteads and structures used to manage spring outflow and direct water usage are still visible in and near the springs. The National Park Service is directed to preserve these historic elements and cultural landscapes against unnatural impacts from continued human use, as well as to protect the spring's water quality and quantity from human induced impairment. Specific major natural resource springs are listed in the following table:

| SPRINGS IN GUADALUPE MOUNTAINS NATIONAL PARK | | | | |
|---|---|---|---|---|
| **Name** | **Discharge (gpm)** | **State Well Number** | **Position NAD 1927 Conus UTM 13 N northing** | **Position NAD 1927 Conus UTM 13 N easting** |
| Bone Spring | 2-3 | - | 3527444 | 512087 |
| Dog Canyon Spring | <1 | - | 3537770 | 514918 |
| Frijole Spring | 6-13 | 47-02-801 | 3530009 | 518842 |
| Goat Spring | 1 | - | 3529611 | 511370 |
| Guadalupe Spring | 6-10 | 47-02-701 | 3526606 | 514633 |
| Juniper Spring | <1 | 47-02-502 | 3531081 | 519488 |
| Manzanita Spring | 10-38 | 47-02-802 | 3530317 | 519111 |
| Smith Spring | 13-55 | 47-02-501 | 3531248 | 518287 |
| Upper Pine Spring | 8-13 | 47-02-803 | 3529514 | 517274 |

## TEXAS NATURE CONSERVANCY INDEPENDENCE CREEK PRESERVE – CAROLINE SPRING

Caroline Spring is located at the Texas Nature Conservancy's Independence Creek Preserve headquarters in northeastern Terrell County. The spring produces 3,000 to 5,000 gallons per minute and comprises about 25 percent of the creek's flow. Downstream, Independence Creek's contribution increases the Pecos River water volume by 42 percent and reduces the total dissolved solids by 50 percent, thus improving water quantity and quality. The preserve hosts a variety of bird and fish species, some of which are extremely rare. Caroline Spring, along with the entirety of the Independence Creek Preserve (19,740 acres), is a significant piece of West Texas natural heritage.

## TEXAS NATURE CONSERVANCY DAVIS MOUNTAINS PRESERVE – TOBE, BRIDGE, PINE AND LIMPIA SPRINGS

The wild and remote Davis Mountains is considered one of the most scenic and biologically diverse areas in Texas. Rising above the Chihuahuan desert, the range forms a unique "sky island" surrounded by the lowland desert. Animals and plants living above 5,000 feet are isolated from other similar mountain ranges by vast distances. The Texas Nature Conservancy has established the 32,000-acre Davis Mountains Preserve (with conservation easements on 65,830 acres of adjoining property) in the heart of this region. Tobe, Bridge, Pine and Limpia springs form critical wetland habitat and establish base flow to the downstream creeks.

# CHAPTER 2
# POPULATION AND WATER DEMAND

*This page intentionally left blank.*

# 2 POPULATION AND WATER DEMAND

Planning for the wise use of the existing water resources in Far West Texas requires a reasonable estimation of current and future water needs for all water-use categories. Regional population and water demand data were initially provided to the Far West Texas Water Planning Group (FWTWPG) at the beginning of the planning period. This information incorporated data from the Texas State Data Center and from the U.S. Bureau of the Census' 2010 census count and revised for the 2017 State Water Plan, and is presented based on utility service areas. The FWTWPG reviewed the provided projections and concluded that an error and inaccuracy had occurred regarding the TWDB projections of the Town of Anthony. In addition, the mining water demands in both Culberson and Jeff Davis Counties were adjusted to reflect newly granted permit and water use. The revised data was found satisfactory for use in this current regional water plan.

# 2.1 POPULATION

### 2.1.1 Population Projection Methodology

County population projections are prepared by the Texas State Data Center / Office of the State Demographer and are based on recent and projected demographic trends, including birth and survival rates and net migration rates of population groups defined by age, gender, and race/ethnicity. Because the fifth cycle of regional water planning falls within an inter-census planning cycle, no new decennial census data is available in time for the use of this Plan. Population projections are therefore based on the 2017 State Water Plan population data.

In addition, population projections and associated water demand projections have been reassembled by utility service areas rather than political boundaries to better plan for the actual water-supply service entity. Previous regional and state water plans have been aligned with political boundaries, such as city limits rather than water utility service areas. Recent TWDB rule changes now define a municipal water user group (WUG) as being utility-based, and thus the emphasis of the development of population and municipal water demands for the 2021 regional water plans transition from political boundaries to utility-service area boundaries.

The projected municipal population is thus allocated to water systems or utilities that provide an average of more than 100 acre-feet per year for municipal use. This newly defined (municipal WUG) includes water systems that vary from privately-owned utilities, systems serving institutions, facilities owned by the state and federal government, and all other retail public utilities that meet the 100-acre feet criteria.

Rural "County Other" population is calculated as the difference between the total projected population of the utility service areas and the total projected county population. Population is then projected from the 2010 base year by decade to the 2070 decade. However, a new set of 2010 population estimates were developed to reflect a utility-based boundary (not political boundary) as a baseline population to be projected for the use of this Plan. A more detailed explanation of the TWDB population projection methodology is available at http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/doc/current_docs/project_docs/20170405_pop_muni_proj_method_summ.pdf?d=75388.485.

### 2.1.2 Current and Projected Population

Although the FWTWPG was mandated to use the 2010 census numbers for the purposes of calculating current and projected population, representatives from both urban and rural areas expressed concerns that the census represents a significant undercount of actual residents in the Region. This is especially true in the rural areas, where serious flaws existed with the U.S. Census Bureau's information-gathering techniques.

Current and projected population by decade for water utilities and county rural areas in Far West Texas is listed in Table 2-1. The year-2020 projected population for the entire Region is 954,035 of which 97 percent reside in El Paso County and 77 percent serviced by El Paso Water (Figure 2-1). The regional population is projected to increase to 1,551,438 by the year 2070, which is an increase of 597,403 citizens. Most of this increase (591,775) is projected to occur in El Paso County (Figure 2-2. Population Projection Distribution in El Paso County), while the distribution of projected population in the remaining counties is shown in Figure 2-3.

**Table 2-1. Far West Texas Population Projections**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Brewster County - Rio Grande Basin** | | | | | | |
| Alpine | 6,066 | 6,185 | 6,231 | 6,265 | 6,283 | 6,293 |
| Lajitas Municipal Services | 542 | 561 | 568 | 575 | 579 | 579 |
| Marathon Water Supply & Sewer Service | 444 | 460 | 466 | 471 | 474 | 475 |
| County-Other | 2,675 | 2,885 | 2,965 | 3,023 | 3,051 | 3,070 |
| **Brewster County Total Population** | 9,727 | 10,091 | 10,230 | 10,334 | 10,387 | 10,417 |
| **Culberson County - Rio Grande Basin** | | | | | | |
| Van Horn | 2,319 | 2,542 | 2,641 | 2,730 | 2,782 | 2,815 |
| County-Other | 376 | 412 | 428 | 443 | 451 | 457 |
| **Culberson County Total Population** | 2,695 | 2,954 | 3,069 | 3,173 | 3,233 | 3,272 |
| **El Paso County - Rio Grande Basin** | | | | | | |
| Anthony | 4,206 | 5,053 | 5,840 | 6,620 | 7,358 | 8,052 |
| El Paso Water (City of El Paso ***only***) | 734,031 | 822,625 | 904,900 | 986,455 | 1,063,672 | 1,136,275 |
| El Paso County Tornillo WID | 3,202 | 3,215 | 3,229 | 3,242 | 3,254 | 3,266 |
| El Paso WCID #4 (Fabens) | 8,858 | 9,131 | 9,385 | 9,636 | 9,874 | 10,098 |
| East Biggs Water System | 11,870 | 11,870 | 11,870 | 11,870 | 11,870 | 11,870 |
| Fort Bliss | 26,453 | 27,499 | 28,471 | 29,434 | 30,343 | 31,200 |
| Horizon Regional MUD | 52,993 | 74,830 | 95,108 | 115,207 | 134,239 | 152,133 |
| Lower Valley WD (Socorro, Clint, San Elizario) | 53,059 | 63,682 | 73,546 | 83,325 | 92,582 | 101,287 |
| East Montana Water System | 6,599 | 7,529 | 8,391 | 9,247 | 10,057 | 10,818 |
| Haciendas Del Norte WID | 1,218 | 1,389 | 1,548 | 1,706 | 1,855 | 1,996 |
| Paseo Del Este MUD #1 | 8,116 | 9,260 | 10,320 | 11,372 | 12,369 | 13,304 |
| Federal Correctional Institution La Tuna | 1,668 | 1,668 | 1,668 | 1,668 | 1,668 | 1,668 |
| County-Other | 12,061 | 16,471 | 20,569 | 24,630 | 28,478 | 32,096 |
| County-Other (Vinton Hills Estates) | 370 | 505 | 631 | 756 | 874 | 985 |
| County-Other (Vinton Hills Subdivision) | 861 | 1,176 | 1,469 | 1,759 | 2,034 | 2,292 |
| **El Paso County Total Population** | 925,565 | 1,055,903 | 1,176,945 | 1,296,927 | 1,410,527 | 1,517,340 |
| **Hudspeth County - Rio Grande Basin** | | | | | | |
| Hudspeth County WCID #1 | 952 | 1,044 | 1,073 | 1,095 | 1,105 | 1,112 |
| Esperanza Water Service | 905 | 996 | 1,023 | 1,043 | 1,053 | 1,058 |
| County-Other | 553 | 609 | 626 | 638 | 643 | 646 |
| County-Other (Dell City) | 424 | 467 | 480 | 489 | 494 | 496 |
| County-Other (Fort Hancock WCID) | 1,079 | 1,188 | 1,222 | 1,246 | 1,258 | 1,263 |
| **Hudspeth County Total Population** | 3,913 | 4,304 | 4,424 | 4,511 | 4,553 | 4,575 |
| **Jeff Davis County - Rio Grande Basin** | | | | | | |
| Fort Davis WSC | 1,361 | 1,361 | 1,361 | 1,361 | 1,361 | 1,361 |
| County-Other | 839 | 839 | 839 | 839 | 839 | 839 |
| County-Other (City of Valentine) | 198 | 198 | 198 | 198 | 198 | 198 |
| **Jeff Davis County Total Population** | 2,398 | 2,398 | 2,398 | 2,398 | 2,398 | 2,398 |
| **Presidio County - Rio Grande Basin** | | | | | | |
| Marfa | 2,583 | 2,807 | 3,022 | 3,261 | 3,473 | 3,674 |
| Presidio | 5,458 | 5,884 | 6,297 | 6,749 | 7,153 | 7,538 |
| County-Other | 651 | 754 | 855 | 962 | 1,062 | 1,155 |
| **Presidio County Total Population** | 8,692 | 9,445 | 10,174 | 10,972 | 11,688 | 12,367 |
| **Terrell County – Rio Grande Basin** | | | | | | |
| Terrell County WCID #1 | 870 | 890 | 890 | 890 | 890 | 890 |
| County-Other | 175 | 179 | 179 | 179 | 179 | 179 |
| **Terrell County Total Population** | 1,045 | 1,069 | 1,069 | 1,069 | 1,069 | 1,069 |
| **Region E Total Population** | **954,035** | **1,086,164** | **1,208,309** | **1,329,384** | **1,443,855** | **1,551,438** |

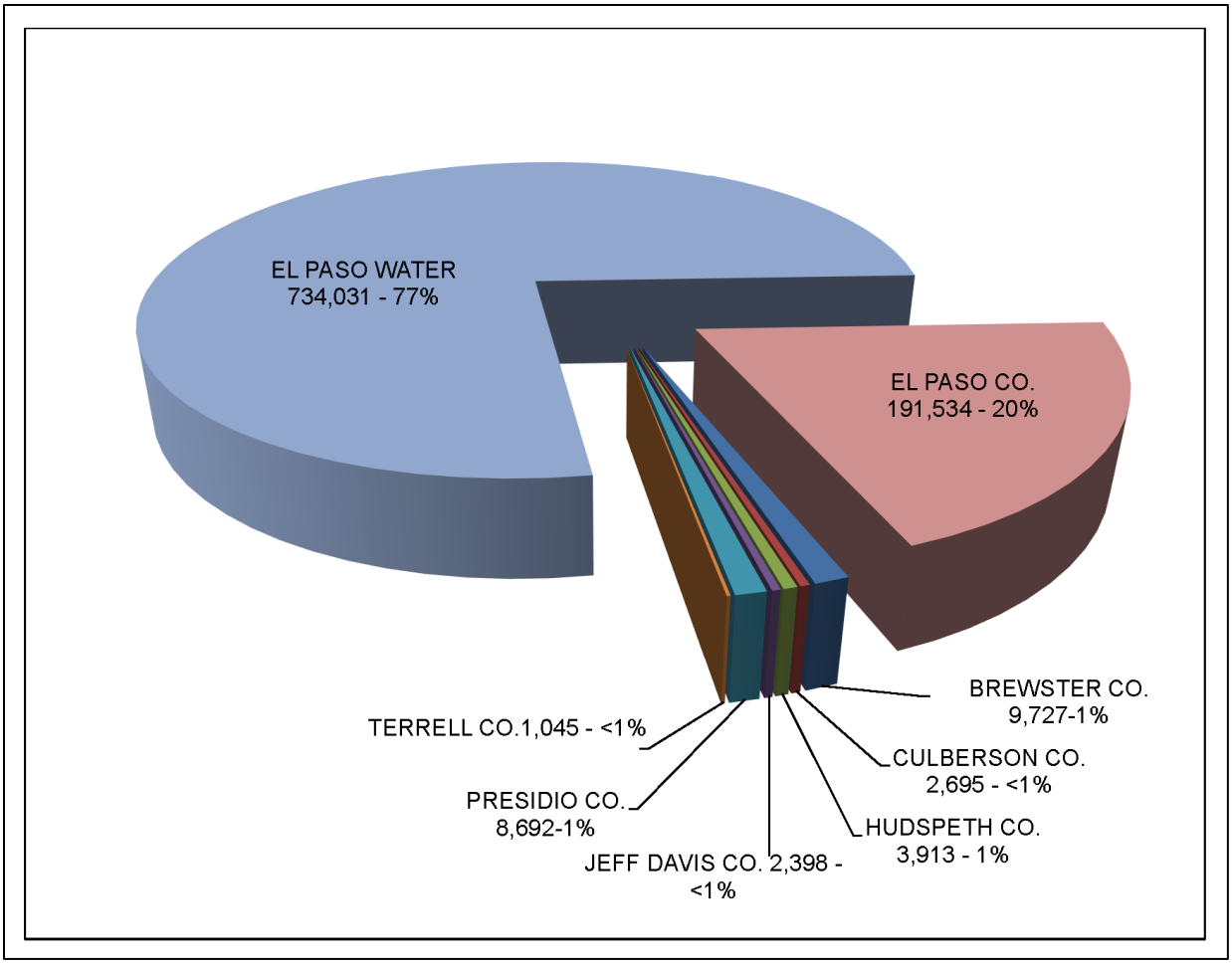



**Figure 2-1. Year 2020 Projected Population**

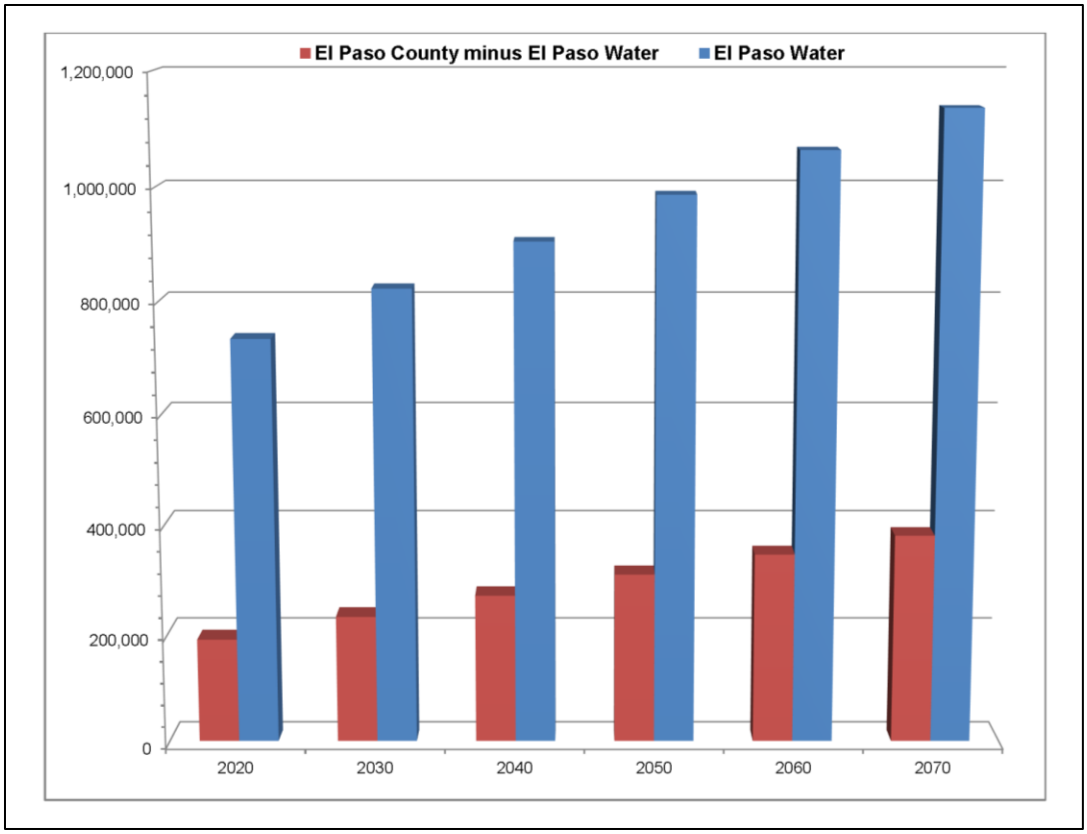



**Figure 2-2. Population Projection Distribution in El Paso County**

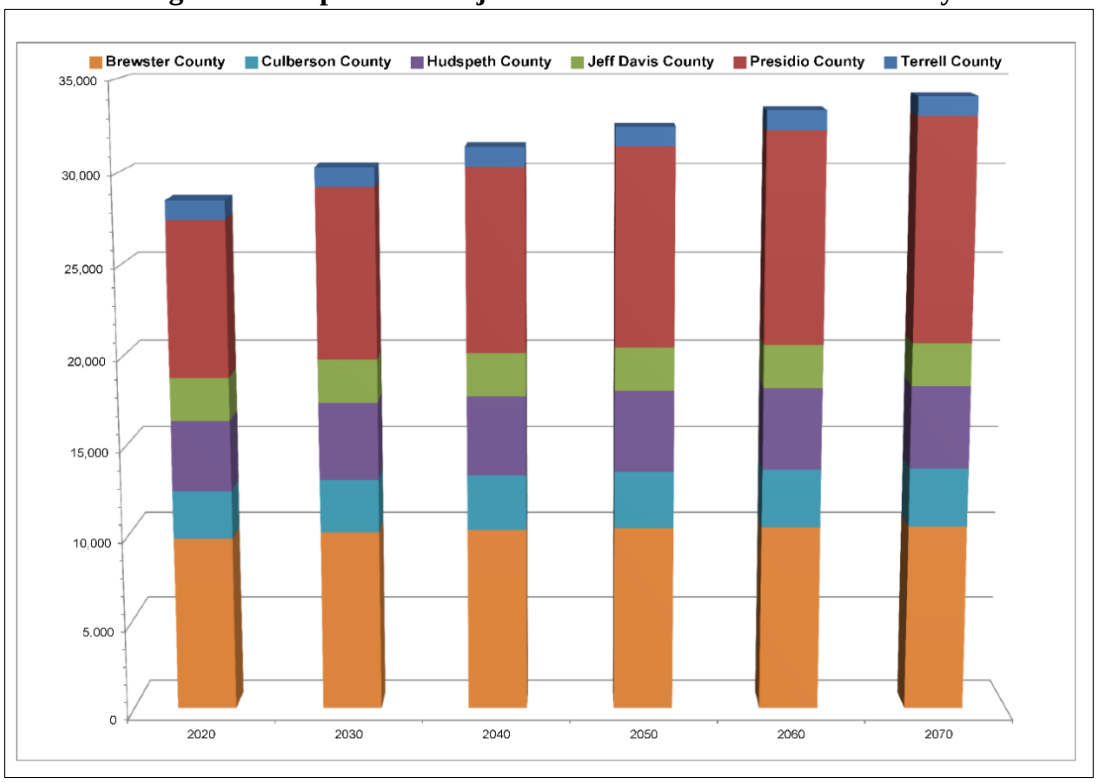



**Figure 2-3. Population Projection Distribution in Rural Counties**

## 2.2 WATER DEMAND

A major component of water planning is the establishment of accurate water demand estimates for all water-use categories. Categories of water use include (1) municipal, (2) county-other (rural domestic), (3) manufacturing, (4) irrigation, (5) steam-electric power generation, (6) livestock, and (7) mining. Individual municipal utility-based are further identified as Water User Groups (WUGs).

In early 2016, the TWDB contracted CDM Smith to review the projection methodologies previously used, provide insight on how projections were developed in other state planning efforts, and recommend alternative methodologies. The TWDB determined that the water demand projections methodologies for three of the categories – manufacturing, irrigation and steam-electric power – should be revised to better reflect reported historical water use. Summaries of the methodologies are included below in Sections 2.2.3 – 2.2.5. A more descriptive report can be found here: http://www.twdb.texas.gov/waterplanning/rwp/planningdocu/2021/current_docs.asp. Regardless of methodologies, the planning group anticipates that water demand is likely underestimated and, therefore, an emphasis is being made in this planning document to recognize a need for more water than is justified simply from the population-derived water demand quantities.

Table 2-2 lists the current and future projected regional water demands by county and water-use category. The percent distribution of year-2020 projected water demand in the Region by the seven water-use categories is shown in Figure 2-4 and by county in Figure 2-5. Other water use categories that are not quantified in this *Plan* but are addressed (Section 2.3) include environmental and recreational needs. An additional use that is not quantified but may be of significance is water that is used in road construction for both compaction and dust suppression.

Figure 2-6 illustrates current and future projected regional water demand estimates by water-use category, while Figure 2-7 illustrates water demand projections by county. For the 2020 to 2070 decades the total water demand in the Region is projected to increase from 480,424 to 559,976 acre-feet per year.

The potential role of conservation is an important factor in projecting future water supply requirements. In this *2021 Plan*, conservation is included in the municipal projections as a measure of expected savings based on requirements of the State plumbing code. All other conservation practices are discussed in terms of water supply strategies in Chapter 5 and as a component of drought management plans in Chapter 7.

The planning group feels that conservation savings reduction to future water demands should not be imposed on rural entities. Counties have not historically been granted significant rule-making authority as compared to municipalities. As such, water-supply districts which are located wholly or primarily in unincorporated communities do not have the same potential to reduce consumption through conservation efforts, given that many of these efforts are established through a municipality's ordinances and/or subdivision standards/codes. Without a statutory mechanism affording counties, or water districts serving unincorporated areas, additional rule-making authority, conservation savings will be very difficult to reach in these communities.

The following sections present an overview of water supply needs for major water providers and for each of the seven-designated water-use categories and include methods and assumptions used in the State's consensus water planning process.

**Table 2-2. Far West Texas Water Demand Projections (Rio Grande River Basin)**
**(Acre-Feet per Year)**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Brewster County** | | | | | | |
| Alpine | 1,934 | 1,944 | 1,935 | 1,933 | 1,937 | 1,940 |
| Lajitas Municipal Services | 103 | 104 | 103 | 103 | 104 | 104 |
| Marathon Water Supply & Sewer Service | 124 | 126 | 126 | 127 | 127 | 127 |
| County-Other | 411 | 431 | 433 | 436 | 439 | 442 |
| Livestock | 347 | 347 | 347 | 347 | 347 | 347 |
| Irrigation | 2,006 | 2,006 | 2,006 | 2,006 | 2,006 | 2,006 |
| **Brewster County Total Demand** | 4,925 | 4,958 | 4,950 | 4,952 | 4,960 | 4,966 |
| **Culberson County** | | | | | | |
| Van Horn | 662 | 711 | 737 | 760 | 774 | 783 |
| County-Other | 65 | 69 | 71 | 73 | 74 | 75 |
| Manufacturing | 5 | 6 | 6 | 6 | 6 | 6 |
| Mining | 2,119 | 2,853 | 3,006 | 2,723 | 2,456 | 2,253 |
| Livestock | 270 | 270 | 270 | 270 | 270 | 270 |
| Irrigation | 37,863 | 37,863 | 37,863 | 37,863 | 37,863 | 37,863 |
| **Culberson County Total Demand** | 40,984 | 41,772 | 41,953 | 41,695 | 41,443 | 41,250 |
| **El Paso County** | | | | | | |
| Anthony | 770 | 905 | 1,033 | 1,163 | 1,291 | 1,412 |
| El Paso Water (City of El Paso ***only***) | 110,572 | 120,315 | 129,713 | 139,978 | 150,601 | 160,792 |
| El Paso County Tornillo WID | 320 | 312 | 306 | 303 | 303 | 304 |
| El Paso WCID #4 (Fabens) | 810 | 793 | 781 | 783 | 798 | 816 |
| East Biggs Water System | 798 | 798 | 798 | 798 | 798 | 798 |
| Fort Bliss | 4,881 | 4,921 | 5,024 | 5,182 | 5,331 | 5,481 |
| Horizon Regional MUD | 7,936 | 11,043 | 13,962 | 16,868 | 19,630 | 22,235 |
| Lower Valley WD (Socorro, Clint, San Elizario) | 5,714 | 6,563 | 7,398 | 8,290 | 9,189 | 10,045 |
| East Montana Water System | 806 | 891 | 974 | 1,064 | 1,155 | 1,241 |
| Haciendas Del Norte WID | 196 | 218 | 240 | 262 | 285 | 306 |
| Paseo Del Este MUD #1 | 1,054 | 1,167 | 1,278 | 1,397 | 1,515 | 1,629 |
| Federal Correctional Institution La Tuna | 352 | 345 | 342 | 340 | 339 | 339 |
| County-Other | 2,086 | 2,758 | 3,395 | 4,055 | 4,680 | 5,272 |
| County-Other (Vinton Hills Estates) | 64 | 85 | 104 | 124 | 144 | 162 |
| County-Other (Vinton Hills Subdivision) | 149 | 197 | 242 | 290 | 334 | 376 |
| Manufacturing | 7,028 | 8,157 | 8,157 | 8,157 | 8,157 | 8,157 |
| Mining | 4,008 | 4,626 | 5,262 | 5,948 | 6,693 | 7,539 |
| Steam Electric Power | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 |
| Livestock | 171 | 171 | 171 | 171 | 171 | 171 |
| Irrigation | 149,570 | 149,570 | 149,570 | 149,570 | 149,570 | 149,570 |
| **El Paso County Total Demand** | 307,830 | 324,380 | 339,295 | 355,288 | 371,529 | 387,190 |
| **Hudspeth County** | | | | | | |
| Hudspeth County WCID #1 | 142 | 151 | 152 | 153 | 154 | 155 |
| Esperanza Water Service | 142 | 152 | 153 | 154 | 155 | 156 |
| County-Other | 58 | 61 | 61 | 61 | 61 | 62 |
| County-Other (Dell City) | 45 | 47 | 47 | 47 | 47 | 47 |
| County-Other (Fort Hancock WCID) | 114 | 119 | 119 | 119 | 120 | 121 |
| Mining | 479 | 451 | 468 | 483 | 492 | 502 |
| Livestock | 437 | 437 | 437 | 437 | 437 | 437 |
| Irrigation | 115,542 | 115,542 | 115,542 | 115,542 | 115,542 | 115,542 |
| **Hudspeth County Total Demand** | 116,959 | 116,960 | 116,979 | 116,996 | 117,008 | 117,022 |

**Table 2-2. (continued) Far West Texas Water Demand Projections (Rio Grande River Basin)**
**(Acre-Feet per Year)**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Jeff Davis County** | | | | | | |
| Fort Davis | 319 | 314 | 309 | 307 | 307 | 307 |
| County-Other | 124 | 120 | 117 | 115 | 115 | 115 |
| County-Other (City of Valentine) | 29 | 28 | 28 | 27 | 27 | 27 |
| Mining | 153 | 153 | 153 | 153 | 153 | 153 |
| Livestock | 397 | 397 | 397 | 397 | 397 | 397 |
| Irrigation | 665 | 665 | 665 | 665 | 665 | 665 |
| **Jeff Davis County Total Demand** | 1,687 | 1,677 | 1,669 | 1,664 | 1,664 | 1,664 |
| **Presidio County** | | | | | | |
| Marfa | 690 | 735 | 781 | 841 | 895 | 947 |
| Presidio | 738 | 772 | 808 | 856 | 905 | 953 |
| County-Other | 100 | 112 | 123 | 139 | 153 | 166 |
| Mining | 403 | 0 | 0 | 0 | 0 | 0 |
| Livestock | 328 | 328 | 328 | 328 | 328 | 328 |
| Irrigation | 4,006 | 4,006 | 4,006 | 4,006 | 4,006 | 4,006 |
| **Presidio County Total Demand** | 6,265 | 5,953 | 6,046 | 6,170 | 6,287 | 6,400 |
| **Terrell County** | | | | | | |
| Terrell County WCID #1 | 178 | 178 | 178 | 177 | 177 | 177 |
| County-Other | 21 | 21 | 20 | 20 | 20 | 20 |
| Mining | 673 | 776 | 740 | 606 | 483 | 385 |
| Livestock | 151 | 151 | 151 | 151 | 151 | 151 |
| Irrigation | 751 | 751 | 751 | 751 | 751 | 751 |
| **Terrell County Total Demand** | 1,774 | 1,877 | 1,840 | 1,705 | 1,582 | 1,484 |
| **Region E Total Water Demand** | **480,424** | **497,577** | **512,732** | **528,470** | **544,473** | **559,976** |

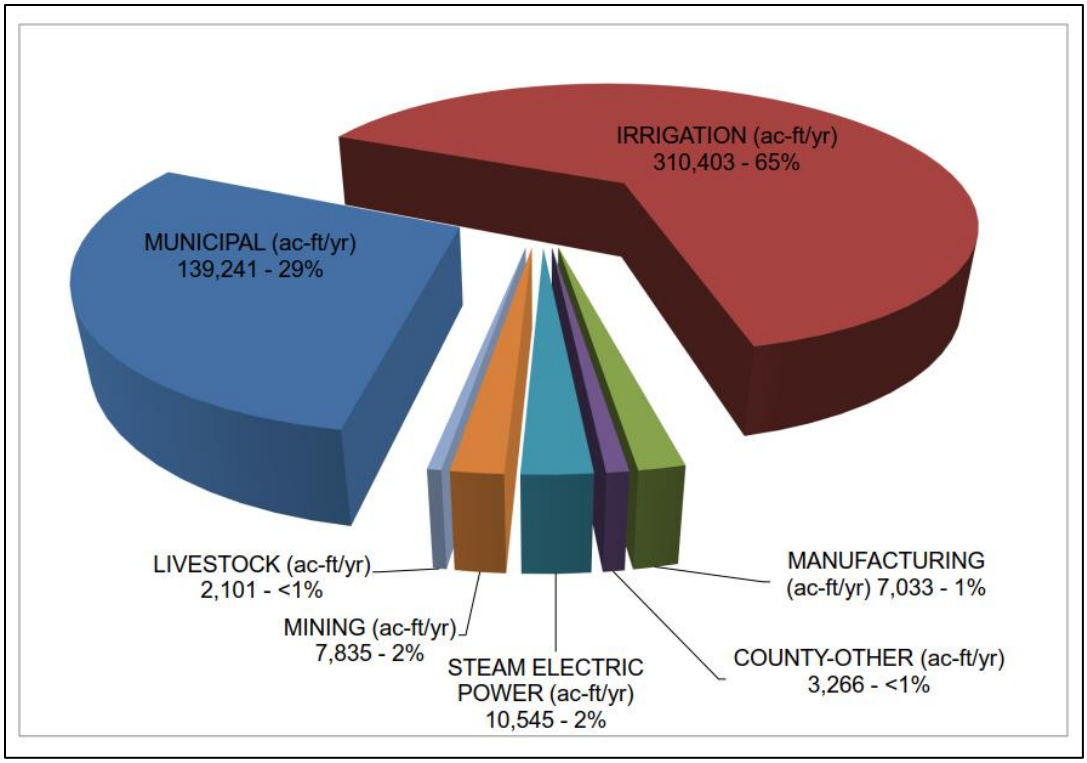



**Figure 2-4. Year 2020 Projected Water Demand by Water Use Category**

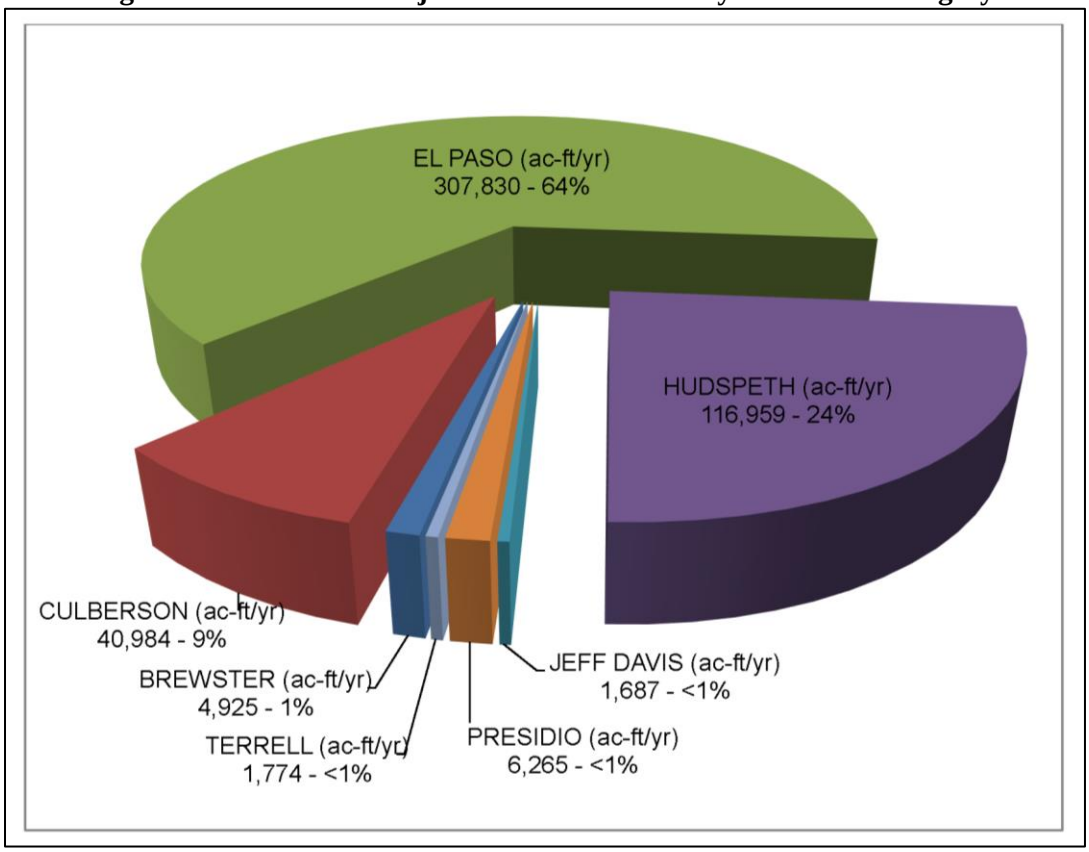



**Figure 2-5. Year 2020 Projected Water Demand by County**

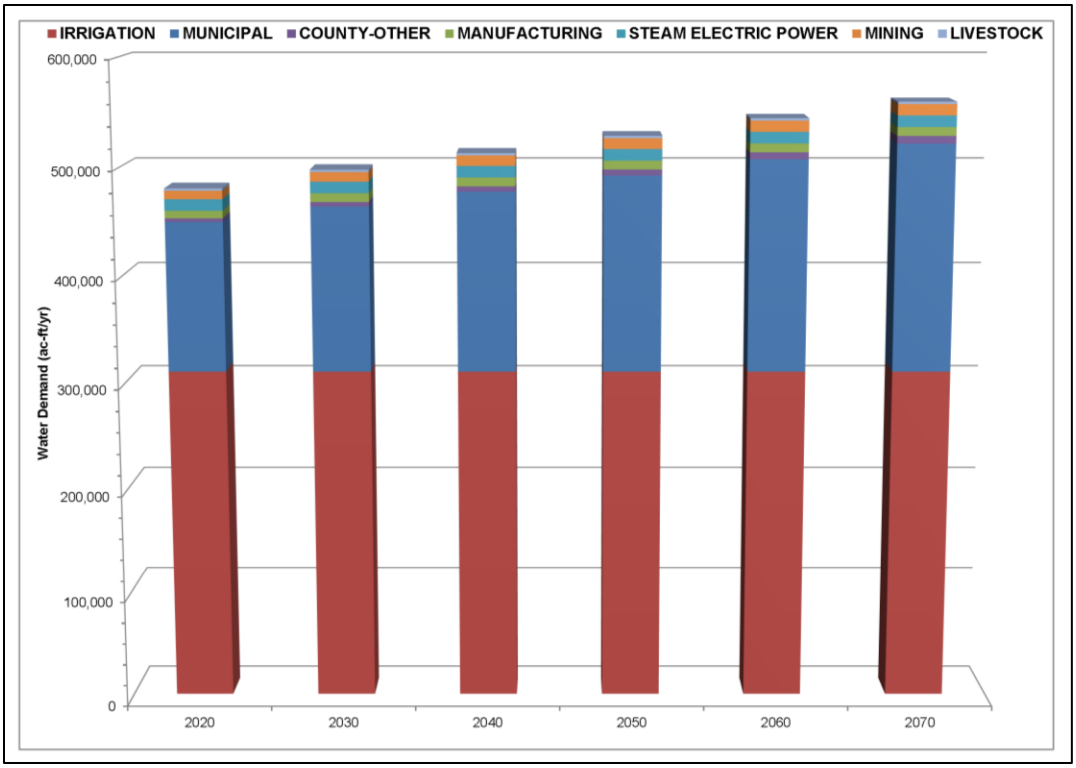



**Figure 2-6. Regional Projected Water Demand by Water Use Category**

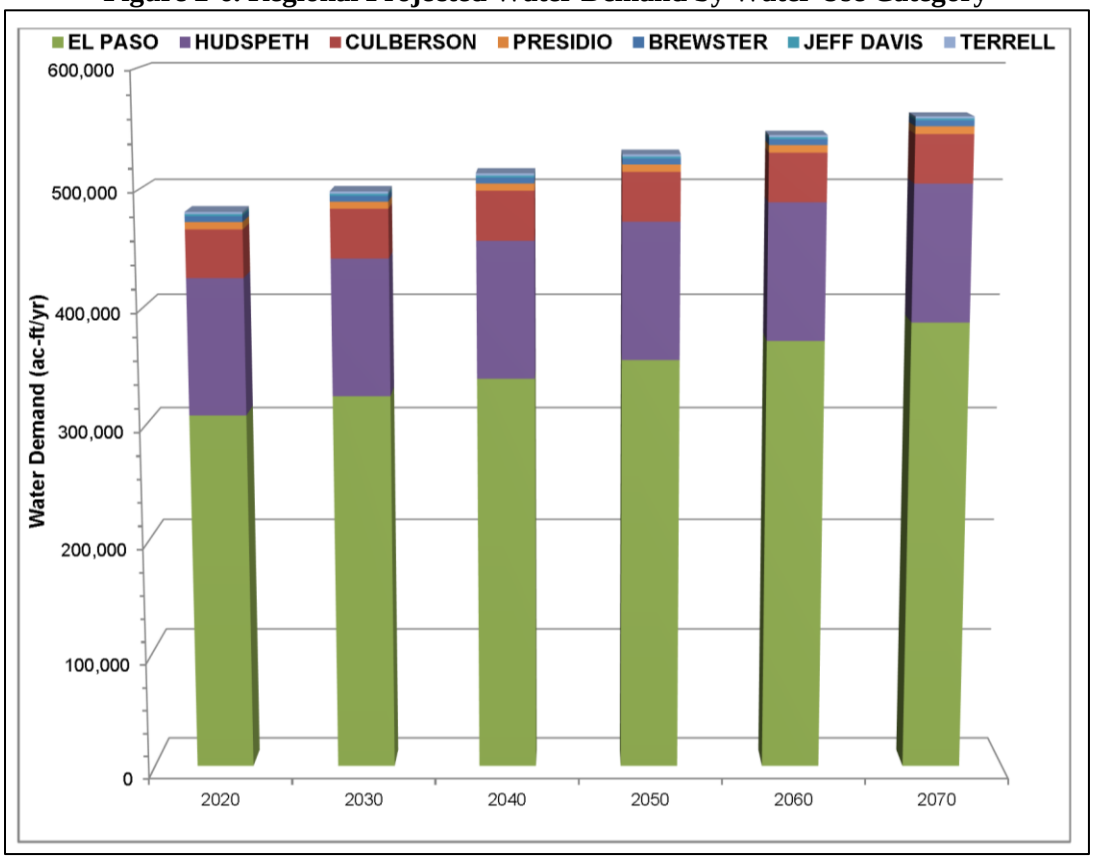



**Figure 2-7. Regional Projected Water Demand by County**

### 2.2.1 Major Water Providers

Recent TWDB rule changes have revised 31TAC §357.30(4), which now requires regional water planning groups to identify "major water providers" as opposed to "wholesale water providers" as performed in previous plans. A major water provider (MWP) is defined as a significant public or private WUG or wholesale water provider (WWP) whose significance is determined by the RWPG and provides water for any water use category in a regional water planning area. This rule revision gives regional water planning groups more flexibility in identifying which large water providers ought to be reported in their regional water plans.

The Far West Texas Planning Group has developed and adopted the following definition of a MWP, and feels that this definition captures all significant municipal WUGs or WWPs that provide water for other water use categories within the Region:

> *"An entity that currently provides significant water supplies (>5,000 acre-feet per year) to other users and which will continue to develop new supplies to meet future needs of those whom they supply during the period covered by this Plan*."

Table 2-3 lists the water demand for the major water providers in the Region and their customers.

**Table 2-3. Far West Texas Major Water Provider Water Demand**

| Wholesale Water Provider | Receiving Entity | Water Demand (Acre-Feet/Year) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| El Paso County WID#1 | El Paso Water (33%) | 49,358 | 49,358 | 49,358 | 49,358 | 49,358 | 49,358 |
| | El Paso County Irrigation | 100,212 | 100,212 | 100,212 | 100,212 | 100,212 | 100,212 |
| | **Total Demand** | **149,570** | **149,570** | **149,570** | **149,570** | **149,570** | **149,570** |
| El Paso Water | City of El Paso | 110,572 | 120,315 | 129,713 | 139,978 | 150,601 | 160,792 |
| | Fort Bliss (25%) | 1,420 | 1,430 | 1,456 | 1,495 | 1,532 | 1,570 |
| | Lower Valley Water District | 5,714 | 6,563 | 7,398 | 8,290 | 9,189 | 10,045 |
| | Vinton | 213 | 282 | 346 | 414 | 478 | 538 |
| | Paseo Del Este MUD #1 | 1,054 | 1,167 | 1,278 | 1,397 | 1,515 | 1,629 |
| | East Montana Water System | 806 | 891 | 974 | 1,064 | 1,155 | 1,241 |
| | Haciendas Del Norte WID | 196 | 218 | 240 | 262 | 285 | 306 |
| | Manufacturing | 7,028 | 8,157 | 8,157 | 8,157 | 8,157 | 8,157 |
| | Mining (12%) | 481 | 555 | 631 | 714 | 803 | 905 |
| | Steam Electric Power (75%) | 7,909 | 7,909 | 7,909 | 7,909 | 7,909 | 7,909 |
| | County Other | 2,086 | 2,758 | 3,395 | 4,055 | 4,680 | 5,272 |
| | **Total Demand** | **137,479** | **150,245** | **161,496** | **173,735** | **185,304** | **198,364** |
| Lower Valley Water District | Socorro | 2,686 | 2,888 | 3,107 | 3,316 | 3,584 | 3,818 |
| | Clint | 57 | 66 | 74 | 83 | 92 | 100 |
| | San Elizario | 2,971 | 3,610 | 4,217 | 4,891 | 5,513 | 6,127 |
| | **Total Demand** | **5,714** | **6,563** | **7,398** | **8,290** | **9,189** | **10,045** |
| Horizon Regional MUD | Horizon City | 4,351 | 6,149 | 7,836 | 9,514 | 11,108 | 12,610 |
| | Other Retail Customers | 3,585 | 4,894 | 6,126 | 7,354 | 8,522 | 9,625 |
| | **Total Demand** | **7,936** | **11,043** | **13,962** | **16,868** | **19,630** | **22,235** |

### 2.2.2 Municipal and County-Other

The quantity of water used for municipal and county-other (rural domestic) purposes is heavily dependent on population, climatic conditions, and water-conservation measures. For planning purposes, municipal water use comprises both residential and commercial. Commercial water use includes business establishments, public offices, and institutions. Residential and commercial uses are categorized together because they are similar types of uses: i.e., they both use water primarily for drinking, cleaning, sanitation, air conditioning, and landscape watering. Also included in this category is water applied to municipally owned golf courses. Water use within a utility service area that is not included in the quantification of municipal demand is that used in self-supplied manufacturing and industrial processes.

Municipal and county-other water demand is calculated based on utility service boundaries designated in the population projections process and include rural domestic use. Projected municipal water demand is based on the year-2010 per-capita water use, which is calculated with year-2010 population counts divided into reported water use for the same year. Per-capita water use in communities with significant non-residential water demands, such as for commercial customers, will appear abnormally high. The year-2010 per-capita water use is reduced slightly over time to simulate expected conservation savings due to state-mandated plumbing code implementation. Table 2-4 presents municipal savings due to the natural installation of plumbing fixtures and appliances to more water-efficient fixtures and appliances. The conservation adjusted per-capita water use is then applied to each of the decade population estimates to produce the projected water demand for each entity. Table 2-5 presents the municipal and county-other projected water use for each decade in the current planning cycle.

Rural communities (outside of El Paso County) are relatively small and are generally reliant on self-provided water supplies. Water demand within these communities is related directly to their population trends and is thus relatively stable or moderately increasing over the next 50 years. Projected water-demand growth for the numerous communities within El Paso County is significantly greater and thus will require a level of coordinated intercommunity planning.

**Table 2-4. Municipal Savings Due to Plumbing Fixture Requirements**
**(Acre-Feet per Year)**

| County | Entity Name | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|---|
| Brewster | Alpine | 63 | 93 | 117 | 130 | 133 | 133 |
| Brewster | Lajitas Municipal Services | 6 | 8 | 11 | 12 | 12 | 12 |
| Brewster | Marathon Water Supply & Sewer Services | 5 | 7 | 9 | 10 | 10 | 10 |
| Brewster | County-Other | 29 | 44 | 55 | 61 | 63 | 63 |
| Culberson | Van Horn | 29 | 47 | 50 | 53 | 55 | 55 |
| Culberson | County-Other | 4 | 6 | 8 | 9 | 9 | 9 |
| El Paso | Anthony | 45 | 74 | 99 | 120 | 135 | 148 |
| El Paso | El Paso Water | 7,828 | 12,375 | 16,248 | 19,138 | 20,970 | 22,490 |
| El Paso | El Paso County Tornillo WID | 28 | 38 | 45 | 50 | 51 | 51 |
| El Paso | El Paso WCID #4 | 93 | 138 | 176 | 200 | 208 | 213 |
| El Paso | East Biggs Water System | 99 | 99 | 99 | 99 | 99 | 99 |
| El Paso | Fort Bliss Water Services | 304 | 469 | 557 | 588 | 617 | 635 |
| El Paso | Horizon Regional MUD | 434 | 775 | 1059 | 1328 | 1571 | 1793 |
| El Paso | Lower Valley Water District | 645 | 1,069 | 1,417 | 1,697 | 1,907 | 2,094 |
| El Paso | East Montana Water System | 66 | 104 | 134 | 157 | 174 | 188 |
| El Paso | Haciendas Del Norte WID | 12 | 19 | 25 | 29 | 32 | 35 |
| El Paso | Paseo Del Este MUD #1 | 81 | 128 | 165 | 193 | 214 | 231 |
| El Paso | Federal Correctional Institution La Tuna | 17 | 23 | 27 | 28 | 29 | 29 |
| El Paso | County-Other | 158 | 316 | 448 | 548 | 643 | 727 |
| Hudspeth | Hudspeth County WCID #1 | 11 | 17 | 20 | 23 | 23 | 23 |
| Hudspeth | Esperanza Water Service | 10 | 16 | 20 | 22 | 22 | 22 |
| Hudspeth | County-Other | 23 | 36 | 44 | 49 | 50 | 51 |
| Jeff Davis | Fort Davis | 13 | 19 | 23 | 25 | 26 | 26 |
| Jeff Davis | County-Other | 11 | 16 | 20 | 22 | 22 | 22 |
| Presidio | Marfa | 31 | 48 | 62 | 68 | 74 | 78 |
| Presidio | Presidio | 56 | 85 | 109 | 127 | 137 | 144 |
| Presidio | County-Other | 8 | 13 | 17 | 20 | 22 | 24 |
| Terrell | Terrell County WCID #1 | 11 | 15 | 16 | 16 | 16 | 16 |
| Terrell | County-Other | 2 | 3 | 3 | 3 | 3 | 3 |
| **Total** | | **10,120** | **16,098** | **21,081** | **24,820** | **27,324** | **29,425** |

**Table 2-5. Municipal and County-Other Water Demand Projections - Rio Grande Basin**
**(Acre-Feet per Year)**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Brewster County** | | | | | | |
| Alpine | 1,934 | 1,944 | 1,935 | 1,933 | 1,937 | 1,940 |
| Lajitas Municipal Services | 103 | 104 | 103 | 103 | 104 | 104 |
| Marathon Water Supply & Sewer Service | 124 | 126 | 126 | 127 | 127 | 127 |
| County-Other | 411 | 431 | 433 | 436 | 439 | 442 |
| **Brewster County Total Demand** | 2,572 | 2,605 | 2,597 | 2,599 | 2,607 | 2,613 |
| **Culberson County** | | | | | | |
| Van Horn | 662 | 711 | 737 | 760 | 774 | 783 |
| County-Other | 65 | 69 | 71 | 73 | 74 | 75 |
| **Culberson County Total Demand** | 727 | 780 | 808 | 833 | 848 | 858 |
| **El Paso County** | | | | | | |
| Anthony | 770 | 905 | 1,033 | 1,163 | 1,291 | 1,412 |
| El Paso Water | 110,572 | 120,315 | 129,713 | 139,978 | 150,601 | 160,792 |
| El Paso County Tornillo WID | 320 | 312 | 306 | 303 | 303 | 304 |
| El Paso WCID #4 | 810 | 793 | 781 | 783 | 798 | 816 |
| East Biggs Water System | 798 | 798 | 798 | 798 | 798 | 798 |
| Fort Bliss | 4,881 | 4,921 | 5,024 | 5,182 | 5,331 | 5,481 |
| Horizon Regional MUD | 7,936 | 11,043 | 13,962 | 16,868 | 19,630 | 22,235 |
| Lower Valley WD | 5,714 | 6,563 | 7,398 | 8,290 | 9,189 | 10,045 |
| East Montana Water System | 806 | 891 | 974 | 1,064 | 1,155 | 1,241 |
| Haciendas Del Norte WID | 196 | 218 | 240 | 262 | 285 | 306 |
| Paseo Del Este MUD #1 | 1,054 | 1,167 | 1,278 | 1,397 | 1,515 | 1,629 |
| Federal Correctional Institution La Tuna | 352 | 345 | 342 | 340 | 339 | 339 |
| County-Other | 2,086 | 2,758 | 3,395 | 4,055 | 4,680 | 5,272 |
| County-Other (Vinton Hills Estates) | 64 | 85 | 104 | 124 | 144 | 162 |
| County-Other (Vinton Hills Subdivision) | 149 | 197 | 242 | 290 | 334 | 376 |
| **El Paso County Total Demand** | 136,508 | 151,311 | 165,590 | 180,897 | 196,393 | 211,208 |
| **Hudspeth County** | | | | | | |
| Hudspeth County WCID #1 | 142 | 151 | 152 | 153 | 154 | 155 |
| Esperanza Water Service | 142 | 152 | 153 | 154 | 155 | 156 |
| County-Other | 58 | 61 | 61 | 61 | 61 | 62 |
| County-Other (Dell City) | 45 | 47 | 47 | 47 | 47 | 47 |
| County-Other (Fort Hancock WCID) | 114 | 119 | 119 | 119 | 120 | 121 |
| **Hudspeth County Total Demand** | 501 | 530 | 532 | 534 | 537 | 541 |
| **Jeff Davis County** | | | | | | |
| Fort Davis | 319 | 314 | 309 | 307 | 307 | 307 |
| County-Other | 124 | 120 | 117 | 115 | 115 | 115 |
| County-Other (City of Valentine) | 29 | 28 | 28 | 27 | 27 | 27 |
| **Jeff Davis County Total Demand** | 472 | 462 | 454 | 449 | 449 | 449 |
| **Presidio County** | | | | | | |
| Marfa | 690 | 735 | 781 | 841 | 895 | 947 |
| Presidio | 738 | 772 | 808 | 856 | 905 | 953 |
| County-Other | 100 | 112 | 123 | 139 | 153 | 166 |
| **Presidio County Total Demand** | 1,528 | 1,619 | 1,712 | 1,836 | 1,953 | 2,066 |
| **Terrell County** | | | | | | |
| Terrell County WCID #1 | 178 | 178 | 178 | 177 | 177 | 177 |
| County-Other | 100 | 112 | 123 | 139 | 153 | 166 |
| **Terrell County Total Demand** | 278 | 290 | 301 | 316 | 330 | 343 |
| **Region E Total Municipal Water Demand** | **142,586** | **157,597** | **171,994** | **187,464** | **203,117** | **218,078** |

**El Paso County Tornillo WID:** While Tables 2-1 and 2-5 list TWDB approved population and water demand projections, Table 2-6 provides a self-evaluated perspective by El Paso County Tornillo WID based on more recent population and water use data. The Water Planning Group recognizes that these projections for Tornillo are likely more accurate than those based on the 2010 census required as a basis for this *Plan* and, thus desire to present this alternative for the community in this current *Plan*.

**Table 2-6. El Paso County Tornillo WID Proposed Alternative Population and Water Demand Projections**

| El Paso County Tornillo WID | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Population | 21 | 21 | 20 | 20 | 20 | 20 |
| Water Demand (acre-feet per year) | 199 | 199 | 198 | 197 | 197 | 197 |

**East Montana Water System:** The County of El Paso has operated the East Montana Water System since it acquired eight independent water systems in the East Montana area in 1996. The water is purchased through a wholesale water agreement from El Paso Water and currently has a capacity of 2,200 connections. The system is nearing its capacity, due to design standards used in constructing eight various smaller systems and not one single-large system. There are currently 3,259 lots within the service area of the system with an identified 1,371 lots needing water connections. In June 2017, the County calculated there were only an available 528 meters to distribute to the public and subsequently adopted a "Water Meter Allocation Policy" which limited meters to:

- No Larger than ¾ inch
- Meters only for single-family residential lots established on or before May 12, 1997
- One meter per single-family residential lot

Additionally, the policy requires that any future subdivisions or projects submitted after March 7, 2016 submit a water supply agreement from a supplier other than the East Montana Water System unless service has been committed and an agreement is pending in County Public Works. In sum, the system is limited in its ability to grow without significant investment in capacity-related improvements. With that context, the East Montana Water System contends that the population and water demand projections shown in Tables 2-1 and 2-2 are significantly exaggerated as they do not account for the fact that the system is at 80 percent capacity.

A significant portion of the municipal water demand in Brewster, Jeff Davis, and Presidio Counties is assigned to the county-other (rural) category. This category represents the aggregation of utilities that provide less than an average of 100 acre-feet per year, as well as rural areas not served by a water utility in each county. Table 2-7 presents a listing of water systems that comprise the county-other category along with the corresponding annual water use survey data (2010-2015).

A water user group within county-other can be further divided into a "sub-WUG" at the discretion of the planning group for a more detailed analysis. This option allows for a higher resolution in water needs analyses to better account for present water supplies and needs within certain county-other systems of interest, which would otherwise be aggregated at the county level. Table 2-7 indicates in italics the water systems that the Far West Texas Water Planning Group designated as official sub-WUGs.

**Table 2-7. County-Other Systems Reported Water Use From 2010 through 2015**
**(Acre-Feet per Year)**

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| **Brewster County-Other** | | | | | | |
| Study Butte Terlingua Water System | 32 | 81 | 119 | 119 | 90 | 106 |
| Panther Junction BBNP | 36 | 26 | 21 | 21 | 23 | 23 |
| Chisos Basin Water BBNP | 16 | 14 | 14 | 16 | 16 | 16 |
| Rio Grande Village BBNP | 2 | 5 | 10 | 11 | 14 | 14 |
| Castolon Maintenance Area BBNP | 2 | 3 | 2 | 1 | 1 | 1 |
| * Big Bend Resort & Adventures | - | - | - | - | - | - |
| **Brewster County-Other Total Water Use** | **88** | **129** | **166** | **168** | **144** | **160** |
| **Culberson County-Other** | | | | | | |
| Pine Springs GMNP | 18 | 18 | 20 | 23 | 28 | 0 |
| * TX Dot Culberson County SRA US 62 | - | - | - | - | - | - |
| * TX Dot Culberson County SRA IH 10 | - | - | - | - | - | - |
| **Culberson County-Other Total Water Use** | **18** | **18** | **20** | **23** | **28** | **0** |
| **El Paso County-Other** | | | | | | |
| Ponderosa and Western Village WSC | 0 | 77 | 77 | 77 | 77 | 77 |
| *Vinton Hills Subdivision* | 69 | 77 | 76 | 72 | 76 | 75 |
| *Vinton Village Estates* | 37 | 39 | 38 | 38 | 33 | 32 |
| River View Estates | 28 | 26 | 25 | 30 | 30 | 24 |
| Green Acres Mobile Home Park | 0 | 0 | 0 | 0 | 0 | 21 |
| Villa Alegre Estates | 11 | 11 | 11 | 10 | 9 | 9 |
| Valley Acres Mobile Home Park Water System | 2 | 3 | 3 | 3 | 0 | 0 |
| Fort Bliss Site Monitor | 6 | 0 | 0 | 0 | 0 | 0 |
| Hueco Tanks State Park TPWD | 2 | 2 | 2 | 0 | 0 | 0 |
| * Hillside Water Works | - | - | - | - | - | - |
| * Chamizal National Memorial | - | - | - | - | - | - |
| * East Montana Location | - | - | - | - | - | - |
| * Hueco Club | - | - | - | - | - | - |
| **El Paso County-Other Total Water Use** | **155** | **235** | **232** | **230** | **225** | **238** |
| **Hudspeth County-Other** | | | | | | |
| *Fort Hancock WCID* | 76 | 76 | 70 | 84 | 82 | 80 |
| *Dell City* | 52 | 55 | 57 | 63 | 63 | 63 |
| Cerro Alto Water System | 0 | 0 | 0 | 0 | 0 | 8 |
| **Hudspeth County-Other Total Water Use** | **128** | **131** | **127** | **147** | **145** | **151** |
| **Jeff Davis County-Other** | | | | | | |
| *City of Valentine* | 29 | 32 | 29 | 21 | 19 | 19 |
| Fort Davis Estates | 0 | 11 | 10 | 8 | 9 | 7 |
| UT McDonald Observatory | 13 | 18 | 16 | 0 | 12 | 0 |
| TPWD Davis Mountains State Park Campground | 23 | 22 | 23 | 22 | 24 | 0 |
| Fort Davis National Historic Site | 0 | 18 | 0 | 0 | 14 | 0 |
| **Jeff Davis County-Other Total Water Use** | **65** | **69** | **78** | **51** | **27** | **26** |
| **Presidio County-Other** | | | | | | |
| Candelaria WSC | 4 | 4 | 4 | 4 | 4 | 4 |
| * Big Bend Ranch State Park TPWD | - | - | - | - | - | - |
| * Redford Water Supply | - | - | - | - | - | - |
| **Presidio County-Other Total Water Use** | **4** | **4** | **4** | **4** | **4** | **4** |
| **Terrell County-Other** | | | | | | |
| *(No Data Provided by the TWDB)* | - | - | - | - | - | - |
| **Region E Total Water Use** | **458** | **586** | **627** | **623** | **573** | **579** |

*****No survey data provided

### 2.2.3 Manufacturing

Manufacturing self-supplied water demand projections are based on the highest county-aggregated manufacturing water use in the most recent five-years (2010-2015) of reported annual water use survey data. The most recent 10-year projections for employment growth from the Texas Workforce Commission was used as proxy for growth by manufacturing sectors between 2020 and 2030. After 2030, the manufacturing water use was held constant through 2070.

The use of water for manufacturing purposes only occurs in, Culberson, and El Paso Counties (Table 2-8). Use in Culberson County is minimal and is not anticipated to change significantly over time, however, manufacturing water use in El Paso County is expected to increase from 7,028 acre-feet in the year 2020 to 8,157 acre-feet by 2070.

**Table 2-8. Manufacturing Water Use Projections**
**(Acre-Feet per Year)**

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Brewster | 0 | 0 | 0 | 0 | 0 | 0 |
| Culberson | 5 | 6 | 6 | 6 | 6 | 6 |
| El Paso | 7,028 | 8,157 | 8,157 | 8,157 | 8,157 | 8,157 |
| Hudspeth | 0 | 0 | 0 | 0 | 0 | 0 |
| Jeff Davis | 0 | 0 | 0 | 0 | 0 | 0 |
| Presidio | 0 | 0 | 0 | 0 | 0 | 0 |
| Terrell | 0 | 0 | 0 | 0 | 0 | 0 |

### 2.2.4 Irrigation

Draft irrigation water demand projections utilize an average of TWDB's 2010-2015 irrigation water use estimates as a base. Those values were then held constant between 2020 and 2070. Annual water use estimates are developed at the county level by applying a calculated evapotranspiration-based "crop water need" estimate to reported irrigated acreage from Farm Service Agency (FSA). These estimates are then adjusted based on surface water release data from TCEQ and Texas Water Masters and comments from Groundwater Conservation Districts. In counties where the total groundwater availability over the planning period is projected to be less than the groundwater portion of the baseline water demand projections, the irrigation water demand projections will begin to decline in 2030 or later, to be compatible with the groundwater availability. However, this approach to a 'groundwater constrained' area presently does not occur in the Far West Texas Region.

Statewide, irrigation water demands are expected to decline over time. More efficient canal delivery systems have improved water-use efficiencies of surface water irrigation. More efficient on-farm irrigation systems have also improved the efficiency of groundwater irrigation. Other factors that have contributed to decreased irrigation demands are declining groundwater supplies and the voluntary transfer of water rights historically used for irrigation to municipal uses.

Water used for agricultural irrigation in Far West Texas is significantly greater (65 percent of total) than all other water-use categories. On a regional basis, water used for the irrigation of crops is projected to decline slightly over the 50-year planning horizon. However, as any irrigator can attest, climate, water availability, and the market play key roles in how much water is actually applied on a year-by-year basis.

The quantity and quality of water needed for agricultural irrigation is dependent on the type of crop grown and on soil characteristics. Although a minimal amount of agriculture can persist on limited water supplies, most crops require significantly larger water applications to remain profitable. Irrigated farms along the Rio Grande corridor in El Paso and Hudspeth Counties are almost entirely dependent on water supplies derived from the River. When Rio Grande water is limited or not available, most farming temporarily ceases until water supplies once again become available. Irrigated farms in other areas within the Region are dependent on groundwater supplies. Availability of these supplies depends on local pumping regulatory limitations, aquifer hydrologic characteristics, and energy cost.

Irrigation strategies principally involve various forms of conservation. Irrigation application equipment has been developed to ensure that greater amounts of applied water reach the root system while minimizing loss to evaporation. Proper application timing is also critical in avoiding over-watering. The lining of canals that transport water from its source to the fields reduces losses due to seepage. Drought tolerant crop selection is also important when faced with limited water supplies.

Some farmers across the Region are using slightly-saline water for irrigation. To maintain long-term soil productivity with saline waters, producers must over irrigate to maintain a leaching fraction that minimizes salt buildup in the crop root zone. In some areas, high levels of sodium have reduced soil infiltration rates. Producers often manage this problem through application of soil amendments (such as gypsum or organic residues) or through mechanical mixing of the soil. Table 2-9 presents the projected irrigation water use for all decades in the current water planning cycle.

**Table 2-9. Irrigation Water Use Projections**
**(Acre-Feet per Year)**

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Brewster | 2,006 | 2,006 | 2,006 | 2,006 | 2,006 | 2,006 |
| Culberson | 37,863 | 37,863 | 37,863 | 37,863 | 37,863 | 37,863 |
| El Paso | 149,570 | 149,570 | 149,570 | 149,570 | 149,570 | 149,570 |
| Hudspeth | 115,542 | 115,542 | 115,542 | 115,542 | 115,542 | 115,542 |
| Jeff Davis | 665 | 665 | 665 | 665 | 665 | 665 |
| Presidio | 4,006 | 4,006 | 4,006 | 4,006 | 4,006 | 4,006 |
| Terrell | 751 | 751 | 751 | 751 | 751 | 751 |

### 2.2.5 Steam Electric Power Generation

Steam-electric power water use is influenced by a variety of factors, including fuel prices, weather conditions, electricity demand, the cooling design of the facilities, and others. As part of this planning cycle, the draft steam-electric power generation water demand projections in 2020 are based on the highest county-aggregated water use in the most recent five-years (2010-2015) of water use estimates. The anticipated water-use of future facilities listed in the state and federal reports was added to the demand projections from the anticipated operation date to 2070. Likewise, the reported water-use of facilities scheduled for retirement was subtracted from the demand projections.

In previous plans, the volumes of reuse water, such as treated effluent, used by generating facilities have not been included in the historic water use estimates or the water demand projections. However, reuse is becoming an increasingly valuable water supply state-wide, and is an important part of meeting future water demands. In recognition of this critical water supply component, the TWDB for this planning cycle

has developed the steam-electric water demand projections to include the relevant reuse volumes reported by the power facilities in both the 2021 regional water plans and the 2022 State Water Plan.

El Paso Electric (EPE) located in El Paso County is the only facility within the Region that uses water in the form of steam to generate electricity. Currently, EPE operates four different electric-generating stations, distributing electricity across a 10,000-square mile service area in the Rio Grande Valley of west Texas and south-central New Mexico. These stations are comprised of a variety of different electric generation technology systems (e.g. steam turbine, gas turbine, combined cycle, etc.) as well as having various cooling systems (once-through, cooling tower). These different generation technologies require various volumes of water use. EPE recommends that in addition to fuel type, the TWDB's methodology also considers the type of generation technology system as another significant component of water consumption rate.

Electricity demands within the Region are likely to increase due to anticipated local population growth, as well as increasing commercial and manufacturing power needs. However, anticipated improvements and shifts in generation technologies and water conservation strategies may offset consumptive water use for steam-electric generation, resulting in a static projection for water demand across the planning horizon.

Table 2-10 presents the steam-electric power water demand projections. The only steam-electric power water use in the Region is within El Paso County. El Paso Electric currently purchases most of its water supply from El Paso Water.

**Table 2-10. Steam Electric Power Generation Water Use Projections**
**(Acre-Feet per Year)**

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Brewster | 0 | 0 | 0 | 0 | 0 | 0 |
| Culberson | 0 | 0 | 0 | 0 | 0 | 0 |
| El Paso | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 |
| Hudspeth | 0 | 0 | 0 | 0 | 0 | 0 |
| Jeff Davis | 0 | 0 | 0 | 0 | 0 | 0 |
| Presidio | 0 | 0 | 0 | 0 | 0 | 0 |
| Terrell | 0 | 0 | 0 | 0 | 0 | 0 |

### 2.2.6 Livestock

Texas is the nation's leading livestock producer, accounting for approximately 11 percent of the total United States production. Although livestock production is an important component of the Texas economy, the industry consumes a relatively small amount of water.

Livestock water demand projections are a combination of an average of the 2010-2014 water use survey information provided by the TWDB, which is based on livestock inventory data from the National Agricultural Statistical Service (NASS) and the Texas Department of Agriculture, and per head water use consumptions by animal class. County-level water use estimates are calculated by applying a water use coefficient for each livestock category to county level inventory estimates. The rate of change for projections from the 2016 Regional Water Plans was then applied to the new base. Many counties chose

to hold the base constant throughout the planning horizon. Table 2-11presents livestock category and per head daily water use information.

**Table 2-11. Estimated per Head Daily Water Use (in gallons)**

| TWDB | NASS Data Type | Per Head Daily Water Use |
|---|---|---|
| Cattle | Milk | 75 |
| | Fed & Other | 15 |
| Poultry | Hens | 86* (per 1,000 head) |
| | Broilers | 77* (per 1,000 head) |
| Horses | Horses, Ponies, & Burros | 12 |
| Hogs | Hogs | 11 |
| Sheep | Sheep | 2 |
| Goats | Milk, Meat, Angora | 0.5 |

Source: University of Georgia - College of Agricultural and Environmental Sciences, 2009

For water-supply planning purposes in the Far West Texas Plan, livestock water use is held constant throughout the 50-year planning period. However, reality dictates that during prolonged drought periods, when poor range conditions exist and/or during unfriendly market conditions, livestock herds are generally reduced thus resulting in significantly less water demand. Table 2-12 presents the projected livestock water use for the Region. It is also important to point out that water consumed by wildlife is not a component of these livestock estimates and remains an unaccounted supply volume as described in Section 2.3 Environmental and Recreational Water Needs.

**Table 2-12. Livestock Water Use Projections (Acre-Feet per Year)**

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Brewster | 347 | 347 | 347 | 347 | 347 | 347 |
| Culberson | 270 | 270 | 270 | 270 | 270 | 270 |
| El Paso | 171 | 171 | 171 | 171 | 171 | 171 |
| Hudspeth | 437 | 437 | 437 | 437 | 437 | 437 |
| Jeff Davis | 397 | 397 | 397 | 397 | 397 | 397 |
| Presidio | 328 | 328 | 328 | 328 | 328 | 328 |
| Terrell | 151 | 151 | 151 | 151 | 151 | 151 |

### 2.2.7 Mining

Although the Texas mineral industry is foremost in the production of crude petroleum and natural gas in the United States, it also produces a wide variety of important nonfuel minerals. In all instances, water is required in the mining of these minerals either for processing, leaching to extract certain ores, controlling dust at the plant site, or for reclamation.

Mining water demand projections were developed by combining annual reported water use data (2010-2014), including reuse and additional oil and gas estimates provided by the TWDB using the FracFocus database. Oil and gas water use estimates are then broken down by water source based on a TWDB-contracted study with the University of Texas Bureau of Economic Geology (BEG) as summarized in Table 2-13 below. The BEG study estimated current mining water use and projected that use across the planning horizon using data collected from trade, organizations, government agencies, and other industry representatives. County-level projections are compiled as the sum of individual projections for four sub-sector mining categories: oil and gas, aggregates, coal and lignite, and other.

**Table 2-13. Estimated Percentages of Reuse and Brackish Water Use in Hydraulic Fracturing**

| Play | Fresh Water | Reuse / Recycle | Brackish |
|---|---|---|---|
| Permian Far West | 20% | 0% | 80% |
| Permian Midland | 68% | 2% | 30% |
| Anadarko Basin | 50% | 20% | 30% |
| Barnett Shale | 92% | 5% | 3% |
| Eagle Ford Shale | 80% | 0% | 20% |
| East Texas Basin | 95% | 5% | 0% |

Source: University of Texas Bureau of Economics Geology, 2012

A portion of the water used in the non-oil and gas mining industry in Far West Texas (Table 2-14) is related to its use in the quarrying of gravel and road base materials. However, the largest single water use occurs in Culberson County where it is employed in the mining of talc mineral aggregates. New to the FWTRWP is a mining water demand in Jeff Davis County. Due to recent oil and gas activity, approximately 153 acre-feet per year is projected to be exported from Jeff Davis County to meet this new mining demand.

**Table 2-14. Mining Water Use Projections**
**(Acre-Feet per Year)**

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Brewster | 0 | 0 | 0 | 0 | 0 | 0 |
| Culberson | 2,119 | 2,853 | 3,006 | 2,723 | 2,456 | 2,253 |
| El Paso | 4,008 | 4,626 | 5,262 | 5,948 | 6,693 | 7,539 |
| Hudspeth | 479 | 451 | 468 | 483 | 492 | 502 |
| Jeff Davis | 153 | 153 | 153 | 153 | 153 | 153 |
| Presidio | 403 | 0 | 0 | 0 | 0 | 0 |
| Terrell | 673 | 776 | 740 | 606 | 483 | 385 |

In recent years, increased oil and gas exploration activity has occurred in the Region, especially in Culberson County where in September 2016 the Apache Corporation announced the discovery of a new oil and natural gas resource play in the southwest corner of the Permian Basin called the Alpine High. The geographic outline of the play extends over 60 miles and is primarily in the southern half of Reeves County, but also falls within the boundaries of Culberson and Jeff Davis counties. The acreage is estimated to hold approximately 75 trillion cubic feet of mostly wet gas and 3 billion barrels of oil in the Barnett and Woodford regions of the field. In addition, significant oil is potentially in the shallower

Pennsylvanian, Bone Springs and Wolfcamp formations. The company has identified 2,000 to 3,000 drilling locations and as of September 2017 has released the results of 20 evaluation wells regarding the delineation of the extent of the resource. Nine of those wells are currently in production.

Table 2-15 presents the total volume of water used as a carrier fluid for hydraulic fracturing in Culberson County from 2012-2017.

**Table 2-15. Total Volume of Water Used for Hydraulic Fracturing in Culberson County (Acre-Feet per Year)**

| Year | Total Base Water Volume |
|---|---|
| 2012 | 34 |
| 2013 | 574 |
| 2014 | 1,651 |
| 2015 | 2,221 |
| 2016 | 1,715 |
| 2017 | 1,377 |

Source: FracFocus

The volume of water that is anticipated for this project is presently speculative, and therefore the Far West Texas Planning Group chooses not to include the estimates in the Table 2-14 mining projections until such time that their anticipated use becomes more established. Until then, the Planning Group intends to closely monitor this potentially significant water use.

## 2.3 ENVIRONMENTAL AND RECREATIONAL WATER NEEDS

Environmental and recreational water use in Far West Texas is not quantified but is recognized as being an important consideration as it relates to the natural community in which the residents of this Region share and appreciate. In Chapter 1, environmental and eco-recreational resources are identified and described. In the following paragraphs, the water resources needed to maintain these functions is discussed. Water-supply sources that serve environmental needs, along with identified major springs, are characterized in Chapter 3, and potential water-supply strategy impacts on the environment are considered in Chapter 5. Chapter 8 contains a discussion and recommendations pertaining to "Ecologically Unique River and Stream Segments."

In terms of combined area, Far West Texas contains most of the federal public land in Texas, and over half the land in the entire Texas State Park system. The presence of these protected public lands contributes greatly to the quality of life for area residents in a way that is not easily described in gallons, acre-feet or dollars and cents. It has been amply demonstrated that to attract 21$^{st}$ century enterprise that pays top salaries for skilled workers, quality of life is a critical issue. The spectacular natural and cultural heritage of the Region not only attracts many hundreds of thousands of temporary visitors per year to Far West Texas (more than 650,000 per year just to Guadalupe Mountains and Big Bend National Parks), it also helps to attract new residents and businesses to the Region. Providing sufficient water for recreation and habitat in Far West Texas is critical to long-term economic health.

All living organisms require water. The amount and quality of water required to maintain a viable population, whether it be plant or animal, is highly variable. While some individuals can migrate long distances in search of water (birds, larger mammals, etc.), others are stationary (plants, fishes, etc.) and must rely on existing supplies. In both cases, endemic wildlife to this desert region of Texas has adapted to the harsh climatic conditions.

Because most available water-supply sources in Far West Texas are relatively small in areal extent and are generally separated by great distances, wildlife dependent on isolated sources exist at the mercy of that water supply. The loss of the supply source, even for a short time, may result in the loss or degradation of the resident species.

Quantifying minimum flows at upland water sources that support wildlife and game through the year is difficult in terms of gallons and acre-feet; however, it is an observable fact that wildlife populations flux wildly over the years due to relative abundance or scarcity of rainfall and related spring productivity. It has also been observed that even major springs that historically have never run dry can disappear when local aquifers are pumped beyond sustainable levels. Even minor aquifer depletion can have a profound effect on wildlife habitat and recreational opportunities in affected local areas.

Quantifying environmental and recreational water needs in some cases has been achieved. For the Rio Grande below Presidio, measured at the IBWC gage below Alamito Creek, a flow of 250 cubic feet per second is sufficient to support minimum needs. When flows fall below this point for any length of time, recreational, agricultural, and habitat values are seriously degraded.

Recreation includes those activities that involve human interaction with the outdoors environment. Many of these activities are directly dependent on water resources such as fishing, swimming, and boating; while a healthy environment enhances many others, such as hiking and bird watching. Thus, it is

recognized that the maintenance of the regional environmental community's water supply needs serves to enhance the lives of citizens of Far West Texas as well as the thousands of annual visitors to this Region.

In terms of the regional planning process, discussion of environmental and recreational water needs has been largely considered a rural issue, and generally overlooked because of the perceived priority of other issues. However, every regional resident uses environmental and recreational water, be it for personal lawn and garden, a golf course, a swimming pool, or for canoeing the Rio Grande, hunting deer, or watching birds. In urban areas and small towns, environmental and recreational needs can constitute a third or more of total use during hot months. The FWTWPG recognizes the importance of supplying adequate environmental and recreational water fairly to all users and supports the goal of better quantifying those needs in future planning cycle.

Natural and environmental resources are often overlooked when considering the consequences of prolonged drought conditions. As water supplies diminish during drought periods, the balance between both human and environmental water requirements becomes increasingly competitive. A goal of the *2021 Far West Texas Water Plan* is to provide for the health, safety, and welfare of the human community, with as little detrimental effect to the environment as possible. To accomplish this goal, the evaluation of strategies to meet future water needs includes a distinct consideration of the impact that each implemented strategy might have on the environment.

In Chapter 5, each water management strategy contains an environmental impact assessment. A review of this chapter reveals that while some strategies may contain variable levels of negative impact, other strategies may likely have a positive effect. Negative environmental impacts are generally associated with the lowering of aquifer water levels due to increased groundwater withdrawals and its potential to cause springs to cease flowing. Also, of concern is that lowered water levels could deplete supplies in shallow livestock wells that are often the only available source of water for some wildlife. The positive environmental aspect of the strategies is that during severe drought conditions when normal wildlife water supplies may naturally diminish, new supply sources might be developed such that wildlife could benefit.

# CHAPTER 3

# REGIONAL WATER SUPPLY SOURCES

*This page intentionally left blank.*

# 3 REGIONAL WATER SUPPLY SOURCES

Whether it flows in rivers or percolates through underground rock formations, water sustains life and thus is our most important natural resource. In the Chihuahuan Desert environment of Far West Texas, water supply availability takes on a more significant meaning than elsewhere in the State. With evaporation far exceeding rainfall, planning for the most efficient management of limited water supplies is essential.

Chapter 3 explores the current and future availability of all water supply resources in the Region including surface water, groundwater, and reuse; all of which is contained within the Rio Grande River Basin. The water demand and supply availability analysis developed in Chapters 2 and 3, respectively, form the basis for identifying in Chapter 4 the areas within Far West Texas that potentially could experience supply shortages in future years. Water supply availability from each recognized source is estimated during *drought-of-record* conditions, which allows each entity and water-use category to evaluate conditions when their supply source is at its most critical availability level.

- Except for controlled flows in the Rio Grande, very little surface water can be considered as a reliable source of supply in Far West Texas, especially in drought-of-record conditions. In this chapter, two primary surface water sources are considered, the Rio Grande and the Pecos River. Other ephemeral creeks and springs (cienegas) are recognized as important livestock supply, wildlife habitat, and recreational resources. The availability of water in the Rio Grande and Pecos River (Run-of-River) to meet existing water rights, including municipal water rights, is determined by the TCEQ Rio Grande Water Availability Model (WAM)–Run 3, except for supplies from the Rio Grande Project. All surface water rights are listed in Appendix 3A.
- The availability of groundwater is based on TWDB provided Modeled Available Groundwater (MAG) as developed through the Groundwater Management Area process. For aquifers that MAG volumes have not been assigned, groundwater availability is calculated separately.
- Direct reuse refers to wastewater that is reused without first being discharged into a stream or other watercourse. Direct reuse of water is calculated for El Paso Water based on anticipated build-out of their "purple pipe" project and advanced purified water treatment projects. Indirect reuse refers to wastewater that is first discharged to a stream or watercourse before being diverted for use. The indirect reuse supply is used during the irrigation season.
- No groundwater availability requirements or limitations as might have been promulgated by the El Paso County Commissioner's Court are associated with the El Paso County Priority Groundwater Management Area. El Paso Water continues to assume the role as the designated "Regional Water Supply Planner" (see Chapter 1, Section 1.1.6).
- Water supplies based upon contracts are assumed to be renewed if they expire during the planning horizon.

Water supplies available to meet projected demands are reported in Tables 3-1, 3-2 and 3-3. Table 3-1 indicates the maximum amount of water supply that can be obtained from each unique supply source. Table 3-2 lists water supplies that are available to municipal utilities and other water-user categories, based on current infrastructure, legal limitations, and the physical availability of water from each source determine this availability. Table 3-3 lists supplies available to major/wholesale water providers. The

amounts listed for municipal utilities and the "county other" category (representing small communities and rural households) are based on TCEQ estimates of infrastructure capacities.

**Table 3-1. Water Supply Source Availability (Rio Grande River Basin)**
**(Acre Feet per Year)**

| Groundwater | County | Salinity | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|---|---|
| Bone Spring-Victorio Peak Aquifer | Hudspeth | Fresh/Brackish | 101,400 | 101,400 | 101,400 | 101,400 | 101,400 | 101,400 |
| Capitan Reef Complex Aquifer | Brewster | Fresh/Brackish | 583 | 583 | 583 | 583 | 583 | 583 |
| Capitan Reef Complex Aquifer | Culberson | Fresh/Brackish | 7,580 | 7,580 | 7,580 | 7,580 | 7,580 | 7,580 |
| Capitan Reef Complex Aquifer \| Non-Relevant | Hudspeth | Fresh/Brackish | 8,695 | 8,695 | 8,695 | 8,695 | 8,695 | 8,695 |
| Capitan Reef Complex Aquifer \| Non-Relevant | Jeff Davis | Fresh | 0 | 0 | 0 | 0 | 0 | 0 |
| Edwards-Trinity (Plateau) Aquifer | Brewster | Fresh/Brackish | 1,394 | 1,394 | 1,394 | 1,394 | 1,394 | 1,394 |
| Edwards-Trinity (Plateau) Aquifer \| Non-Relevant | Culberson | Fresh | 399 | 399 | 399 | 399 | 399 | 399 |
| Edwards-Trinity (Plateau), Pecos Valley, Trinity Aquifer | Terrell | Fresh | 1,420 | 1,420 | 1,420 | 1,420 | 1,420 | 1,420 |
| Hueco-Mesilla Bolson Aquifer | El Paso | Fresh/Brackish | 435,000 | 435,000 | 435,000 | 435,000 | 435,000 | 435,000 |
| Hueco-Mesilla Bolson Aquifer | Hudspeth | Fresh/Brackish | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 |
| Igneous Aquifer | Brewster | Fresh | 2,586 | 2,586 | 2,585 | 2,583 | 2,583 | 2,582 |
| Igneous Aquifer | Culberson | Fresh | 99 | 99 | 99 | 99 | 99 | 99 |
| Igneous Aquifer | Jeff Davis | Fresh | 4,584 | 4,584 | 4,584 | 4,584 | 4,584 | 4,584 |
| Igneous Aquifer | Presidio | Fresh | 4,064 | 4,064 | 4,064 | 4,063 | 4,063 | 4,063 |
| Marathon Aquifer | Brewster | Fresh | 7,327 | 7,327 | 7,327 | 7,327 | 7,327 | 7,327 |
| Other Aquifer \| Brewster Cretaceous | Brewster | Fresh | 1,896 | 1,896 | 1,896 | 1,896 | 1,896 | 1,896 |
| Other Aquifer \| Rio Grande Alluvium | El Paso | Brackish | 57,922 | 57,922 | 57,922 | 57,922 | 57,922 | 57,922 |
| Other Aquifer \| Rio Grande Alluvium | Hudspeth | Brackish | 52,478 | 52,478 | 52,478 | 52,478 | 52,478 | 52,478 |
| Other Aquifer \| Diablo Plateau | Hudspeth | Fresh | 26,400 | 26,400 | 26,400 | 26,400 | 26,400 | 26,400 |
| Pecos Valley, Edwards-Trinity (Plateau) Aquifer \| Non-Relevant | Jeff Davis | Fresh | 374 | 374 | 374 | 374 | 374 | 374 |
| Rustler Aquifer \| Non-Relevant | Brewster | Brackish/Saline | 0 | 0 | 0 | 0 | 0 | 0 |
| Rustler Aquifer \| Non-Relevant | Culberson | Brackish/Saline | 53 | 53 | 53 | 53 | 53 | 53 |
| Rustler Aquifer \| Non-Relevant | Jeff Davis | Fresh | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 3-1. (Continued) Water Supply Source Availability (Rio Grande River Basin)**
**(Acre Feet per Year)**

| Groundwater | County | Salinity | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|---|---|
| West Texas Bolsons Aquifer \| Upper Salt Basin | Culberson | Brackish | 16,851 | 16,851 | 16,851 | 16,851 | 16,851 | 16,851 |
| West Texas Bolsons Aquifer \| Wild Horse, Michigan and Lobo | Culberson | Fresh/Brackish | 35,749 | 35,678 | 35,601 | 35,550 | 35,476 | 35,409 |
| West Texas Bolsons Aquifer \| Upper Salt Basin \| Non-Relevant | Hudspeth | Brackish | 429 | 429 | 429 | 429 | 429 | 429 |
| West Texas Bolsons \| Red Light Draw, Eagle Flat, Green River Valley | Hudspeth | Fresh/Brackish | 4,582 | 4,582 | 4,582 | 4,582 | 4,582 | 4,582 |
| West Texas Bolsons Aquifer \| Green River Valley, Wild Horse, Michigan, Lobo, Ryan Flat | Jeff Davis | Fresh | 6,324 | 6,324 | 6,258 | 6,229 | 6,196 | 6,161 |
| West Texas Bolsons \| Green River Valley, Presidio-Redford | Presidio | Fresh/Brackish | 7,743 | 7,743 | 7,743 | 7,743 | 7,743 | 7,743 |
| West Texas Bolsons Aquifer \| Ryan Flat | Presidio | Fresh | 9,112 | 8,982 | 8,834 | 8,710 | 8,571 | 8,436 |
| **Groundwater Total Source Availability** | | | **840,044** | **839,843** | **839,551** | **839,344** | **839,098** | **838,860** |
| **Reuse** | **County** | **Salinity** | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| Direct Reuse | El Paso | Fresh | 13,748 | 15,025 | 16,150 | 17,374 | 18,530 | 19,836 |
| Direct Reuse | Brewster | Fresh | 84 | 84 | 84 | 84 | 84 | 84 |
| Indirect Reuse | El Paso | Fresh | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 |
| Indirect Reuse | Hudspeth | Fresh | 334 | 334 | 334 | 334 | 334 | 334 |
| **Reuse Total Source Availability** | | | **48,335** | **49,612** | **50,737** | **51,961** | **53,117** | **54,423** |
| **Surface Water** | **County** | **Salinity** | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| Rio Grande Run-of-River | Brewster | Fresh | 7,774 | 7,774 | 7,774 | 7,774 | 7,774 | 7,774 |
| Rio Grande Run-of-River | El Paso | Fresh | 46,605 | 46,605 | 46,605 | 46,605 | 46,605 | 46,605 |
| Rio Grande Run-of-River | Hudspeth | Fresh | 725 | 725 | 725 | 725 | 725 | 725 |
| Rio Grande Run-of-River | Presidio | Fresh | 10,218 | 10,218 | 10,218 | 10,218 | 10,218 | 10,218 |
| Rio Grande Run-of-River | Terrell | Fresh | 441 | 441 | 441 | 441 | 441 | 441 |
| **Surface Water Total Source Availability** | | | **65,763** | **65,763** | **65,763** | **65,763** | **65,763** | **65,763** |
| **Region E Total Source Availability** | | | **954,142** | **955,218** | **956,051** | **957,068** | **957,978** | **959,046** |

Note: Largest amount of water that can be withdrawn from a given source without violating the most restrictive physical, regulatory, or policy conditions limiting withdrawals, under drought-of-record conditions. All sources are within the Rio Grande Basin.

**Table 3-2. Water User Group Existing Water Supply (Rio Grande River Basin)**
**(Acre Feet per Year)**

| **Brewster County** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
|---|---|---|---|---|---|---|---|
| Alpine | Igneous \| Brewster County | 1,238 | 1,238 | 1,238 | 1,238 | 1,238 | 1,238 |
| Alpine | Igneous \| Jeff Davis County | 1,234 | 1,234 | 1,234 | 1,234 | 1,234 | 1,234 |
| Alpine | Direct Reuse | 59 | 59 | 59 | 59 | 59 | 59 |
| Lajitas Municipal Services | Other Aquifer \| Brewster Cretaceous | 331 | 331 | 331 | 331 | 331 | 331 |
| Marathon WSSS | Marathon | 242 | 242 | 242 | 242 | 242 | 242 |
| County-Other | Edwards-Trinity (Plateau) | 23 | 23 | 23 | 23 | 23 | 23 |
| County-Other | Igneous | 446 | 446 | 446 | 446 | 446 | 446 |
| County-Other | Other Aquifer \| Brewster Cretaceous | 217 | 217 | 217 | 217 | 217 | 217 |
| Livestock | Capitan Reef Complex | 30 | 30 | 30 | 30 | 30 | 30 |
| Livestock | Edwards-Trinity (Plateau) | 97 | 97 | 97 | 97 | 97 | 97 |
| Livestock | Igneous | 112 | 112 | 112 | 112 | 112 | 112 |
| Livestock | Marathon | 15 | 15 | 15 | 15 | 15 | 15 |
| Livestock | Other Aquifer \| Brewster Cretaceous | 112 | 112 | 112 | 112 | 112 | 112 |
| Irrigation | Igneous | 291 | 291 | 291 | 291 | 291 | 291 |
| Irrigation | Marathon | 309 | 309 | 309 | 309 | 309 | 309 |
| Irrigation | Other Aquifer \| Brewster Cretaceous | 1,236 | 1,236 | 1,236 | 1,236 | 1,236 | 1,236 |
| Irrigation | Rio Grande Run-Of-River | 1,551 | 1,551 | 1,551 | 1,551 | 1,551 | 1,551 |
| **Brewster County Total Existing Supply** | | **7,543** | **7,543** | **7,543** | **7,543** | **7,543** | **7,543** |
| **Culberson County** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| Van Horn | West Texas Bolsons (Wild Horse, Michigan, Lobo) | 1,016 | 1,016 | 1,016 | 1,016 | 1,016 | 1,016 |
| County-Other | Edwards-Trinity (Plateau) | 3 | 3 | 3 | 3 | 3 | 3 |
| County-Other | Rustler | 2 | 2 | 2 | 2 | 2 | 2 |
| County-Other | West Texas Bolsons (Wild Horse, Michigan, Lobo, Upper Salt Basin) | 152 | 152 | 152 | 152 | 152 | 152 |
| Manufacturing | West Texas Bolsons (Wild Horse, Michigan, Lobo) | 6 | 6 | 6 | 6 | 6 | 6 |
| Mining | Capitan Reef Complex | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Mining | Rustler | 0 | 0 | 0 | 0 | 0 | 0 |
| Mining | West Texas Bolsons (Wild Horse, Michigan, Lobo, Upper Salt Basin) | 2,045 | 2,045 | 2,045 | 2,045 | 2,045 | 2,045 |
| Livestock | Capitan Reef Complex | 55 | 55 | 55 | 55 | 55 | 55 |
| Livestock | Edwards-Trinity (Plateau) | 20 | 20 | 20 | 20 | 20 | 20 |
| Livestock | Igneous | 15 | 15 | 15 | 15 | 15 | 15 |
| Livestock | Rustler | 31 | 31 | 31 | 31 | 31 | 31 |
| Livestock | West Texas Bolsons (Wild Horse, Michigan, Lobo, Upper Salt Basin) | 164 | 164 | 164 | 164 | 164 | 164 |
| Irrigation | Capitan Reef Complex | 5,525 | 5,525 | 5,525 | 5,525 | 5,525 | 5,525 |
| Irrigation | West Texas Bolsons (Wild Horse, Michigan, Lobo) | 32,005 | 32,005 | 32,005 | 32,005 | 32,005 | 32,005 |
| **Culberson County Total Existing Supply** | | **43,039** | **43,039** | **43,039** | **43,039** | **43,039** | **43,039** |
| **El Paso County** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| Anthony | Hueco-Mesilla Bolson | 1,532 | 1,532 | 1,532 | 1,532 | 1,532 | 1,532 |
| East Biggs Water System | Hueco-Mesilla Bolson | 1,242 | 1,242 | 1,242 | 1,242 | 1,242 | 1,242 |
| East Montana Water System | Hueco-Mesilla Bolson | 1,241 | 1,241 | 1,241 | 1,241 | 1,241 | 1,241 |
| El Paso County Tornillo WID | Hueco-Mesilla Bolson | 807 | 807 | 807 | 807 | 807 | 807 |

**Table 3-2. (continued) Water User Group Existing Water Supply (Rio Grande River Basin)**
**(Acre Feet per Year)**

| **El Paso County** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
|---|---|---|---|---|---|---|---|
| El Paso County WCID 4 | Hueco-Mesilla Bolson | 1,855 | 1,855 | 1,855 | 1,855 | 1,855 | 1,855 |
| El Paso Water Utilities | Direct Reuse | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| El Paso Water Utilities | Hueco-Mesilla Bolson | 115,000 | 115,000 | 115,000 | 115,000 | 115,000 | 115,000 |
| El Paso Water Utilities | Rio Grande Run-Of-River | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Federal Correctional Institution La Tuna | Hueco-Mesilla Bolson | 2,016 | 2,016 | 2,016 | 2,016 | 2,016 | 2,016 |
| Fort Bliss Water Services | Hueco-Mesilla Bolson | 7,158 | 7,158 | 7,158 | 7,158 | 7,158 | 7,158 |
| Haciendas Del Norte WID | Hueco-Mesilla Bolson | 306 | 306 | 306 | 306 | 306 | 306 |
| Horizon Regional MUD | Hueco-Mesilla Bolson | 3,649 | 3,649 | 3,649 | 3,649 | 3,649 | 3,649 |
| Horizon Regional MUD | Other Aquifer \| Rio Grande Alluvium | 1,578 | 1,578 | 1,578 | 1,578 | 1,578 | 1,578 |
| Lower Valley WD | Hueco-Mesilla Bolson | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 |
| Paseo Del Este MUD 1 | Hueco-Mesilla Bolson | 1,629 | 1,629 | 1,629 | 1,629 | 1,629 | 1,629 |
| County-Other \| Vinton Hills Estates | Hueco-Mesilla Bolson | 120 | 120 | 120 | 120 | 120 | 120 |
| County-Other \| Vinton Hills Subdivision | Hueco-Mesilla Bolson | 280 | 280 | 280 | 280 | 280 | 280 |
| County-Other | Hueco-Mesilla Bolson | 6,278 | 6,278 | 6,278 | 6,278 | 6,278 | 6,278 |
| Manufacturing | Hueco-Mesilla Bolson | 7,297 | 7,297 | 7,297 | 7,297 | 7,297 | 7,297 |
| Mining | Hueco-Mesilla Bolson | 810 | 810 | 810 | 810 | 810 | 810 |
| Mining | Other Aquifer \| Rio Grande Alluvium | 1,347 | 1,347 | 1,347 | 1,347 | 1,347 | 1,347 |
| Steam Electric Power | Hueco-Mesilla Bolson | 3,285 | 3,285 | 3,285 | 3,285 | 3,285 | 3,285 |
| Livestock | Hueco-Mesilla Bolson | 205 | 205 | 205 | 205 | 205 | 205 |
| Livestock | Other Aquifer \| Rio Grande Alluvium | 33 | 33 | 33 | 33 | 33 | 33 |
| Irrigation | Hueco-Mesilla Bolson | 7,392 | 7,392 | 7,392 | 7,392 | 7,392 | 7,392 |
| Irrigation | Other Aquifer \| Rio Grande Alluvium | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 |
| Irrigation | Rio Grande Indirect Reuse | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 |
| Irrigation | Rio Grande Run-Of-River | 36,605 | 36,605 | 36,605 | 36,605 | 36,605 | 36,605 |
| **El Paso County Total Existing Supply** | | **286,190** | **286,190** | **286,190** | **286,190** | **286,190** | **286,190** |
| **Hudspeth County** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| Esperanza Water Service | Hueco-Mesilla Bolson | 484 | 484 | 484 | 484 | 484 | 484 |
| Hudspeth County WCID 1 | West Texas Bolsons (Wild Horse, Michigan, Lobo) | 532 | 532 | 532 | 532 | 532 | 532 |
| County-Other \| Dell City | Bone Spring-Victorio Peak | 63 | 63 | 63 | 63 | 63 | 63 |
| County-Other \| Fort Hancock WCID | Other Aquifer \|Rio Grande Alluvium | 270 | 270 | 270 | 270 | 270 | 270 |
| County-Other | Hueco-Mesilla Bolson | 23 | 23 | 23 | 23 | 23 | 23 |
| Mining | Hueco-Mesilla Bolson | 52 | 52 | 52 | 52 | 52 | 52 |
| Mining | Other Aquifer \|Rio Grande Alluvium | 21 | 21 | 21 | 21 | 21 | 21 |

**Table 3-2. (continued) Water User Group Existing Water Supply (Rio Grande River Basin)**
**(Acre Feet per Year)**

| **Hudspeth County** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
|---|---|---|---|---|---|---|---|
| Mining | West Texas Bolsons (Upper Salt Basin) | 210 | 210 | 210 | 210 | 210 | 210 |
| Livestock | Bone Spring-Victorio Peak | 84 | 84 | 84 | 84 | 84 | 84 |
| Livestock | Capitan Reef Complex | 7 | 7 | 7 | 7 | 7 | 7 |
| Livestock | Hueco-Mesilla Bolson | 11 | 11 | 11 | 11 | 11 | 11 |
| Livestock | Other Aquifer \| Diablo Plateau | 281 | 281 | 281 | 281 | 281 | 281 |
| Livestock | West Texas Bolsons (Red Light Draw, Eagle Flat, Green River Valley) | 77 | 77 | 77 | 77 | 77 | 77 |
| Irrigation | Bone Spring-Victorio Peak | 68,495 | 68,495 | 68,495 | 68,495 | 68,495 | 68,495 |
| Irrigation | Capitan Reef Complex | 4,213 | 4,213 | 4,213 | 4,213 | 4,213 | 4,213 |
| Irrigation | Other Aquifer \| Rio Grande Alluvium | 52,187 | 52,187 | 52,187 | 52,187 | 52,187 | 52,187 |
| Irrigation | Rio Grande Indirect Reuse | 334 | 334 | 334 | 334 | 334 | 334 |
| Irrigation | Rio Grande Run-Of-River | 725 | 725 | 725 | 725 | 725 | 725 |
| **Hudspeth County Total Existing Supply** | | **128,069** | **128,069** | **128,069** | **128,069** | **128,069** | **128,069** |
| **Jeff Davis County** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| Fort Davis WSC | Igneous | 468 | 468 | 468 | 468 | 468 | 468 |
| County-Other \| City of Valentine | West Texas Bolsons (Ryan Flat) | 29 | 29 | 29 | 29 | 29 | 29 |
| County-Other | Igneous | 315 | 315 | 315 | 315 | 315 | 315 |
| County-Other | Pecos Valley \| Edwards-Trinity (Plateau) | 0 | 0 | 0 | 0 | 0 | 0 |
| Mining | Igneous | 153 | 153 | 153 | 153 | 153 | 153 |
| Livestock | Igneous | 299 | 299 | 299 | 299 | 299 | 299 |
| Livestock | Pecos Valley \| Edwards-Trinity (Plateau) | 108 | 108 | 108 | 108 | 108 | 108 |
| Livestock | West Texas Bolsons (Ryan Flat) | 63 | 63 | 63 | 63 | 63 | 63 |
| Irrigation | Igneous | 735 | 735 | 735 | 735 | 735 | 735 |
| Irrigation | Pecos Valley \| Edwards-Trinity (Plateau) | 70 | 70 | 70 | 70 | 70 | 70 |
| Irrigation | West Texas Bolsons (Wild Horse, Michigan, Lobo, Ryan Flat) | 561 | 561 | 561 | 561 | 561 | 561 |
| **Jeff Davis County Total Existing Supply** | | **2,801** | **2,801** | **2,801** | **2,801** | **2,801** | **2,801** |
| **Presidio County** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| Marfa | Igneous Aquifer | 2,097 | 2,097 | 2,097 | 2,097 | 2,097 | 2,097 |
| Presidio | West Texas Bolsons (Presidio Redford) | 3,766 | 3,766 | 3,766 | 3,766 | 3,766 | 3,766 |
| County-Other | Igneous | 289 | 289 | 289 | 289 | 289 | 289 |
| County-Other | West Texas Bolsons (Presidio Redford) | 193 | 193 | 193 | 193 | 193 | 193 |
| Mining | West Texas Bolsons (Presidio Redford) | 403 | 403 | 403 | 403 | 403 | 403 |
| Livestock | Igneous | 224 | 224 | 224 | 224 | 224 | 224 |
| Livestock | West Texas Bolsons (Presidio Redford, Ryan Flat) | 142 | 142 | 142 | 142 | 142 | 142 |
| Irrigation | Igneous | 605 | 605 | 605 | 605 | 605 | 605 |
| Irrigation | Rio Grande Run-Of-River | 6,140 | 6,140 | 6,140 | 6,140 | 6,140 | 6,140 |
| Irrigation | West Texas Bolsons (Presidio Redford, Ryan Flat) | 2,256 | 2,256 | 2,256 | 2,256 | 2,256 | 2,256 |
| **Presidio County Total Existing Supply** | | **16,115** | **16,115** | **16,115** | **16,115** | **16,115** | **16,115** |

**Table 3-2. (continued) Water User Group Existing Water Supply (Rio Grande River Basin)**
**(Acre Feet per Year)**

| Terrell County | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|---|
| Terrell County WCID 1 | Edwards-Trinity (Plateau) \| Pecos Valley \| Trinity | 476 | 476 | 476 | 476 | 476 | 476 |
| County-Other | Edwards-Trinity (Plateau) \| Pecos Valley \| Trinity | 75 | 75 | 75 | 75 | 75 | 75 |
| Mining | Edwards-Trinity (Plateau) \| Pecos Valley \| Trinity | 190 | 190 | 190 | 190 | 190 | 190 |
| Livestock | Edwards-Trinity (Plateau) \| Pecos Valley \| Trinity | 206 | 206 | 206 | 206 | 206 | 206 |
| Irrigation | Edwards-Trinity (Plateau) \| Pecos Valley \| Trinity | 473 | 473 | 473 | 473 | 473 | 473 |
| Irrigation | Rio Grande Run-Of-River | 441 | 441 | 441 | 441 | 441 | 441 |
| **Terrell County Total Existing Supply** | | **1,861** | **1,861** | **1,861** | **1,861** | **1,861** | **1,861** |
| **Region E Existing Water Supply** | | **485,618** | **485,618** | **485,618** | **485,618** | **485,618** | **485,618** |

Note: Water Supply capacity based on current infrastructure, existing contracts, and source supply availability under drought-of-record conditions.
All WUGs and supplies are within the Rio Grande Basin

.

**Table 3-3. Far West Texas Major Water Provider Supplies (Rio Grande River Basin)**
**(Acre-Feet per Year)**

| Wholesale Water Provider | Source Supply | Water Demand (Acre-Feet/Year) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| El Paso County WID#1 | Rio Grande Indirect Reuse | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 | 34,169 |
| | Rio Grande Alluvium Aquifer | 54,834 | 54,834 | 54,834 | 54,834 | 54,834 | 54,834 |
| | Rio Grande Run-Of-River | 36,605 | 36,605 | 36,605 | 36,605 | 36,605 | 36,605 |
| | Hueco-Mesilla Bolson Aquifer | 7,392 | 7,392 | 7,392 | 7,392 | 7,392 | 7,392 |
| | **Total Supply** | **133,000** | **133,000** | **133,000** | **133,000** | **133,000** | **133,000** |
| El Paso Water | Direct Reuse | 13,748 | 15,025 | 16,150 | 17,374 | 18,530 | 19,836 |
| | Hueco-Mesilla Bolson Aquifer | 123,866 | 123,866 | 123,866 | 123,866 | 123,866 | 123,866 |
| | Rio Grande Run-Of-River | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| | **Total Supply** | **147,614** | **148,891** | **150,016** | **151,240** | **152,396** | **153,702** |
| Lower Valley Water District | Hueco-Mesilla Bolson Aquifer | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 |
| | **Total Supply** | **4,356** | **4,356** | **4,356** | **4,356** | **4,356** | **4,356** |
| Horizon Regional MUD | Hueco-Mesilla Bolson Aquifer | 3,649 | 3,649 | 3,649 | 3,649 | 3,649 | 3,649 |
| | Rio Grande Alluvium Aquifer | 1,578 | 1,578 | 1,578 | 1,578 | 1,578 | 1,578 |
| | **Total Supply** | **5,227** | **5,227** | **5,227** | **5,227** | **5,227** | **5,227** |

## 3.1 SURFACE WATER

Surface water supplies in the Far West Texas Region (Region E) are obtained from the Rio Grande River and Pecos River, a tributary of the Rio Grande. During drought-of-record conditions, there is very little reliable surface water in Region E, except for controlled releases in the Rio Grande.

In accordance with regional planning rules and guidelines, the Far West Texas Region used the Full Authorization Run (Run 3) of the TCEQ-approved water availability model (WAM) of the Rio Grande Basin for determining surface water availability in the region. The exception is water from the Rio Grande Project, which is located in New Mexico and is discussed below. The WAM is a computer model of the Rio Grande watershed that evaluates surface water availability based on Texas water rights. It is maintained by the TCEQ for the purpose of reviewing and granting new surface water right permits and required by TWDB to evaluate surface water availability for regional water planning purposes. The amount of water that can actually be diverted by a water right is referred to as the water availability and may be less than the permitted amount.

The prior appropriation doctrine governs surface water law in Texas and can be summarized as "first in time is first in right." Each water right in the WAM is assigned a priority date that determines the order in which water is allocated among water rights in the Rio Grande Basin. In times when there are shortages, water rights with older priority dates are given preference when allocating water. The oldest water rights in the Rio Grande WAM date to the 1700s and correspond to the date when water was first put to beneficial use by people besides the native Pueblo Indians.

In contrast to other regions, the available surface water supplies in Far West Texas consist almost entirely of run-of-river supplies with the exception of small impoundments for domestic and livestock purposes and water provided through the Rio Grande Project. A run-of-river right is authorized to divert from a stream but does not have authorization for storage. According to Texas law, water users with small impoundments up to 200 acre-feet for domestic and livestock purposes do not require a water right. The Bureau of Reclamation's Rio Grande Project includes releases from Elephant Butte and Caballo Reservoirs as well as run-of-river flows entering Texas from New Mexico.

As intended by Senate Bill 1, the assessment of surface water availability in the Far West Texas Region was conducted to reflect water supplies that are currently available for use. The available supply from a run-of-river water right is calculated as the minimum annual diversion during the period-of-record (1940-2000) as simulated in the WAM. The assessment includes updates to new water right permits, current operating policies and contractual agreements. The following changes were made to the WAM to more accurately reflect the current conditions and operations of the region and are consistent with the assumptions used in previous Far West Texas water plans, except where noted.

- The supply from the Rio Grande Project is not based on the WAM but on the lowest annual historical allotment delivered to the entities served by the Project, which occurred in 2013. The period-of-record for the WAM only extends to year 2000 and so does not cover the most recent drought. The supply from the Project does not include return flows, which were evaluated separately. Entities served by the Rio Grande Project include El Paso Water, El Paso County Water Improvement District #1, and irrigators in Hudspeth County.
- The demand pattern for irrigation rights above Fort Quitman was modified so that diversions only occur from March through October to be consistent with actual operation of the Rio Grande Project.
- The TCEQ Rio Grande WAM was updated to reflect adjudicated water rights above Fort Quitman. Cancelled or abandoned claims and permits were removed from the WAM. No new water rights were added to the WAM.

- Modeling proposed by Region F in the Balmorhea area of the Pecos Basin was incorporated into the modified WAM. These changes are related to San Solomon Springs and Giffin Springs flows, which in the unmodified TCEQ WAM were being passed downstream instead of being used by the water rights dependent on those springs. In reality, these flows would be lost before they reached the Pecos River, resulting in what is termed a futile call. This change had not been included in previous water plans for the Far West Texas Region.

These modifications were approved by the Executive Administrator (EA) of the Texas Water Development Board in a letter to the Chairman of the Far West Texas Water Planning Group, dated April 18, 2018. The results of the modified WAM combined with the assumptions for availability from the Rio Grande Project indicate that the surface water supply in Far West Texas totals 65,763 acre-feet per year throughout the planning period (2020 to 2070) (Table 3-1). Of that, the Rio Grande Project supplies 47,043 acre-feet per year (i.e. the minimum allotment in 2013) to water users in El Paso and Hudspeth Counties. The apportionment of Rio Grande Run-of-River is explained below in Table 3-4.

**Table 3-4. Surface Water Source Availability Methodology**

| Water Supply Source | County | Annual Availability (Acre-Feet/Year) | Remarks |
|---|---|---|---|
| Rio Grande Run-of-River | Brewster | 7,774 | WAM3 with no return flows |
| | El Paso | 46,605 | U.S. Bureau of Reclamation reported minimum annual diversion of Project water occurred in 2013. Total amount from Rio Grande Project (47,043) was apportioned to irrigators in El Paso County and Hudspeth County based on percentages in WAM. This results in 46,605 for El Paso and 438 for Hudspeth. |
| | Hudspeth | 725 | Hudspeth County irrigators get 438 from Rio Grande Project water based on 2013 availability. |
| | | | Hudspeth County irrigators also get 287 (WAM) below Fort Quitman that are not included in the Rio Grande Project totals. |
| | Presidio | 10,218 | WAM3 |
| | Terrell | 441 | WAM3; Lower Rio Grande = 152 & Pecos River = 289. Total = 441 |

### 3.1.1 Rio Grande

Waters of the Rio Grande (Mexico's Rio Bravo) originate in the San Luis Valley, the principal drainage basin of the San Juan Mountains in southwestern Colorado, and in the mountain ranges of northern New Mexico. The river flows southward through New Mexico, and then forms the international boundary between the Mexican States of Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, and the State of Texas. The Rio Grande's total length is approximately 1,896 miles, with approximately 1,248 making the international boundary between Texas and Mexico. Figure 3-1 illustrates the drainage basins of the Rio Grande within the Far West Texas Region.

The water supply available from the Upper Rio Grande is affected by climatic conditions in Colorado and northern New Mexico. Although dams have been built on the River in New Mexico to provide a degree of control, floods and droughts still take their toll in the region. Most of the Rio Grande's flow above Fort Quitman is diverted at the Mesilla Dam in New Mexico to support irrigation in Dona Ana County, New Mexico and at the American Dam in Texas to supply irrigation and municipal demands in Texas. Water is also diverted at the International Dam for delivery through the Acequia Madre to supply irrigation demand in Mexico as stipulated by Treaty. Downstream from El Paso, most of the flow in the River consists of irrigation return flow, and both treated and untreated municipal wastewater discharge from both sides of the border.

The flow from Fort Quitman to Presidio is often intermittent and is commonly referred to as the "Forgotten River". The River becomes a permanent stream again at the junction where the Mexican river, the Rio Conchos, enters the Rio Grande upstream of Presidio. From Presidio downstream through the Big Bend until it reaches the Amistad Reservoir, the Rio Grande often lacks sufficient flow to adequately support minimum recreational, environmental, or agricultural needs; and during dry periods, may fall significantly short of supplying such needs.

Under drought conditions in the upper catchment basin, flows in the Rio Grande are significantly reduced and are allotted by the United States Bureau of Reclamation (USBR) in accordance with a prearranged schedule. Low releases and diversions significantly affect downstream water users who are highly dependent on a steady source of river water. In addition, such low diversions result in a degradation of the River's water and environmental quality.

**American Heritage River Initiative** – The Rio Grande, from El Paso to Laredo, is one of only 14 rivers in the United States, and the only river in Texas, to receive the American Heritage River designation. Established in 1997, the American Heritage River Initiative recognizes rivers, or segments of rivers, that have played a significant role in the history and culture of the region it traverses. The Initiative gives federal support to voluntary community-led work that benefits riverfront communities. Some of the possible benefits of being designated an American Heritage River are increased opportunities in commerce and trade, recreational improvements along the River, incorporation of wildlife habitats, and cultural stimulation. The American Heritage River Initiative does not conflict with matters of state and local government jurisdiction, such as water rights, land-use planning and water-quality standards. Also, the initiative does not impair the authority of each state to allocate quantities of water within its jurisdiction.

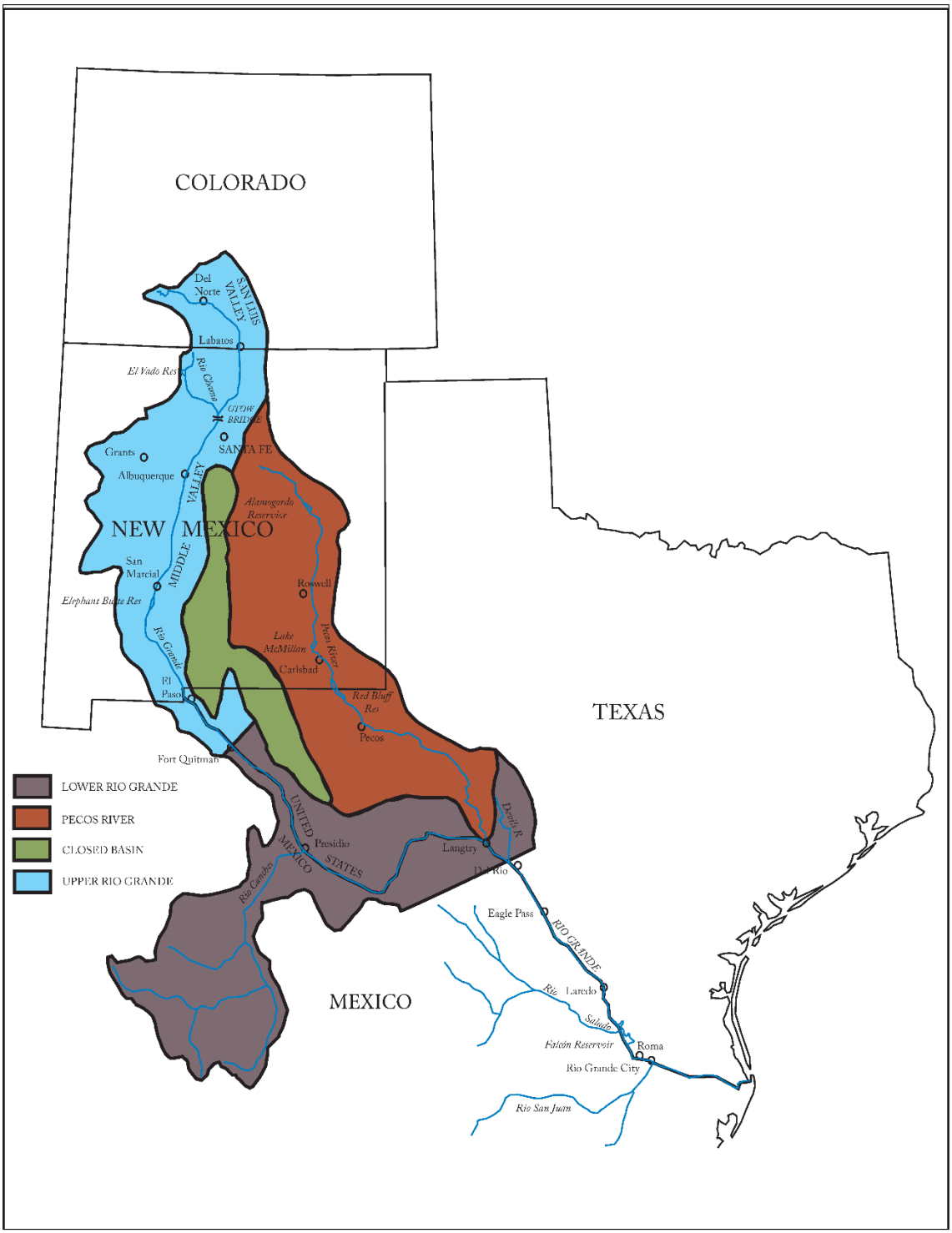



**Figure 3-1. Rio Grande Drainage Basins Above Amistad Reservoir**
**(USGS Professional Paper 372-D)**

**Rio Grande Wild and Scenic River –** In 1978, Congress designated a 196-mile reach of the Rio Grande, from the Coahuila-Chihuahua State line, near Mariscal Canyon, to the Terrell-Val Verde County line, a "Wild and Scenic River". Approximately 69 miles of the designated river stretch is within Big Bend National Park. This segment of the River is recommended by the Far West Texas Water Planning Group (FWTWPG) as an "Ecologically Unique River Segment" and is discussed in further detail in Chapter 8.

#### 3.1.1.1 Rio Grande Treaties and Compact

Water demand related to irrigation use and population growth has impacted the Rio Grande since the 1800s. Water appropriations and shortages have spawned lawsuits, as well as the involvement of the federal government in the management of the River. The following sections describe efforts by state and national governments to address many of the complex management issues associated with the Rio Grande.

**1906 International Treaty** – Under the 1906 International Treaty, the United States is obligated to deliver 60,000 acre-feet of water annually from the Rio Grande to Mexico, except in case of extraordinary drought or serious accident to the irrigation system in the United States. The 60,000 acre-feet must be delivered, at no cost to Mexico and in accordance with a monthly distribution schedule from February through November, in the bed of the Rio Grande at the headworks of the Acequia Madre (International Dam). The International Boundary and Water Commission (IBWC)/Comisión International de Límites y Aguas (CILA) is the designated binational agency that makes the yearly delivery of international waters to Mexico. The U.S. Bureau of Reclamation (USBR) calculates the allocations in coordination with the IBWC.

**Rio Grande Compact** – The Rio Grande Compact signed in 1938 is a tri-state agreement, approved by the U.S. Congress and ratified by the states of Colorado, New Mexico and Texas. The Rio Grande Compact Commission, which administers the Compact, is comprised of a Commissioner from each of the states and a nonvoting chairman appointed by the President of the United States. The Compact encompasses the waters of the Rio Grande from the southern Colorado headwaters to above Fort Quitman, Texas and equitably apportions them between the three states. It sets out a schedule of the water-delivery obligation of Colorado at the Colorado/New Mexico state line and the obligation of New Mexico to deliver water to Texas via Rio Grande Project reservoirs at Elephant Butte and Caballo. Releases from the reservoirs are measured downstream of Caballo Reservoir.

**1944 International Treaty** – The 1944 International Treaty addresses the waters in the international segment of the Rio Grande from Fort Quitman, Texas to the Gulf of Mexico. The Treaty allocates water in the River based on percentage of flows in the River from each country's tributaries to the Rio Grande. The 1944 Treaty also stipulates that one-third of the flow of the Rio Conchos in Mexico is allotted to the United States. The Rio Conchos is by far the largest tributary of the Rio Grande. The treaty requires that the combined flow of the Rio Conchos and five other tributaries (San Diego, San Rodrigo, Escondido, Salado Rivers and Las Vacas Arroyo) shall have an annual average of not less than 350,000 acre-feet. The IBWC/CILA is responsible for implementing the treaties between the United States and Mexico. In previous years, the required minimum flow was not met.

#### 3.1.1.2 Rio Grande Project and the El Paso County Water Improvement District #1

The Rio Grande Project is an irrigation storage and flood control federal reclamation project administered by the USBR. Elephant Butte and Caballo Reservoirs in southern New Mexico and the diversion dams at the headings of the main canals make up the Project's primary facilities. Built in 1915 and fed by the Rio Grande, Elephant Butte is the largest reservoir in New Mexico and provides water for approximately 90,000 acres of farmland. In the summer of 2013, Elephant Butte Reservoir dwindled to its lowest level in 40 years, and thus represents a drought of record in terms of irrigation-use impact.

The Project delivers water to the Elephant Butte Irrigation District (EBID) and the El Paso County Water Improvement District No. 1 (EPCWID#1). The EBID encompasses all the project lands in New Mexico south of the Caballo Reservoir and delivers water to farmlands in New Mexico. The Project also delivers water to Mexico in accordance with the Treaty of 1906. In 1979 and 1980, the two Irrigation Districts took over the operation and maintenance responsibilities of most of the respective irrigation works within the boundaries of each entity. Legal titles to the rights-of-way of irrigation canals and drains were transferred from the United States to the Districts in January 1996.

**El Paso County Water Improvement District No. 1** – In Texas, the Rio Grande Project provides water for 69,010 acres of water-right lands, all of which are located within the boundaries of the EPCWID #1. The District contains 156 square miles, with over 350 miles of canals and laterals in the distribution system, and over 269 miles in the drainage system. Water is delivered through canals and laterals to more than 2,205 turnouts, irrigating crops of cotton, alfalfa, pecans, chilies, wheat, milo, vegetables, pastures and family gardens. Since 1941, EPCWID#1 has delivered water to the City of El Paso (El Paso Water) for municipal and industrial use through contracts among the District, the City and the USBR. The City of El Paso also owns farmland with first class water rights, which it uses for municipal purposes.

**Project Water Allocation** – Deliveries of Rio Grande Project water is based on irrigation requirements authorized for the Project and are agreed on by the two Irrigation Districts and the USBR. The annual allotment of Rio Grande Project water downstream of the Caballo Reservoir is determined by the USBR based on the amount of usable water in storage. Through data obtained from the measurement of snow pack and river gauging stations along the upper reaches of the Rio Grande, the USBR determines the projected inflow to Elephant Butte Reservoir. The USBR measures storage available in the Elephant Butte and Caballo Reservoirs and determines the volumes available for allocation.

Total releases from Project storage during a full-allotment year average approximately 764,000 acre-feet. Total diversions, however, average approximately 932,000 acre-feet per year. Total average diversions exceed average total releases by 168,000 acre-feet. The difference between the two is attributable to irrigation and municipal return flows, operation spills from upstream users, and rainfall runoff. Total diversion allocations are 495,000 acre-feet to EBID, 376,000 acre-feet to EPCWID#1, and 60,000 acre-feet to Mexico during years of full supply allocation.

Currently, the City of El Paso's (El Paso Water) right to use water from the Project arises from its ownership of 2,000 acres of land with rights to use water, approximately 5,542 acres of 50- and 75-year term City of El Paso Irrigation Water Assignments (Leases) for rights to use water from urbanized land parcels, and approximately 3,088 acres of Lower Valley Water District (LVWD) leases. The rights to use water from the LVWD leases are transferred to El Paso Water (EPW) on an annual basis in exchange for a wholesale supply of water from the city utility. EPW receives an annual allocation for water leased and land ownership categories based on the yearly allocation and the provisions of the respective 1941, 1962,

1989, and 2001 contracts. During a full allocation year, EPW has rights to divert 65,000 acre-feet of Rio Grande Project water from all contract sources. The conversion of rights to use water from agricultural to municipal and industrial use must be contracted with the EPCWID#1 and the USBR. EPW has also finalized an agreement with EPCWID#1 to acquire additional raw water based on EPCWID#1's operation of new shallow wells intended for drought relief. The 2001 Third Party Implementing Contract with EPCWID#1 converts to municipal and industrial use Project water saved from canal lining, operational efficiencies, and other miscellaneous water sources. EPW has also negotiated and agreed in principal on the terms of a Third Party Implementing Contract that would allow it to contract for the conversion of rights to use water directly from farmers through the use of short-term "Forbearance Contracts."

In recent decades, the amount of water released from Caballo Reservoir for the Rio Grande Project has been trending downward (Figure 3-2). The year with the least amount of flow below Caballo Dam was 2013, which was used to determine surface water availability from the Rio Grande Project for water users in Far West Texas. Releases from Caballo Reservoir are used to meet the needs of water users in New Mexico, Texas and Mexico, and so are higher than the amounts shown in Table 3-1. The flows have increased since 2013. For the purposes of regional water planning, the 2013 availability can be thought of as the new drought-of-record for the Rio Grande Project.

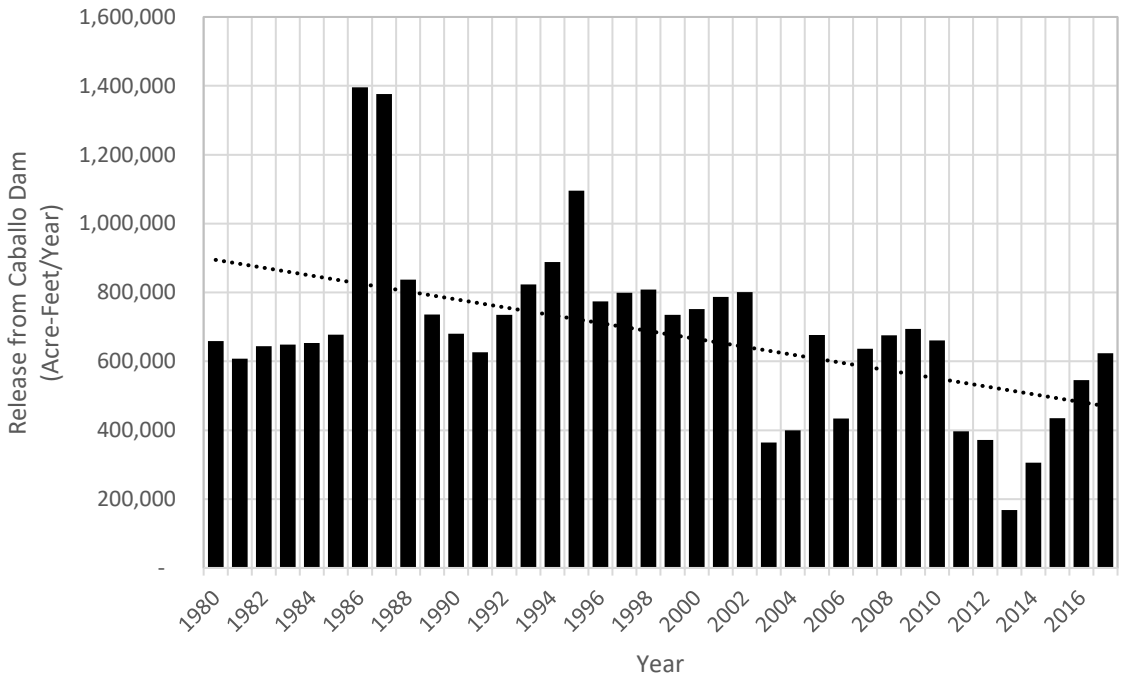



**Figure 3-2. Annual Releases from Caballo Dam**
(Data from 1980 to 2013 is from USGS Gage 08362500 Rio Grande Below Caballo Dam, NM. Data from 2014 to 2017 is from the USBR Water Information System)

The Rio Grande Water Availability Model (WAM) has a period of record from 1940 to 2000 and does not include the recent drought. In 2013, the USBR released 47,043 acre-feet of water for EPCWID#1 as part of the Rio Grande Project, which was lower than the amount indicated by the WAM. For this reason, the

2013 release was used as the available supply from the Project. Table 3-5 summarizes the allocation of water from the Rio Grande Project for water users in Far West Texas.

EPCWID#1 allocates the Rio Grande Project water to users in El Paso County and irrigators in Hudspeth County upstream of Fort Quitman. According to the WAM, users in El Paso County receive 99.068% of the Rio Grande Project water (46,605 acre-feet per year in 2013) and users in Hudspeth County upstream of Fort Quitman receive 0.931% of the allocation (438 acre-feet per year in 2013). Users in Hudspeth County downstream of Fort Quitman also receive water from the Rio Grande River, but not as part of the Rio Grande Project. This amount is 287 acre-feet per year according to the WAM, for a total of 725 acre-feet per year from the Rio Grande River for Hudspeth County (Table 3-1). In El Paso County, Rio Grande Project water is used by EPW and EPCWID#1. 10,000 acre-feet per year of the Rio Grande Project water reserved for El Paso County is allocated to EPW. The remaining 36,605 acre-feet per year stays with EPWID#1 for irrigation in El Paso County (Table 3-2 and Table 3-3).

**Table 3-5. Supplies from Rio Grande Project**
**(Acre Feet per Year)**

| Water User Group | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| El Paso Water | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| El Paso County Irrigation | 36,605 | 36,605 | 36,605 | 36,605 | 36,605 | 36,605 |
| Hudspeth County Irrigation[1] | 438 | 438 | 438 | 438 | 438 | 438 |
| **Total** | **47,043** | **47,043** | **47,043** | **47,043** | **47,043** | **47,043** |

[1.] Hudspeth County Irrigation also receives 287 acre-feet per year from water rights below Fort Quitman, which are not part of the Rio Grande Project.

#### 3.1.1.3 Hudspeth County Conservation and Reclamation District No. 1

The HCCRD #1, headquartered in Fort Hancock, was created in 1924 to provide irrigation waters to 18,300 acres of Rio Grande bottomlands that are located downstream of the El Paso-Hudspeth County line to Fort Quitman. The District operates under a Warren Act contract and diverts tailwater, returns, and excess flows from the Rio Grande Project. Water reuse and recycling are its primary operations; the District does not provide potable water.

Water sources include untreated water from permitted Rio Grande diversions, drainage waters, return flows from farming operations, operational waste associated with the USBR's Rio Grande Project, and return flows from El Paso water and wastewater treatment plants. The supply to the District is completely dependent on the EPCWID #1 annual operations, and therefore can be unpredictable. When flows are erratic, the District utilizes drought contingency planning. If a mild to moderate shortage is predicted, users are notified of the expected shortage. For severe shortages, when supply is less than half of demand, agricultural producers are asked to prioritize water requests based upon crop needs.

#### 3.1.1.4 Rio Grande Watermaster

Rio Grande water below Ft. Quitman is stored in two reservoirs located in the middle (Amistad) and lower (Falcon) segments of the River. A binational commission determines the allocation of these international waters between Mexico and the U.S. (Texas). The TCEQ Rio Grande Watermaster administers Texas' share of the international water in the Lower Rio Grande and its Texas tributaries, excluding the drainage basins of the Pecos and Devils Rivers.

#### 3.1.1.5 Rio Grande Water Quality

The quality of water in the segment of the Rio Grande that flows through Far West Texas varies significantly from specific locations and season of the year. Of prime consideration is that there is little natural flow in the River. The TNRCC's (predecessor name of TCEQ) inventory of water quality in the state (TNRCC, 1996) cites drainage area and a wide range of geologic and climatic conditions in Far West Texas as factors responsible for water-quality conditions in the Rio Grande. Heavy metals and pesticides have been identified along the course of the Rio Grande. Elevated fecal coliform and nutrient levels occur in the River downstream of border cities, primarily because of untreated wastewater from Mexico. Additional discussion on Rio Grande water quality is provided in Chapter 1, Section 1.8.

#### 3.1.1.6 Long-Term Reliability of the Rio Grande

The long-term reliability of Rio Grande water is sporadic. Aside from the legal mechanisms governing allocation of the water from Elephant Butte Reservoir and the allocation of water between the two nations of Mexico and the United States, the meteorologic and hydrologic reality is that the West Texas segment of the Rio Grande has its headwaters in a climatic region totally apart from the climatic regime of Far West Texas. If a drought occurs in Colorado, the El Paso area is essentially thrown into a drought-like scenario. As the science of drought prediction matures, it could become a useful source of information for modeling the long-term availability of water in the Rio Grande headwaters.

#### 3.1.1.7 Rio Grande Channelization

In 1933, the United States and Mexico signed a Convention entitled, "Rectification of the Rio Grande", in which the two countries agreed to provide flood protection to urban, suburban and agricultural lands and stabilize the international boundary line. Construction work authorized by this Convention addressed channel aggrading due to the flat gradient and low velocities of the Rio Grande and the new channels that tended to form on lower ground during flood flows. The rectified channel between its upper end at Cordova Island, near El Paso, to its lower end reduced the original river channel length from 155.2 miles to 85.6 miles and increased the gradient from about two feet per mile to 3.2 feet per mile. The Rectification Project also included the construction of three toll-free bridges. Construction commenced in March 1934 and was completed in 1938. In June of 1987, the Riverside Dam failed. The EPCWID#1 constructed a temporary rock cofferdam immediately downstream of Riverside Dam as a temporary means of diverting irrigation water through Riverside Heading, with the stipulation that the temporary dam would be removed once the American Canal Extension, scheduled for completion in February 1999, was constructed.

The other important joint project with Mexico, the Rio Grande Boundary Preservation Project, carries out the provisions of Article IV of the 1970 "Treaty to Resolve Pending Boundary Differences and Maintain the Rio Grande and Colorado River as the International Boundary". The project covers the Rio Grande's 194-mile reach between Fort Quitman and Haciendita, Texas and addresses sedimentation as well as the

phenomenon of salt cedars choking the channel. In some places the channel is nearly obliterated, and lands on both sides of the river are subject to periodic flooding from flash floods of tributary arroyos. The final Environmental Impact Statement for the Boundary Preservation Project was completed in 1978. In the United States, the Boundary Preservation Project was constructed in reaches based on contracts issued and inspected by the IBWC's United States Section.

Construction was completed for Reach I but was interrupted for other reaches by an extended period of flooding in 1981. Subsequent work done by IBWC's United States Section was tied to the Mexican Section's schedule; February of 1986 marked the end of U.S. Section construction work anywhere within the Boundary Preservation Project.

Funding to continue maintenance of the completed channel work has not been received since 1985; consequently, sediment plugs on the large tributary arroyos and high flows in the river have caused overtopping of the banks with the result that the channel has deviated from its original alignment. It is this deviation from channel alignment that concerns IBWC and which is properly termed "re-channelization". IBWC's perspective is that re-channelization of the Rio Grande is a treaty requirement, and that re-channelization offers some water salvage potential when combined with removal of salt cedar.

#### 3.1.1.8 Forgotten River Reach of the Rio Grande

Reduced flows below Fort Quitman have resulted in a long stretch of the Rio Grande (locally known as the "Forgotten River") with no defined channel and riparian vegetation that has become a tamarisk thicket. The Rio Grande within this reach follows a sinuous channel for almost 200 river miles from about 13 miles downstream of Fort Quitman to about 6 miles upstream of Presidio. The high flows and periodic floods necessary to maintain the river channels have been reduced significantly over the past several decades.

In 2004, the TCEQ voiced concerns related to floodplain and riverine function, environmental resources, water quality, agriculture, and watershed hydrology. At the request of TCEQ, the Albuquerque Division of the US Army Corps of Engineers conducted a reconnaissance level investigation of the Forgotten River, which culminated in recommendations that the "Forgotten River Reach" study proceed into the feasibility phase to develop comprehensive watershed management recommendations. In response, several studies have been conducted that examine environmental resources, water supply, groundwater recharge, flooding and erosion, geology, cultural resources, and history. The latest feasibility study by the US Army Corps of Engineers, published in August 2007, provides recommendations pertaining to a needed systematic watershed approach to understanding the dynamics of the river environment. The study also presents an opportunity for local, state, and federal agencies to work together in developing solutions to managing the varied resources of the Forgotten River Reach.

#### 3.1.1.9 Rio Grande Interstate Litigation

The Rio Grande is an interstate and international river that originates in Colorado, flows in a southerly direction into and through New Mexico and into Texas, where the River is a significant water resource in Far West Texas with far reaching economic and social ties to the Region. To ensure an equitable divide and apportionment of Rio Grande water, Colorado, New Mexico and Texas signed the Rio Grande Compact in 1938, which a year later was approved by the United States pursuant to an Act of Congress.

In 2013, the State of Texas brought a complaint against the State of New Mexico and the State of Colorado in the Supreme Court of the United States contesting that:

> *New Mexico has, contrary to the purpose and intent of the Rio Grande Compact, allowed and authorized Rio Grande Project water intended for use in Texas to be intercepted and used in New Mexico. New Mexico's actions, in allowing and authorizing the interception of Rio Grande Project water intended for use in Texas, violates the purpose and intent of the Rio Grande Compact, causing grave and irreparable injury to Texas.*
> *New Mexico, through the actions of its officers, agents and political subdivisions, has increasingly allowed the diversion of surface water, and has allowed and authorized the extraction of water from beneath the ground, downstream of Elephant Butte Dam, by individuals or entities within New Mexico for use within New Mexico. The excess diversion of Rio Grande surface water and the hydrologically connected underground water downstream of Elephant Butte Reservoir adversely affects the delivery of water that is intended for use within the Rio Grande Project in Texas*.

The Far West Texas Water Planning Group recognizes the potential impact of diminished water-supply availability from the Rio Grande from this interstate issue and encourages the State of Texas to continue its pursuit of rectifying the problem through whatever action is deemed most appropriate.

### 3.1.2 Pecos River

Originating in the Sangre de Cristo Mountains of northern New Mexico, the Pecos River flows 926 miles south into Texas, and discharges into the channel of the Rio Grande near the upper reaches of Amistad Reservoir. The Pecos is the largest Texas river basin that flows into the Rio Grande (Figure 3-1), contributing an average of 9.5 percent of the average annual streamflow into the Rio Grande. The River forms the easternmost border of the Far West Texas planning region along the northeast corner of Terrell County.

Pecos River flow is controlled by releases from Red Bluff Reservoir near the Texas–New Mexico state line, where storage in the reservoir is affected by the required delivery of water from New Mexico (see Section 3.1.2.1 below). Water released from Red Bluff is high in salt content and is used by downstream irrigators growing salt-tolerant crops. The Pecos contributes more than 26 percent of the annual salt load into Amistad Reservoir. Independence Creek in northern Terrell County is the principal contributor (42 percent) to Pecos flow in Texas and its fresh quality reduces the salt load in the River by 50 percent (see Section 3.1.2.3 below).

#### 3.1.2.1 Pecos River Compact

Signed by Texas and New Mexico in 1948 and approved by Congress the following year, the Pecos River Compact provides for a Commission to administer the apportionment and diversion of Pecos River waters. The Compact repeatedly refers to the "1947 Condition," which is a Pecos River Basin situation defined in the Compact Commission's Report of the Engineering Advisory Committee. The terms of the Pecos River Compact can be summarized by the following four points:

- New Mexico cannot decrease the Pecos flow at the New Mexico/Texas border to a point less than that of the 1947 condition. (When determining the quantity of Texas water for the 1947 condition, waters of the Delaware River are apportioned to Texas.)
- Of the beneficial consumptive use of water salvaged in New Mexico on the River, Texas shall receive 43 percent and New Mexico 57 percent.

- Any water salvaged by beneficial use, but which is not beneficially consumed, shall be apportioned to New Mexico. Any water salvaged in Texas shall go to Texas.
- Beneficial consumptive use of unappropriated floodwaters shall go equally to Texas and to New Mexico.

The Pecos River Compact allows Texas and New Mexico to build additional reservoir capacity to replace unusable reservoir capacity, for the utilization of salvaged water and unappropriated floodwaters as apportioned by the Compact and for making more efficient use of water. Each state shall work with agencies to solve the salinity problem in the Pecos, and each may construct and operate facilities to prevent flood damage.

Texas and New Mexico were involved in a lawsuit over New Mexico's obligation to deliver water to Texas was decided and ordered by the U.S. Supreme Court in 1988 (485 U.S. 388). The decree requires New Mexico to abide by the terms of the Pecos River Compact, and resulted in the appointment of a Pecos River Master.

#### 3.1.2.2 Water Allocation and Water Rights

Pecos water delivered to Texas is stored in Red Bluff Reservoir and is allocated by a master irrigation control district to seven other irrigation districts downstream; each district then apportions the waters to individual farmers. The irrigation districts are in Loving, Ward, Reeves and Pecos Counties, which lie in Far West Texas' neighboring Region F.

Within the reach of the Pecos that borders Far West Texas, the TCEQ water-rights master file lists five water rights on unnamed tributaries of the Pecos River (Certificates of Adjudication 5462 through 5466). These water-rights holders, located in Terrell County, are authorized to divert 873.25 acre-feet of water per year for irrigation purposes (Appendix 3A).

#### 3.1.2.3 Significant Pecos River Basin Tributaries

**Phantom Creek** – Phantom Creek originates from groundwater discharging at Phantom Spring in Jeff Davis County. The Creek flows northeastward into Reeves County, where it gains additional flow from San Solomon, Giffin, Saragosa, East Sandia and West Sandia Springs. Surface flow in the Creek, however, does not reach the Pecos River, but rather infiltrates into the farm land south of the town of Pecos. Phantom Creek is a source of water for irrigation in southern Reeves County. The U.S. Bureau of Reclamation manages the spring property and holds two water rights for the annual diversion of as much as 18,900 acre-feet of water for irrigation, however, this volume is rarely available.

A study performed by the TWDB in 2003 reports that flow in Phantom Spring has experienced significant decline over the past several drought years, declining from more than 10 cubic feet per second (cfs) during the 1930s to less than 1cfs during the recent drought period. Recently Phantom Spring has ceased flowing on several occasions and a pump has been installed into the spring pool to support species residing at the spring outfall.

**Independence Creek** – Independence Creek, a large spring-fed creek in northern Terrell County, is the most important of the few remaining freshwater tributaries to the lower Pecos River. Caroline Spring flows at a rate of 3,000 to 5,000 gpm and comprises about 25 percent of the Creek's flow. Independence Creek's contribution increases the Pecos River water volume by 42 percent at the confluence and reduces

the total suspended solids by 50 percent, thus improving both water quantity and quality (Nature Conservancy of Texas descriptive flier).

Independence Creek hosts a variety of bird and fish species, some of which are extremely rare. For the Proserpine shiner, Rio Grande darter, headwater catfish, and several other native fishes, Independence Creek is an important refuge during stressful Pecos River conditions. Following periods of low-water quality and occasional algae blooms on the Pecos River, fish populations in the clear waters of the Creek help to repopulate the River after a fish kill. The Nature Conservancy of Texas manages a significant portion of Independence Creek, including Caroline Spring, as a natural preserve. The reach of Independence Creek managed by the Nature Conservancy is recommended as an Ecologically Unique Stream Segment by the Far West Texas Water Planning Group.

#### 3.1.2.4 Pecos River Watershed Protection Plan

The Pecos River is the lifeblood of many communities within its reaches, and serves as a major water source for irrigation, recreational uses, and recharge for underlying aquifers. However, the flows of the once great Pecos River have dwindled to a mere trickle due to natural and man-induced causes. Because water quality and streamflow has declined, the aquatic community of the Pecos River has been drastically altered. To address these river issues, the Pecos River Basin Assessment Program was initiated in 2004 by the Texas Water Resources Institute of Texas A&M University (http://pecosbasin.tamu.edu/). The project was funded by the Texas Soil and Water Conservation Board through the U.S. Environmental Protection Agency-Clean Water Act Grant. Components of the project include:

- A basin assessment of stream channel morphology, riparian vegetation, land use, salinity mapping, water inflows and outflows, aquatic habitats, historic perspectives and economic modeling.
- Educational programs working with various state and local agencies to assemble a series of publications and organize and a series of educational meetings targeted at landowners, stakeholders and policymakers in the Basin.
- Monitoring programs consisting of data collection, analysis, and water use studies intended to estimate the effect of salt concentration and fate of water salvaged through salt cedar control.

"A Watershed Protection Plan for the Pecos River in Texas" was published in 2008 and updated in 2013 (http://pecosbasin.tamu.edu/assessment-program/). The WPP for the Pecos River in Texas recommends management strategies that typically address more than one concern. The plan includes an in-depth overview that defines the watershed and its characteristics and provides some of the history behind the current issues. As a primer on management strategies, the WPP also discusses past and current uses of the river and watershed. Landowners' concerns about the Pecos River watershed are discussed, management strategies are recommended, costs are estimated, technical assistance is outlined, and timelines for implementing these strategies and a program to address each concern are included. The plan includes:

- Identification of the causes and sources of pollutants
- Estimation of expected pollutant reductions
- Identification of critical areas of the watershed
- Description of the management measures needed

- Estimation of the costs of technical assistance and sources of funding
- An information and educational outreach component
- A feasible implementation schedule
- Milestones to assess the effectiveness of plan implementation
- Criteria for assessing success
- A long-term monitoring effort

## 3.2 GROUNDWATER

Other than irrigation use and a portion of El Paso Water municipal use from the Rio Grande, almost all other water use in Far West Texas is supplied from groundwater sources. Although not as large in areal extent as some aquifers in the State, such as the Ogallala and the Carrizo-Wilcox, individual aquifers in Far West Texas are more numerous (10 TWDB designated and 3 Planning Group designated) than in any of the other planning regions state wide (Figure 3-3).

- Hueco Bolson
- Mesilla Bolson
- West Texas Bolsons
    - Salt Basin
        - Upper Salt Basin
        - Wild Horse and Michigan Flats
        - Lobo Flat
        - Ryan Flat
    - Presidio / Redford
    - Green River Valley
    - Red Light Draw
    - Eagle Flat
- Bone Spring-Victorio Peak
- Igneous (Davis Mountains Igneous)
- Edwards-Trinity (Plateau)
- Capitan Reef Complex
- Marathon
- Rustler
- Pecos Valley (Balmorhea Alluvium)

Other locally recognized groundwater sources:

- Rio Grande Alluvium
- Edwards-Trinity of Brewster County (Brewster Cretaceous)
- Diablo Plateau

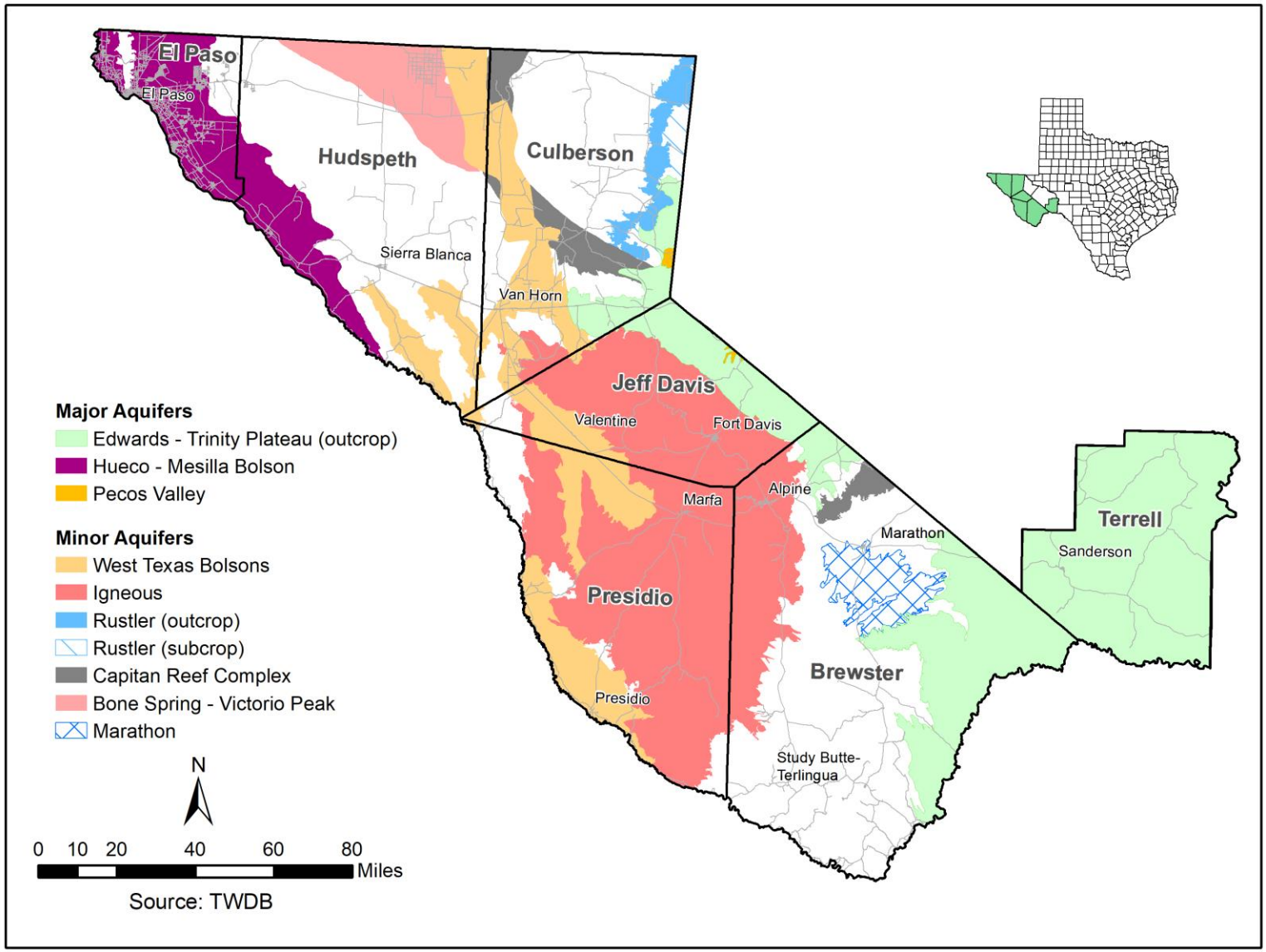



**Figure 3-3. Major and Minor Aquifers**

Aquifers in the Region can be categorized into three basic types; bedrock, bolson and alluvium. Bedrock aquifers are those where groundwater flows through permeable fractures in hard-rock formations (limestone, dolomite, volcanic basalt, etc.). Aquifers of this type include the Bone Spring-Victorio Peak, Capitan Reef, Edwards-Trinity, Rustler, Marathon, and Igneous. Bolson aquifers occur in thick silt, sand, and gravel deposits that fill valleys between the numerous mountain ranges. Bolson aquifers in the Region include the Hueco, Mesilla, and the various individual aquifers that comprise the West Texas Bolson Aquifer group. Alluvial aquifers occur in the floodplain deposits adjacent to riverbeds and are often hydrologically connected to the surface water body. The Rio Grande Alluvium Aquifer is in this category. Water quality characteristics of these aquifers are discussed in Chapter 1, Section 1.8.

The FWTWPG has continuously acknowledged the need to increase the reliability of groundwater availability estimates by supporting the acquisition of additional data that can be used to characterize the many aquifers in the Region. Interim TWDB funded projects were performed during previous planning periods in which new well data, water quality analyses, and aquifer parameters ascertained through pumping tests were developed. Project reports are accessible on the Rio Grande Council of Government website at http://www.riocog.org/ENVSVCS/FWTWPG/docs.htm.

- Igneous Aquifer System of Brewster, Jeff Davis and Presidio Counties, Texas (2001)
- West Texas Bolsons and Igneous Aquifer System Groundwater Availability Model Data Collection (2003)
- Groundwater Data Acquisition in Far West Texas (2009)
- Groundwater Data Acquisition and Analysis for the Marathon and Edwards-Trinity (Plateau) Aquifers (2010)

The evaluation of groundwater availability as reported in this *2021 Plan*, including MAG volumes and local analyses, is based on previous geohydrologic studies, groundwater data including historical use contained in state and federal databases, and groundwater availability models (GAMs). Regardless of the specific method used to calculate groundwater supply availability, all analyses include the consideration of four basic components: (1) recharge to the aquifer, (2) recoverable storage capacity within the aquifer, (3) lateral movement into and out of the aquifer, and (4) withdrawals from the aquifer. Table 3-6 lists the methodologies used to estimate total groundwater source availability as reported in Table 3-1. Table 3-7 lists the "desired future conditions" established by groundwater conservation districts for their assigned Groundwater Management Areas. These aquifer conditions are used to assess the Modeled Available Groundwater (MAG) supply availability for designated aquifers.

**Table 3-6. Groundwater Source Availability Methodology**

| Water Supply Source | County | Methodology |
|---|---|---|
| Hueco-Mesilla Bolson | El Paso | One percent of total calculated/modeled volume in storage minus Hudspeth ten percent |
| | Hudspeth | Ten percent of total calculated/modeled volume in storage |
| Edwards-Trinity (Plateau) | Brewster | MAG |
| | Culberson | GCD (non-relevant) TWDB modeled |
| | Jeff Davis | |
| | Terrell | MAG |
| Bone Spring - Victorio Peak | Hudspeth | MAG |
| Capitan Reef Complex | Brewster | MAG |
| | Culberson | |
| | Jeff Davis | GCD Non-Relevant TWDB-Null |
| | Hudspeth | GCD Non-Relevant (TWDB-Null). Max 8-year historical annual use. |
| Igneous | Brewster | MAG |
| | Culberson | |
| | Jeff Davis | |
| | Presidio | |
| Marathon | Brewster | MAG |
| Rustler | Brewster | GCD Non-Relevant (TWDB modeled) |
| | Culberson | |
| | Jeff Davis | |
| West Texas Bolson (Red Light Draw) | Hudspeth | GCD Non-Relevant. GAM recharge from TWDB Contract Report (June 2004). |
| West Texas Bolson (Eagle Flat) | Hudspeth | |
| West Texas Bolson Green River Valley) | Hudspeth | |
| West Texas Bolson (Green River Valley) | Jeff Davis | |
| West Texas Bolson (Green River Valley) | Presidio | |
| West Texas Bolson (Presidio-Redford) | Presidio | MAG |
| West Texas Bolson (Upper Salt Basin) | Hudspeth | GCD Non-Relevant. Max 8-year historical annual use. |
| | Culberson | GCD Non-Relevant (TWDB-Null). TWDB Report AA 10-38 MAG. |
| West Texas Bolson (Wild Horse, Michigan and Lobo) | Culberson | MAG |
| West Texas Bolsons (Ryan) | Jeff Davis | MAG |
| | Presidio | |
| Other Aquifer (Brewster Cretaceous) | Brewster | RWPG Assigned. Max 8-year historical annual use. |
| Other Aquifer (Diablo Plateau) | Hudspeth | RWPG Assigned. Recharge rate of 3% of average annual rainfall (11 inches/yr) over 1,500 square miles of outcrop. |
| Other Aquifer (Balmorhea Alluvium) | Jeff Davis | RWPG Assigned. 22017 reported use by GCD. |
| Other Aquifer (Rio Grande Alluvium) | El Paso | RWPG Assigned. Max 8-year historical annual use. |
| | Hudspeth | RWPG Assigned. Max 8-year historical annual use. |

**Table 3-7. GMA Aquifer Desired Future Conditions**

| GMA | Aquifer | County | Desired Future Condition for the Period from 2010-2060 |
|---|---|---|---|
| 4 | Bone Spring - Victorio Peak | Hudspeth | 0-feet drawdown averaged across the portion of the aquifer within the boundaries of the district |
| | Capitan Reef Complex | Brewster | 0-feet drawdown |
| | | Culberson | 50-feet drawdown |
| | | Jeff Davis | Non-relative |
| | | Hudspeth | Non-relative |
| | Edwards-Trinity (Plateau) | Brewster | 3-feet drawdown |
| | | Culberson | Non-relative |
| | | Jeff Davis | Non-relative |
| | Igneous | Brewster | 10-feet drawdown |
| | | Culberson | 66-feet drawdown |
| | | Jeff Davis | 20-feet drawdown |
| | | Presidio | 14-feet drawdown |
| | Marathon | Brewster | 0-feet drawdown |
| | Rustler | Brewster | Non-relative |
| | | Culberson | Non-relative |
| | | Jeff Davis | Non-relative |
| | West Texas Bolsons (Wildhorse, Michigan, & Lobo Flats) | Culberson | 78-feet drawdown |
| | West Texas Bolsons (Ryan Flat) | Jeff Davis | 72-feet drawdown |
| | | Presidio | 72-feet drawdown |
| | West Texas Bolsons (Presidio & Redford Bolsons) | Presidio | 72-feet drawdown |
| | West Texas Bolsons (Upper Salt Basin) | Culberson | Non-relative |
| | | Hudspeth | Non-relative |
| | West Texas Bolsons (Eagle Flat) | Hudspeth | Non-relative |
| | West Texas Bolsons (Green River Valley) | Hudspeth | Non-relative |
| | | Jeff Davis | Non-relative |
| | | Presidio | Non-relative |
| | West Texas Bolsons (Red Light Draw) | Hudspeth | Non-relative |
| | Brewster Cretaceous | Brewster | FWT declared aquifer |
| | Diablo Plateau | Hudspeth | FWT declared aquifer |
| | Pecos Valley (Balmorhea Alluvium) | Jeff Davis | FWT declared aquifer |
| | Presidio Cretaceous | Presidio | FWT declared aquifer |
| 5 | Hueco-Mesilla Bolson | El Paso | Non-DFC |
| | | Hudspeth | Non-DFC |
| | Rio Grande Alluvium | El Paso | FWT declared aquifer |
| | | Hudspeth | FWT declared aquifer |
| 7 | Edwards-Trinity (Plateau) | Terrell | 7-Feet drawdown |

### 3.2.1 Hueco Bolson Aquifer

The Hueco Bolson Aquifer is a major source of groundwater for cities in El Paso and Hudspeth Counties, as well as Ciudad Juarez, Mexico. The Hueco Bolson extends southeastward from the Franklin Mountains in El Paso County to the southern end of the Quitman Mountains in Hudspeth County. The eastern boundary of the bolson is established by the Diablo Plateau in El Paso and Hudspeth Counties and the Malone and Quitman Mountains in Hudspeth County. Northward, the Hueco extends into New Mexico where it is hydrologically connected to the Tularosa Basin Aquifer. The Hueco Bolson also extends southward into the Mexican State of Chihuahua, where it is bounded by a series of mountain ranges that trend toward the southeast from Ciudad Juarez to near the southernmost point of the Quitman Mountains in Texas.

The Hueco Bolson consists of deposits of basin fill with a maximum thickness of approximately 10,000 feet along its western edge. The upper part of the basin fill consists of silt, sand and gravel. The lowermost deposits are made up largely of clay and silt. Only portions of the upper several hundred feet along the western edge of the bolson fill are known to contain fresh to slightly saline water. East and below the fresh water zone, the aquifer contains large volumes of brackish quality groundwater, which is currently being desalinated for public supply use by EPW and Horizon MUD. Where Hueco Bolson sediments directly underlie Rio Grande alluvial sediments, the two units are hydrologically connected. Recent data analysis and computer modeling indicate that the Hueco Bolson Aquifer can continue to be sustainably developed well beyond previous estimates.

The TWDB official designations the Hueco and Mesilla Bolsons as a single major-aquifer system (Figure 3-3) and reports its combined source availability in El Paso and Hudspeth Counties as a single volume, 480,000 acre-feet per year (Table 3-1). However, the two bolsons are not hydrologically connected. For this 2021 *Plan*, The Hueco and Mesilla Bolsons Aquifer is subdivided as follows:

El Paso County:

Hueco Bolson – 410,000 af/y

Mesilla Bolson – 25,000 af/y

Hudspeth County:

Hueco Bolson – 45,000 af/y

### 3.2.2 Mesilla Bolson Aquifer

The Mesilla Bolson Aquifer is located west of the Franklin Mountains and is part of a larger bolson that extends from southern New Mexico to northern Mexico. The bolson deposits consist of approximately 2,000 feet of clay, silt, sand, and gravel. Three water-bearing zones have been identified based on water levels and quality. The shallow zone includes the overlying Rio Grande Alluvium. El Paso Water maintains a municipal wellfield in the Mesilla Bolson Aquifer near Canutillo. For the 2021 *Plan*, Mesilla Bolson source availability is estimated to be approximately 25,000 acre-feet per year (see Hueco Bolson availability above).

### 3.2.3 West Texas Bolsons Aquifer

#### 3.2.3.1 Salt Basin Bolson

The Salt Basin is the largest of the West Texas Bolson Aquifers extending from the New Mexico state line on the western side of the Guadalupe Mountains southward to near Marfa in northern Presidio County. The basin is subdivided into five distinct but hydrologically connected areas referred to as "flats" that contain significant quantities of groundwater that are being produced for municipal, irrigation, and livestock use. These sub-aquifers include from north to south Upper Salt, Wild Horse, Michigan, Lobo, and Ryan Flats. Water supplies used by the oil and gas industry is derived from this aquifer source.

**Upper Salt Basin** is not currently identified as part of the TWDB-designated West Texas Bolsons Minor Aquifer system, but is listed here because it is recognized as a source supply for specified water-user categories in this *Plan*. The Upper Salt Basin is the northern extension of Wild Horse Flat and is described separately because of a difference in water quality and primary use. The aquifer generally produces brackish to slightly saline groundwater to low-capacity wells primarily serving livestock needs.

**Wild Horse Flat and Michigan Flat** lie to the south of the Upper Salt Basin and are hydrogeologically interconnected with the northernmost part of Lobo Valley. Mountains bound the Wild Horse-Michigan Flat area along its western, eastern and southeastern margins. The Wild Horse-Michigan Flat watershed covers an area of approximately 1,000 $mi^2$ with a storage area of approximately 375 $mi^2$. The Wild Horse Flat area of the basin is a source of municipal supply for the Towns of Van Horn (Culberson County) and Sierra Blanca (Hudspeth County). The Wild Horse-Michigan Flat Aquifer is a major source of domestic and stock water for ranches and of irrigation water for farms in the valley.

**Lobo Flat** lies southwest of Wild Horse and Michigan Flats and is bound by mountains along its western and eastern margins. The bolson watershed covers an area of 350 $mi^2$, with a groundwater storage area of 130 $mi^2$. The largest part of the storage area (75 $mi^2$) is in Culberson County, and a smaller part (55 $mi^2$) lies within Jeff Davis County. The bolson is not a source of municipal supply, however, it is a source of domestic and stock water for ranches and a significant source of irrigation water.

**Ryan Flat** is the southernmost extension of the Salt Basin. The bolson watershed covers an area of 1,410 $mi^2$, and the storage area is 525 $mi^2$. The largest part of the storage area (360 $mi^2$) is in Presidio County, and a smaller area (165 $mi^2$) extends northward into Jeff Davis County, where it is the source of municipal supply for the Town of Valentine. It is also the source of domestic water, stock water for ranches, and a source of irrigation water for farms. Well completion information and pumping records from the Antelope Valley Ranch owned by EPW indicate that a zone of saturated, permeable, fractured volcanic rocks from 1,000 to as much as 3,000 feet thick underlies the bolson fill in Ryan Flat.

#### 3.2.3.2 Presidio-Redford Bolson

In Texas, the Presidio-Redford Bolson extends along the Rio Grande from Candelaria to outcrops of volcanic rocks 6 to 10 miles southeast of Presidio. The Redford extension of the bolson continues along the Rio Grande for another 12 miles. The bolson is bounded along the northeast by the Chinati Mountains and along the southeast by the Cienega Mountains, the Black Hills, and the Bofecillos Mountains. This is an area of approximately 480 $mi^2$. Saturated thickness is conservatively estimated to be 500 feet beneath this area. The Presidio-Redford Bolson is the source of municipal supply water for the Town of Presidio and the Mexican community of Ojinaga. It is also the source supply for domestic, irrigation and livestock use.

#### 3.2.3.3 Green River Valley Bolson

The Green River Valley Bolson lies in parts of Hudspeth, Jeff Davis and Presidio Counties. It is bordered by the Eagle Mountains on the west, the Van Horn Mountains on the east, and the Rio Grande on the south. The Green River Valley watershed covers an area of 160 $mi^2$, however the storage area is only 40 $mi^2$. Green River Valley is the smallest of the West Texas Bolsons and is a source of water only for ranches in the basin. A few abandoned wells give witness to a history of irrigation.

#### 3.2.3.4 Red Light Draw Bolson

Red Light Draw, located in Hudspeth County, is situated between the Eagle Mountains along the north-northeast and the Quitman Mountains along the southwest. The Rio Grande is the southern border of the basin. The drainage area of the Red Light Draw watershed is estimated to be 370 $mi^2$ and an aquifer area of 185 $mi^2$. The Red Light Bolson is a source of water only for ranches in the basin, and at its southern end for a research station operated by the University of Texas at El Paso.

#### 3.2.3.5 Eagle Flat Bolson

The Eagle Flat Bolson, located in Hudspeth County, is situated between the Eagle Mountains along the south-southwest, the Diablo Plateau along the north, and the Carrizo and Van Horn Mountains along the east. The drainage area of the bolson watershed is estimated to be 560 $mi^2$ and the basin fill covers an area of 156 $mi^2$. Only the southeastern part of the basin is regarded as having potential for the development of groundwater resources. The Eagle Flat Bolson is not a source of supply for municipalities in Hudspeth County. The unincorporated Town of Sierra Blanca, located in the western region of the basin, obtains water from a wellfield operated by the Town of Van Horn in Wild Horse Flat.

### 3.2.4 Bone Spring-Victorio Peak Aquifer

The Bone Spring-Victorio Peak Aquifer underlies the Dell Valley area of northeastern Hudspeth County between the Salt Flat Basin and the Guadalupe Mountains on the east and the Diablo Plateau on the west. The aquifer, which extends northward into the Crow Flats area of New Mexico, is used primarily for irrigation, but is also the public water supply source for Dell City. In 2007 the TWDB significantly enlarged the designated area of the aquifer to a total of 710 $mi^2$ by extending its western and southern boundary.

The aquifer consists of carbonate rocks (limestone and dolomite) of early Permian age. Groundwater in the aquifer occurs under water-table conditions in interconnected solution cavities of variable size and dimension that formed along joints, fractures and bedding planes. Water-bearing zones have been encountered in wells as deep as 2,000 feet. The productivity of a well completed in the aquifer is dependent on the number and size of cavities penetrated by the well bore. Well yields are reported to range from 150 gpm to as much as 4,000 gpm. The depth to groundwater within the irrigated region of Dell Valley ranges from approximately 35 feet along the eastern side of the valley to 325 feet on the west. Although the water table has declined since pre-development, static water levels have remained relatively constant since the late 1970s.

There are four principal components of recharge to the Bone Spring-Victorio Peak Aquifer:

- Precipitation that falls over watersheds that drain toward Dell Valley infiltrates rapidly along fractures and solution features such as sinkholes;

- The Sacramento River, which drains the Sacramento Mountains of New Mexico, discharges large volumes of water to the subsurface in the lowlands that border the mountain catchments;
- Lateral inflow of groundwater from areas to the north and the west; and
- Return flow from irrigation in Dell Valley.

During the irrigation season, the direction of groundwater flow is highly influenced by pumping wells, which create cones of depression in the water table. If pumping rates were not managed, significant water-level declines could result in highly saline water from the Salt Flats migrating westward into the fresher zones. However, chemical analyses of wells along the eastern border of the valley have not indicated a significant influx of saline water. The Hudspeth County Groundwater Conservation District engages management rules to insure the water table remains at a sustainable level.

### 3.2.5 Igneous Aquifer (Davis Mountains Igneous)

The Igneous Aquifer system comprises all contiguous Tertiary igneous (volcanic) formations underlying the Davis Mountains and adjacent areas primarily in Brewster, Jeff Davis and Presidio Counties. Most of the aquifer's areal extent is underlain by a thickness ranging from 1,000 to 4,000 feet; however, most wells are less than 1,000 feet in depth. The aquifer is not a single homogeneous aquifer but rather a system of complex water-bearing formations that are in varying degrees of hydrologic communication.

The extent of the Igneous Aquifer as illustrated in Figure 3-3. Major and Minor Aquifers3 represents a new boundary established in recent studies of the aquifer system. Groundwater is stored in the fissures and fractures of intrusive and extrusive rocks of volcanic origin. The chemical quality of the aquifer is generally good to excellent and well yields generally range from small to moderate.

Over 40 separately named volcanic units have been identified, each of which are highly variable in nature. Water quality of the aquifer is relatively good and generally meets safe drinking water standards. Alpine, Marfa and Fort Davis, along with a growing rural population, derive their municipal supplies from this aquifer.

### 3.2.6 Edward-Trinity (Plateau) Aquifer

The Edwards-Trinity (Plateau) Aquifer in Far West Texas is the westernmost extension of a vast groundwater system that underlies the Edwards Plateau east of the Pecos River and the Stockton Plateau west of the River. The aquifer is exposed over an area of 4,690 $mi^2$ in Terrell (2,350 $mi^2$), Brewster (1,460 $mi^2$), Jeff Davis (530 $mi^2$) and Culberson (350 $mi^2$) Counties. It is the source of municipal water for the City of Sanderson (Terrell County); a source of domestic water in Brewster, Culberson, and Terrell Counties; a source of irrigation water in Brewster and Terrell Counties; a source of stock water in all four counties; and a source of water for oil and gas operations in Terrell County.

The aquifer consists of saturated sediments of the Cretaceous age Trinity Group formations and the overlying carbonate rocks (limestone and dolomite) of the Comanche Peak, Edwards, and Georgetown formations. Groundwater occurs under water-table conditions in the four Far West Texas counties.

The hydrogeology of the Edwards-Trinity (Plateau) Aquifer in Far West Texas is not understood as well as in areas to the east, where the aquifer is a major source of supply for the municipal, industrial and agricultural sectors of the economy.

### 3.2.7 Capitan Reef Complex Aquifer

The Capitan Reef formed along the margins of the Delaware Basin, a Late Paleozoic sea. In Texas, the reef formed along the western and eastern edges of the basin in arcuate strips 10 to 14 miles wide. The reef is exposed in the Guadalupe and Apache Mountains of Culberson County and in the Glass Mountains of Brewster County. In other areas, the reef is found only in the subsurface. It extends northward into New Mexico, where it is a source of fresh water for the City of Carlsbad. The Capitan Reef Aquifer is composed of up to 2,000 feet of massive to cavernous dolomite and limestone, bedded limestone and reef talus. In many areas of Culberson and Hudspeth Counties, the yields of wells are commonly more than 1,000 gpm. Further to the south, in the Apache Mountains of Culberson County, well yields appear to be in the range of 400 gpm. There is no reported production data for the Glass Mountains portion of the Capitan Reef.

The aquifer is not currently a source of municipal supply; however, El Paso Water Utilities owns land over the aquifer in Culberson County and may tap the aquifer for municipal supply in the future. Most of the groundwater pumped from the aquifer in Far West Texas is used for irrigation in Culberson and Hudspeth Counties.

### 3.2.8 Marathon Aquifer

The Marathon Aquifer is located entirely within the north-central area of Brewster County, where it is the source of municipal supply for the Town of Marathon, and of domestic and stock water for ranches in the area. The Marathon area is underlain by complexly faulted and folded Paleozoic rocks having a total thickness of 21,000 feet and occupy an area of approximately 390 $mi^2$. The most significant water-bearing formation of the aquifer is the Marathon Limestone (early Ordovician age).

Groundwater in the Marathon Aquifer generally occurs under unconfined conditions in crevices, joints and cavities; however artesian conditions are common in areas where the Paleozoic rocks are buried beneath younger formations. Existing water wells have penetrated up to 900 feet, however most wells are generally less than 250 feet deep. Many of the shallow wells in the area actually produce water from alluvial deposits that overlie rocks of the Marathon Aquifer. The depth to groundwater is generally less than 150 feet, and depths of less than 50 feet are not uncommon. Groundwater in the aquifer is typically of good quality but hard.

### 3.2.9 Rustler Aquifer

The Rustler Aquifer located in eastern Culberson County is exposed in a southwest-trending belt that begins at the northeast corner of the county. The aquifer dips toward the east, and is found in the subsurface in easternmost Culberson County and Jeff Davis County. Approximately 803 $mi^2$ of land in Far West Texas are underlain by the Rustler Aquifer. The Rustler Aquifer is a source of water for irrigation and livestock. High concentrations of dissolved solids render the formation unsuitable as a source of municipal and domestic supply. The Rustler Aquifer consists mainly of dolomite, limestone, and gypsum of the Rustler Formation (Permian age). Groundwater is produced primarily from solution channels, caverns and collapsed breccia zones. The aquifer is under water-table conditions in the outcrop recharge zone in eastern Culberson County and is under artesian conditions elsewhere.

### 3.2.10 Pecos Valley Aquifer (Balmorhea Alluvium)

The Balmorhea Alluvium Aquifer, located in a small area along the Jeff Davis and Reeves county line, is recognized in this *Plan* due to its use as a municipal supply source for the City of Balmorhea and the Madera Valley WSC. The TWDB classifies this area as belonging to the Pecos Valley Aquifer; however, the erosion-derived gravel sequence is much unlike the sand and silts of the Pecos Valley Alluvium, and recharge is also unique to runoff from the slopes of the Davis Mountains.

### 3.2.11 Other Groundwater Resources

Also shown in Figure 3-3. Major and Minor Aquifers3 are large areas of Far West Texas that are depicted as not underlain by major or minor aquifers. The map, however, should not be interpreted as an indication that such areas are devoid of groundwater, but rather as a reflection of the current level of understanding of the extent of known groundwater resources in the Region.

**Rio Grande Alluvium Aquifer**

The Rio Grande Alluvium forms the flood plain of the Rio Grande in El Paso and Hudspeth Counties. Averaging approximately 200 feet in thicknesses, the alluvial aquifer is hydrologically connected to the underlying Hueco Bolson. TWDB Report 246 states that the Rio Grande Alluvium Aquifer within El Paso County contains about 1.4 million acre-feet of theoretically recoverable groundwater having less than 2,500 mg/l dissolved solids. Groundwater contained within the Rio Grande alluvial sediments generally has high concentrations of dissolved solids (typically greater than 2,000 mg/l), and requires desalination to meet drinking-water standards. However, it is a source of irrigation water in El Paso and Hudspeth Counties whenever flow in the Rio Grande is insufficient to support agricultural operations. These irrigation wells are capable of annually producing approximately 80,000 acre-feet in El Paso County and 15,000 acre-feet in Hudspeth County from the Aquifer. In addition, the Horizon Regional MUD pumps alluvial groundwater for municipal use, which must be desalinated to meet safe drinking water standards.

For this *Plan*, groundwater availability from the Rio Grande Alluvial Aquifer in El Paso County is calculated as 89,330 acre-feet per year effective recharge plus 5 percent of water in storage to a depth of 200 feet and with a salinity range of 1,000 to 2,000 mg/l (TWDB Rept. 246), or 130,380 acre-feet per year. Groundwater availability from the Aquifer in Hudspeth County is estimated at approximately 11.5 percent of that in El Paso County, or 15,000 acre-feet per year.

**Edwards-Trinity Aquifer of Brewster County (Brewster Cretaceous)**

In southern Brewster County, the small communities of Study Butte and Terlingua, as well as the Lajitas Golf Resort, obtain groundwater from underlying Cretaceous formations that are geologically equivalent to the Edwards-Trinity (Plateau) Aquifer. Wells recently drilled to supply water for the Lajitas golf courses have demonstrated that groundwater of likely significant quantity is present in this aquifer system. However, very little data has been collected pertaining to this aquifer. The Lajitas' wells are relatively deep, the temperature of the water is warm, and the water contains elevated radioactivity. The FWTWPG recommends that this aquifer be studied in more detail.

**Diablo Plateau Aquifer**

The Permian and Cretaceous rock formations that make up the subsurface of the Diablo Plateau of central and northern Hudspeth County may have large volumes of groundwater in storage. Although the aquifer system has not been adequately researched, Hutchison (2008) included a portion of this aquifer system in a flow simulation model of the Bone Springs-Victorio Peak Aquifer. Also, several wells have been drilled that testify to the existence of an underground supply.

For this *Plan*, groundwater availability for the eastern and southern portion of the Diablo Plateau is conservatively calculated as 26,400 acre-feet per year effective recharge based on three percent (drought rate) of average annual rainfall (11 inches) times the areal extent of the designated portion of the aquifer (1,500 mi² or 960,000 acres).

### 3.2.12 Groundwater Conditions in Municipal Wellfields

#### 3.2.12.1 Brewster County

**City of Alpine** – The City of Alpine operates 13 active and 4 backup municipal supply wells in three wellfields (the Musquiz, Sunny Glen, and Town wellfields). Water levels have remained relatively stable near the wellfields, and there are no reported major water quality problems. The Musquiz field produces approximately two thirds of the City's municipal water, but the Sunny Glen field is regarded as having greater storage capacity. Several wells within the Sunny Glen field have been deepened, and yields are reported to have increased from less than 100 gpm to as much as 500 gpm. The City is actively upgrading both its wellfields and its distribution system.

**Community of Marathon –** The Marathon Water and Sewer Service Corporation provides water to the Community of Marathon from two wells screened in the Marathon Aquifer. Water levels have remained stable in the vicinity of the Community, and there are no reported major water quality problems. There are no other sources of groundwater near the Community.

**Communities of Terlingua and Study Butte –** The Study Butte Water Supply Corporation, which provides water to the towns of Study Butte and Terlingua, has developed two wells into the Cretaceous Santa Elena Limestone with the capacity of either well to sufficiently supply daily needs. Water levels have remained relatively stable, but little is known about how high-production wells into the same formation 10 miles away might affect local static water levels. Radiological activity in the untreated water consists mainly of Radon gas and radium 226, which are present in levels barely above detection limits. Radon levels are drastically reduced by mechanically assisted gassing, and the particulate R226 can be filtered out in such a quantity as to leave both an excellent product water and to pose no problems for disposal. This water system has one of the most sophisticated rural public water treatment facilities in West Texas, combining reverse osmosis desalination and other more traditional technologies to produce a product of superior taste and quality. The Study Butte WSC is currently requesting TWDB funding to install radio-read meters and the installation of 4,500 feet of 4-inch water line.

**Resort of Lajitas –** The Resort of Lajitas currently relies on two deep, large-bore wells of varying water quality drilled into Cretaceous formations. Depending on location, wells have demonstrated artesian characteristics, with completed static level as much as 700 feet above the level where the formation was entered. The water is chemically similar to that found 10 miles away by the Terlingua-Study Butte WSC, and poses similar treatment problems. Most water produced by the Lajitas Resort water system is for golf

course and turf irrigation from a combination of sources. A state-of-the-art electro-dialysis desalination plant provides high quality product for municipal use by residents, employees, and resort guests. No change in aquifer levels has been reported since the onset of high volume pumping in 2000, but little reliable data is available for either recharge rates or total pumping volumes.

### 3.2.12.2 Culberson County

**Town of Van Horn –** Municipal supply for the Town of Van Horn is derived from four active city-owned wells in the Wild Horse Flat Aquifer. Water levels near Van Horn have remained stable. Other than fluoride concentrations that have been reported to range from 2.3 to 3.1 mg/l, all other dissolved constituents are within their respective safe drinking-water standards. The current wellfield has significant expansion capability if additional production is needed to meet increased demand. The City is replacing all water meters to better monitor water use.

### 3.2.12.3 El Paso County

**City of El Paso (El Paso Water) and Vicinity –** The production of groundwater from wellfields in the vicinity of El Paso and in Ciudad Juarez has created a large cone of depression in the potentiometric surface beneath each city. Average declines in wells in the upper portion of the Lower Valley in El Paso are more than 100 feet. These declines, in combination with deteriorating water quality, have prompted El Paso Water (EPW) to discontinue pumping from certain wells. Elsewhere, average water-level declines are generally in the range of 60 to 80 feet. Recent water-level data indicate a slight rise of water levels in the valley. This is probably traceable to lower pumpage in some areas. The lowering of the potentiometric surface not only has reversed the predevelopment hydraulic gradient in the westernmost regions of the Hueco Bolson, but also is a factor underlying the deterioration of water quality in part of the El Paso area.

The concentrations of chloride and other dissolved ions have increased in many of the municipal wells of both cities. In El Paso County, for example, the TDS in production wells has risen to more than 1,000 mg/l. In recent years, EPW has taken approximately 30 wells out of service due to elevated levels of chloride and TDS. In many cases, the greatest increases in TDS are associated with wells that have had large, sustained drawdowns, but similar changes have also been observed in some wells from which much less pumping has occurred. To continue the use of some of the more brackish quality wells, EPW has installed skid-mounted desalination equipment. EPW and El Paso County Tornillo WID are installing treatment facilities to mitigate elevated arsenic levels in groundwater supplies.

### 3.2.12.4 Hudspeth County

**Community of Sierra Blanca –** Water provided to the Community of Sierra Blanca by the Hudspeth County Water Control and Improvement District #1 is from a well located near the airport northwest of the Town of Van Horn in Culberson County. The well produces groundwater from the Wild Horse Flat Aquifer where water levels near the well have remained relatively constant and water quality has been acceptable. Groundwater from the well feeds into the Van Horn water supply and from there is diverted by pipeline to Sierra Blanca under a contract between the District and the City of Van Horn. There is substantial room for expansion if an additional well is needed to meet increased demand. Also, a larger diameter pipeline is being considered for transporting this water to Sierra Blanca. Since 1970, Sierra Blanca has drilled as many as five wells near the town in unsuccessful attempts to develop local sources of groundwater.

**City of Dell City –** Dell City relies on three wells (only one of which is currently active) completed in the Bone Spring-Victorio Peak Aquifer for municipal water, which is brackish and must be desalinated. The Bone Spring-Victorio Peak Aquifer is capable of supporting production from additional municipal supply wells if needed.

**Communities of Fort Hancock and McNary –** Fort Hancock and McNary have relied on groundwater provided by one well owned by the Fort Hancock WCID and on 11 wells owned by the Esperanza FWSD#1. All production is from the Rio Grande Alluvium Aquifer. Water levels fall in response to extended drought conditions in the region, but the owner of the Esperanza FWSD #1 reports that water levels usually recover quickly after periods of rainfall. Water quality is a problem in the area, as TDS ranges from approximately 1,000 mg/l to as much as 2,500 mg/l. Other dissolved solids in excess of drinking water standards are fluoride and manganese. The possibilities for expansion are limited by the occurrence of saline groundwater in both the Rio Grande Alluvium and the Hueco Bolson Aquifer.

### 3.2.12.5 Jeff Davis County

**Community of Fort Davis –** The Fort Davis Water Supply Corporation (FDWSC) provides water to the Community of Fort Davis and the surrounding area from three wells completed in the Igneous Aquifer. One of the wells is used only as a backup. Water levels in the vicinity of the wells have remained stable; and other than elevated fluoride, there are no reported problems with water quality. The FDWSC has recently completed an additional well in town and is considering connecting to a private public-supply well east of town.

**Town of Valentine –** The Town of Valentine relies on one municipal water supply well completed in the Ryan Flat Aquifer. A pumping test conducted on the well in 2004 produced at an average rate of 59 gpm with 201 feet of water level drawdown. A second well owned by the Valentine Independent School District provides water to the school and to a small number of residences occupied by teachers. Water levels near Valentine have remained stable, and there are no reported problems with water quality. Under consideration is a proposal to drill a second municipal water supply well. The Ryan Flat Aquifer appears to have ample capacity to support additional well development for Valentine.

### 3.2.12.6 Presidio County

**City of Marfa –** The City of Marfa depends on three city-owned wells for all its municipal water needs. Two of the wells can produce as much as 1,100 gpm, and the third well yields an additional 450 gpm. The Tertiary volcanic formations of the Igneous Aquifer are the source of groundwater. Other than fluoride, which has been reported at concentrations ranging from 2.5 to 3 mg/l, all other dissolved solids are below their respective safe drinking-water standards, and TDS are typically less than 400 mg/l. The City of Marfa recently drilled a new well to replace an older well that was no longer functioning.

**City of Presidio –** The City of Presidio derives its municipal water from four wells located east of the City along Alamito Creek. The wells are approximately 530 feet in depth and produce from the Presidio Bolson Aquifer. A water quality analysis of one of the wells records a total dissolved solids level of 374 mg/l. Additional supply is needed to serve a developing area around the airport north of town.

### 3.2.12.7 Terrell County

**Community of Sanderson –** The Terrell County WCID#1 provides municipal water to the Community of Sanderson from 14 active public supply wells that produce groundwater from the Edwards-Trinity

(Plateau) Aquifer. The wells are in three fields; four in the north field, three in the middle field, and seven in the south field. Water levels have remained stable; and water quality is not reported to be a problem for the Community.

### 3.2.13 Groundwater Exports

Jeff Davis is the only county from which water is exported to other areas outside of its borders. As shown by Table 3-8 below, in 2017 the City of Alpine pumped 689 acre-feet from four wells in the Musquiz well field in southeastern Jeff Davis County. All other exports go to Reeves County. In 2017 the City of Balmorhea and the Madera Valley WSC extracted 175 and 83 acre-feet respectively, from the Edwards-Trinity (Plateau) & Pecos Valley Alluvium aquifers in northeastern Jeff Davis County.

**Table 3-8. Far West Texas 2017 Groundwater Exports**
**(Acre Feet per Year)**

| Exporting County | Receiving County | Received By | Source | Amount in 2017 | Remarks |
|---|---|---|---|---|---|
| Jeff Davis | Brewster | City of Alpine | Igneous Aquifer | 689 | Pumpage from four wells in Musquiz wellfield |
| Jeff Davis | Reeves | City of Balmorhea | Pecos Valley | 175 | Pumpage from one well |
| Jeff Davis | Reeves | Madera Valley WSC | Pecos Valley | 83 | Pumpage from two wells |

Source: Jeff Davis County Underground Water Conservation District
Note: See Region F Water Plan for future water use projections for the Reeves County water user entities.

Also, the U.S. Bureau of Reclamation has water rights for diversions of up to 18,936 acre-feet per year of surface water from Phantom Creek for irrigation use in Reeves County.

## 3.3 LOCAL SUPPLY

Limited surface water supplies, “Local Supplies”, are recognized to occur within “stock tanks” that catch precipitation runoff and are used primarily for livestock watering, but at times may be available for other local needs such as mining and irrigation. For planning purposes, the volume of runoff water in these catchment basins is significantly reduced during drought-of-record conditions and does not include any groundwater that might be pumped into them. No documentation has been identified that quantifies the available supply during drought-of-record conditions for these local supplies. Thus, per TWDB regional water planning guidelines, it is assumed for this 2021 Far West Texas Water Plan that all local supplies not represented by a specified water right have a volume of zero ac-ft per year.

## 3.4 REUSE

Reuse refers to the utilization of return flows from municipal wastewater treatment plants and other water users. Reuse water can be broadly characterized as one of two types: direct reuse, or wastewater that is reused without first being discharged into a stream or watercourse, and indirect reuse in which wastewater is discharged to a stream or other watercourse prior to being diverted for use.

El Paso Water's direct reuse project has nearly 40 miles of reclaimed water lines (purple pipeline) in place in all areas of the City. Reclaimed water serves the landscape irrigation demand of golf courses, parks, schools, and cemeteries, and provides water supplies for steam electric plants and industries within the City. EPW does not plan on extending or growing the purple pipe infrastructure, but will focus on maintaining existing purple pipe customers and work towards increasing the use of reclaimed water through additional purified water projects (see EPW strategies in Chapter 5). For planning purposes, the direct reuse supply estimated to be available to EPW increases from 13,748 in 2020 to 19,836 acre-feet per year in 2070, which is 10 percent of future projected EPW water-supply demand. The City of Alpine in Brewster County is also reusing treated wastewater to irrigate City properties.

Indirect reuse in the form of municipal return flow is an important source of supply for irrigators in El Paso and Hudspeth Counties during the irrigation season from March through September. Supplies currently available in El Paso County are estimated be 34,164 acre-feet per year. Irrigators in Hudspeth County utilize irrigation return flows from Rio Grande Project water, which is estimated to total 334 acre-feet per year.

# APPENDIX 3A
# AUTHORIZED SURFACE WATER RIGHTS

*This page intentionally left blank*

# APPENDIX 3A. AUTHORIZED SURFACE WATER RIGHTS AS EXTRACTED FROM TCEQ'S ACTIVE WATER RIGHTS MASTER FILE

| Water Right Number | Water Right Type | Application Number | Owner | Diversion Amount (ac-ft) | Use | Priority Date | Reservoir Name | Reservoir Capacity (ac-ft) | Site Name | Basin | County |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 121 | App/Perm | 121 | CLAYTON W WILLIAMS JR ET AL | 124 | D&L | 9/13/1915 | RES 1, RES 2 | 16 | | Rio Grande | Jeff Davis |
| 375 | Cert Filing | | US DEPT OF THE INTERIOR | 900 | Irr | 6/25/1914 | PHANTOM LAKE | | RIO GRANDE PROJECT,BUREAU | Rio Grande | Jeff Davis |
| 899 | Cert of Adj | | C & L COMPANY | 60 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 900 | Cert of Adj | | DARWIN RAY NILSSON ET AL | 800 | Irr | 1/28/1924 | | 395 | | Rio Grande | Hudspeth |
| 900 | Cert of Adj | | DARWIN RAY NILSSON ET AL | 700 | Irr | 1/1/1909 | | | | Rio Grande | Hudspeth |
| 901 | Cert of Adj | | WILLIAM N ROTH ET AL | 507 | Irr | 1/1/1932 | | | | Rio Grande | Hudspeth |
| 902 | Cert of Adj | | GILBERTO MORALES & PATRICIA ROSALES | 287.5 | Irr | 1/1/1925 | | | | Rio Grande | Hudspeth |
| 902 | Cert of Adj | | ESTATE OF SIDNEY W COWAN | 42.5 | Irr | 1/1/1925 | | | | Rio Grande | Hudspeth |
| 903 | Cert of Adj | | DOUGLAS A JOHNSTON | 63 | Irr | 1/1/1925 | | | | Rio Grande | Hudspeth |
| 904 | Cert of Adj | | JIM B BEAN ET AL | 831 | Irr | 1/1/1925 | | | | Rio Grande | Hudspeth |
| 905 | Cert of Adj | | KATHRYNE ALICE G LOPEZ ET AL | 330 | Irr | 1/1/1925 | | | | Rio Grande | Hudspeth |
| 906 | Cert of Adj | | TOM H NEELY TRUST | 164 | Irr | 1/1/1925 | | | | Rio Grande | Hudspeth |
| 906 | Cert of Adj | | RAYMOND R WHETSTONE ET AL | 82 | Irr | 1/1/1925 | | | | Rio Grande | Hudspeth |
| 907 | Cert of Adj | | LOUIS M FOIX SR | 150 | Irr | 1/1/1925 | | | | Rio Grande | Hudspeth |
| 908 | Cert of Adj | | LESTER RAY TALLEY JR ET AL | 138 | Irr | 1/1/1919 | | | | Rio Grande | Hudspeth |
| 909 | Cert of Adj | | LESTER RAY TALLEY JR ET AL | 144 | Irr | 1/1/1947 | | | | Rio Grande | Hudspeth |
| 910 | Cert of Adj | | LESTER RAY TALLEY ET AL | 126 | Irr | 1/1/1948 | | | | Rio Grande | Hudspeth |
| 911 | Cert of Adj | | LESTER RAY TALLEY | 216 | Irr | 1/1/1952 | | | | Rio Grande | Hudspeth |
| 912 | Cert of Adj | | AUTRY C STEPHENS | 15 | Irr | 1/1/1920 | | | | Rio Grande | Hudspeth |
| 912 | Cert of Adj | | AUTRY C STEPHENS | 162 | Irr | 1/1/1948 | | | | Rio Grande | Hudspeth |
| 913 | Cert of Adj | | GLORIA GUERRA ADDINGTON | 582 | Irr | 1/1/1912 | | | | Rio Grande | Hudspeth |
| 914 | Cert of Adj | | TEXAS PARKS & WILDLIFE DEPT | 219 | Irr | 1/1/1939 | | | | Rio Grande | Hudspeth |
| 914 | Cert of Adj | | TEXAS PARKS & WILDLIFE DEPT | | Other | 1/1/1939 | | | | Rio Grande | Hudspeth |
| 915 | Cert of Adj | | RANCHO PENSADO PROPERTIES LLC | 291.6 | Irr | 1/1/1902 | | | | Rio Grande | Presidio |
| 915 | Cert of Adj | | OSCAR B JACKSON | 291.6 | Irr | 1/1/1902 | | | | Rio Grande | Presidio |
| 915 | Cert of Adj | | RANCHO PENSADO PROPERTIES LLC | 291.6 | Irr | 1/1/1902 | | | | Rio Grande | Presidio |
| 915 | Cert of Adj | | KENNETH R MATHEWS | 291.6 | Irr | 1/1/1902 | | | | Rio Grande | Presidio |
| 915 | Cert of Adj | | HARRY MILLER | 291.6 | Irr | 1/1/1902 | | | | Rio Grande | Presidio |
| 915 | Cert of Adj | | ANDREW H JACKSON | 194.4 | Irr | 1/1/1902 | | | | Rio Grande | Presidio |
| 915 | Cert of Adj | | C B FIELDS | 291.6 | Irr | 1/1/1902 | | | | Rio Grande | Presidio |
| 916 | Cert of Adj | | TEXAS PARKS & WILDLIFE DEPT | 714 | Irr | 1/1/1932 | | | LOS PALOMAS WLMA | Rio Grande | Presidio |
| 917 | Cert of Adj | | LEO J PAVLAS & CARLYE PAVLAS | 405 | Irr | 11/11/1924 | | | | Rio Grande | Presidio |
| 918 | Cert of Adj | | BILLY O WALKER ET UX | 29.19 | Irr | 1/1/1932 | | | | Rio Grande | Presidio |
| 918 | Cert of Adj | | B J BISHOP | 18.81 | Irr | 1/1/1932 | | | | Rio Grande | Presidio |
| 919 | Cert of Adj | | JAVIER R MOLINA ET UX | 243 | Irr | 1/1/1949 | | | | Rio Grande | Presidio |
| 920 | Cert of Adj | | GORDON LEE JONES ET UX | 475.78 | Irr | 3/20/1917 | | | | Rio Grande | Presidio |
| 920 | Cert of Adj | | FERNWOOD ENTERPRISES | 19.22 | Irr | 3/20/1917 | | | | Rio Grande | Presidio |
| 921 | Cert of Adj | | AC&L ARMENDARIZ PARTNERSHIP | 270 | Irr | 1/1/1917 | | | | Rio Grande | Presidio |
| 922 | Cert of Adj | | MERCED O GARCIA ET AL | 90 | Irr | 1/1/1924 | | | | Rio Grande | Presidio |
| 923 | Cert of Adj | | LA HACIENDITA PECAN COMPANY LLC | 120 | Irr | 3/20/1917 | | | | Rio Grande | Presidio |
| 924 | Cert of Adj | | LA HACIENDITA PECAN COMPANY LLC | 54 | Irr | 3/20/1917 | | | | Rio Grande | Presidio |
| 925 | Cert of Adj | | ERNESTINA CHAVEZ ET AL | 42 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 926 | Cert of Adj | | ROBERT L SOZA | 66 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 927 | Cert of Adj | | LAJITAS CAPITAL PARTNERS LLC | 72 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 928 | Cert of Adj | | LAJITAS CAPITAL PARTNERS LLC | 57 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 929 | Cert of Adj | | ALFREDO S BAEZA | 48 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 930 | Cert of Adj | | SOZA & COMPANY | 114 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 931 | Cert of Adj | | ROBERTO R SPENCER ET AL | 111 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 932 | Cert of Adj | | FRANK ARMENDARIZ ET UX | 606 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |

## APPENDIX 3A. (Continued) AUTHORIZED SURFACE WATER RIGHTS

| Water Right Number | Water Right Type | Applica-tion Number | Owner | Diversion Amount (ac-ft) | Use | Priority Date | Reservoir Name | Reservoir Capacity (ac-ft) | Site Name | Basin | County |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 933 | Cert of Adj | | LUZ S ARMENDARIZ | 321 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 936 | Cert of Adj | | JOSE N RODRIGUEZ | 113.806 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 936 | Cert of Adj | | JOSE N RODRIGUEZ | 33.994 | Irr | 1/1/1914 | | | | Rio Grande | Presidio |
| 936 | Cert of Adj | | SALVADOR RODRIGUEZ SR | 33.166 | Irr | 1/1/1914 | | | | Rio Grande | Presidio |
| 936 | Cert of Adj | | SALVADOR RODRIGUEZ SR | 111.034 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 937 | Cert of Adj | | JOSE A RODRIGUEZ | 114 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 938 | Cert of Adj | | JOSE A RODRIGUEZ | 120 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 939 | Cert of Adj | | LORENZO HERNANDEZ | 45 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 939 | Cert of Adj | | LORENZO HERNANDEZ | 45 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 940 | Cert of Adj | | JESUS M RODRIGUEZ JR | 180 | Irr | 1/1/1914 | | | | Rio Grande | Presidio |
| 941 | Cert of Adj | | RCS INC | 164 | Irr | 3/26/1917 | | | | Rio Grande | Presidio |
| 942 | Cert of Adj | | PAULINE JUAREZ CROSSON | 25.98 | Irr | 1/1/1914 | | | | Rio Grande | Presidio |
| 942 | Cert of Adj | | RCS INC | 145.32 | Irr | 1/1/1914 | | | | Rio Grande | Presidio |
| 942 | Cert of Adj | | EDMUNDO SANCHEZ | 28.7 | Irr | 1/1/1914 | | | | Rio Grande | Presidio |
| 943 | Cert of Adj | | RCS INC | 420 | Irr | 1/1/1927 | | | | Rio Grande | Presidio |
| 944 | Cert of Adj | | SANTA CRUZ LAND & CATTLE INC | 743 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 946 | Cert of Adj | | RCS INC | 61 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 947 | Cert of Adj | | RCS INC | 800 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 948 | Cert of Adj | | C & L COMPANY | 880 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 949 | Cert of Adj | | C & L COMPANY | 267 | Irr | 12/12/1924 | | | | Rio Grande | Presidio |
| 950 | Cert of Adj | | OSCAR M SPENCER | 39 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 952 | Cert of Adj | | CITY OF EAGLE PASS WATER WORKS SYSTEM | 4600 | Mun | 2/12/1925 | | | | Rio Grande | Presidio |
| 952 | Cert of Adj | | CITY OF LAREDO | 2818 | Mun | 2/12/1925 | | | | Rio Grande | Presidio |
| 952 | Cert of Adj | | MAVERICK COUNTY | 641 | Mun | 2/12/1925 | | | | Rio Grande | Presidio |
| 953 | Cert of Adj | | CF&L ENTERPRISES | 407 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 954 | Cert of Adj | | CF&L ENTERPRISES | 684 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 955 | Cert of Adj | | CF&L ENTERPRISES | 172 | Irr | 2/12/1925 | | | | Rio Grande | Presidio |
| 956 | Cert of Adj | | MANUEL M RUBIO ET AL | 84 | Irr | 1/1/1925 | | | | Rio Grande | Presidio |
| 957 | Cert of Adj | | EVA MARIA NIETO ET AL | 536 | Irr | 1/1/1932 | | | | Rio Grande | Presidio |
| 958 | Cert of Adj | | OSCAR CARNERO | 48.28 | Irr | 1/1/1932 | | | | Rio Grande | Presidio |
| 958 | Cert of Adj | | MANUEL COVOS ET UX | 43.72 | Irr | 1/1/1932 | | | | Rio Grande | Presidio |
| 960 | Cert of Adj | | LAURENCIO BRITO | 140 | Irr | 1/1/1932 | | | | Rio Grande | Presidio |
| 961 | Cert of Adj | | LAURENCIO BRITO | 72 | Irr | 1/1/1925 | | | | Rio Grande | Presidio |
| 962 | Cert of Adj | | REYNALDO HERNANDEZ | 96 | Irr | 1/1/1925 | | | | Rio Grande | Presidio |
| 963 | Cert of Adj | | RCS INC | 160 | Irr | 1/1/1900 | | | | Rio Grande | Presidio |
| 964 | Cert of Adj | | RCS INC | 376 | Irr | 1/1/1927 | | | | Rio Grande | Presidio |
| 965 | Cert of Adj | | GEORGE & CONSUELO HERNANDEZ | 60 | Irr | 1/1/1900 | | | | Rio Grande | Presidio |
| 966 | Cert of Adj | | HECTOR A HERNANDEZ | 80 | Irr | 1/1/1918 | | | | Rio Grande | Presidio |
| 967 | Cert of Adj | | HERMINIA M MCCALL | 80 | Irr | 1/1/1932 | | | | Rio Grande | Presidio |
| 967 | Cert of Adj | | HERMINIA M MCCALL ET AL | 180 | Irr | 1/1/1932 | | | | Rio Grande | Presidio |
| 969 | Cert of Adj | | JOHN T MACGUIRE ET UX | | Rec | 10/13/1910 | SAN ESTEBAN DAM & LAKE | 1870 | | Rio Grande | Presidio |
| 971 | Cert of Adj | | WILLIAM M WEATHERS ET UX | 35 | Irr | 1/1/1918 | | | | Rio Grande | Presidio |
| 972 | Cert of Adj | | LUCIA H RUSSELL ESTATE | 80 | Irr | 10/13/1927 | | | | Rio Grande | Presidio |
| 973 | Cert of Adj | | JOSE A HERNANDEZ | 96 | Irr | 1/1/1948 | | | | Rio Grande | Presidio |
| 974 | Cert of Adj | | PRESIDIO CO WID 1 | 2780 | Irr | 1/1/1978 | | | | Rio Grande | Presidio |
| 975 | Cert of Adj | | LAJITAS CAPITAL PARTNERS LLC | 380 | Irr | 1/1/1908 | | | | Rio Grande | Presidio |
| 976 | Cert of Adj | | RUBEN H MADRID | 56 | Irr | 1/1/1952 | | | | Rio Grande | Presidio |
| 977 | Cert of Adj | | LYDIA MADRID | 40 | Irr | 1/1/1945 | | | | Rio Grande | Presidio |
| 978 | Cert of Adj | | MARGARITA C MADRID ET AL | 32 | Irr | 1/1/1953 | | | | Rio Grande | Presidio |
| 978 | Cert of Adj | | MARGARITA C MADRID ET AL | 304 | Irr | 8/12/1974 | | | | Rio Grande | Presidio |
| 979 | Cert of Adj | | JOSEPH TRAVIS TUCKER JR | 52 | Irr | 1/1/1953 | | | | Rio Grande | Presidio |

## APPENDIX 3A. (Continued) AUTHORIZED SURFACE WATER RIGHTS

| Water Right Number | Water Right Type | Application Number | Owner | Diversion Amount (ac-ft) | Use | Priority Date | Reservoir Name | Reservoir Capacity (ac-ft) | Site Name | Basin | County |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 980 | Cert of Adj | | JOSEPH TRAVIS TUCKER JR | 52 | Irr | 1/1/1953 | | | | Rio Grande | Presidio |
| 981 | Cert of Adj | | NADINE PINEDA MATA | 84 | Irr | 1/1/1921 | | | | Rio Grande | Presidio |
| 981 | Cert of Adj | | LEO N PINEDA | 84 | Irr | 1/1/1921 | | | | Rio Grande | Presidio |
| 982 | Cert of Adj | | JAIME REDE MADRID ET AL | 80 | Irr | 1/1/1947 | | | | Rio Grande | Presidio |
| 983 | Cert of Adj | | THOMAS A MALLAN | 84 | Irr | 1/1/1947 | | | | Rio Grande | Presidio |
| 985 | Cert of Adj | | ADAN MADRID & NINFA MADRID | 20 | Irr | 1/1/1921 | | | | Rio Grande | Presidio |
| 986 | Cert of Adj | | LAJITAS CAPITAL PARTNERS LLC | 224.26 | Irr | 3/26/1917 | | | | Rio Grande | Brewster |
| 986 | Cert of Adj | | LAJITAS MUNICIPAL SERVICES CO LLC | 144 | Mun | 3/26/1917 | | | | Rio Grande | Brewster |
| 986 | Cert of Adj | | FRANK W HOWARD | 0.74 | Irr | 3/26/1917 | | | | Rio Grande | Brewster |
| 987 | Cert of Adj | | US NATIONAL PARK SVC/US DEPT OF | 530 | Mun | 11/17/1915 | | | BIG BEND NATIONAL PARK.US | Rio Grande | Brewster |
| 987 | Cert of Adj | | US NATIONAL PARK SVC/US DEPT OF | 1000 | Irr | 11/17/1915 | | | U S DEPT OF THE INTERIOR | Rio Grande | Brewster |
| 988 | Cert of Adj | | EL CARMEN LAND & CONSERVATION CO LLC | 20 | Irr | 1/1/1932 | | | | Rio Grande | Brewster |
| 989 | Cert of Adj | | EL CARMEN LAND & CONSERVATION CO LLC | 180 | Irr | 1/1/1932 | | | | Rio Grande | Brewster |
| 990 | Cert of Adj | | SUSAN COMBS ET AL | 1520 | Irr | 7/2/1925 | | | COMBS MARAVILLAS RANCHES | Rio Grande | Brewster |
| 991 | Cert of Adj | | W N CHRIS JORDAN | 3800 | Irr | 7/2/1925 | | | | Rio Grande | Brewster |
| 991 | Cert of Adj | | E A BASSE III | 3800 | Irr | 7/2/1925 | | | | Rio Grande | Brewster |
| 992 | Cert of Adj | | BYRON HODGE ET AL | 152 | Irr | 1/1/1956 | | | | Rio Grande | Terrell |
| 1172 | Cert of Adj | | SCOTT LOCKE MCIVOR | 15 | Irr | 4/1/1963 | | 20 | | Rio Grande | Jeff Davis |
| 1172 | Cert of Adj | | SCOTT LOCKE MCIVOR | | Rec | 4/1/1963 | | | | Rio Grande | Jeff Davis |
| 1173 | Cert of Adj | | TANNER FULTON WHITESELL | 13.8 | Irr | 1/1/1923 | | | | Rio Grande | Jeff Davis |
| 1173 | Cert of Adj | | TRENT MCCANN WHITESELL | 13.8 | Irr | 1/1/1923 | | | | Rio Grande | Jeff Davis |
| 1173 | Cert of Adj | | STEPHANIE SPROUL RENTFRO | 13.8 | Irr | 1/1/1923 | | | | Rio Grande | Jeff Davis |
| 1173 | Cert of Adj | | JOHNATHAN MCCANN RENTFRO | 13.8 | Irr | 1/1/1923 | | | | Rio Grande | Jeff Davis |
| 1173 | Cert of Adj | | ZACHARY EVERETT RENTFRO | 13.8 | Irr | 1/1/1923 | | | | Rio Grande | Jeff Davis |
| 1174 | Cert of Adj | | H E SPROUL | 224 | Irr | 1/1/1992 | | 3 | | Rio Grande | Jeff Davis |
| 1174 | Cert of Adj | | H E SPROUL | | Rec | 1/1/1992 | | | | Rio Grande | Jeff Davis |
| 1175 | Cert of Adj | | ISABEL CECILIA THOMPSON | 5 | Irr | 1/1/1916 | | | | Rio Grande | Jeff Davis |
| 1176 | Cert of Adj | | JIMMY G & BESSIE J HIGGINS | 4 | Irr | 1/1/1985 | | | | Rio Grande | Jeff Davis |
| 1177 | Cert of Adj | | GEORGE A HOFFMAN MD ET AL | 50 | Irr | 11/4/1907 | | | | Rio Grande | Jeff Davis |
| 1178 | Cert of Adj | | ESTELLE LANGHAM SHARP | 15 | Irr | 1/1/3796 | | | | Rio Grande | Jeff Davis |
| 1392 | App/Perm | 149 | U S BUREAU OF RECLAM | 18000 | Irr | 6/18/1946 | | | BUREAU OF RECLAMATION | Rio Grande | Jeff Davis |
| 2926 | Claim | | LEONCITA LAND COMPANY | | Irr | 8/28/1969 | | 900 | | Rio Grande | Brewster |
| 3002 | App/Perm | 324 | JOE RUSSELL BROWN | 312 | Irr | 6/15/1974 | | | | Rio Grande | Hudspeth |
| 3003 | App/Perm | 324 | JOE RUSSELL BROWN | 156 | Irr | 7/15/1974 | | | | Rio Grande | Hudspeth |
| 3005 | App/Perm | 325 | THOMAS E HAEFELI ET AL | 108 | Irr | 8/12/1974 | | | | Rio Grande | Presidio |
| 3006 | App/Perm | 325 | LAJITAS RESORT LTD | 132 | Irr | 8/12/1974 | | | | Rio Grande | Presidio |
| 3032 | App/Perm | 329 | POPE RANCH | 140.7 | Irr | 11/4/1974 | | | | Rio Grande | Brewster |
| 3032 | App/Perm | 329 | POPE RANCHES LP | 1119.3 | Irr | 11/4/1974 | | | | Rio Grande | Brewster |
| 3033 | App/Perm | 332 | SUSAN COMBS ET AL | 80 | Irr | 12/16/1974 | SUMP HOLE AT THE CONFLUENCE OF | 10 | COMBS MARAVILLAS RANCHES | Rio Grande | Brewster |
| 3033 | App/Perm | 332 | SUSAN COMBS ET AL | 20 | Rec | 12/16/1974 | | | COMBS MARAVILLAS RANCHES | Rio Grande | Brewster |
| 3033 | App/Perm | 332 | SUSAN COMBS ET AL | | Irr | 12/16/1974 | | | COMBS MARAVILLAS RANCHES | Rio Grande | Brewster |
| 3034 | App/Perm | 332 | SUSAN COMBS ET AL | 450 | Irr | 12/16/1974 | | | COMBS MARAVILLAS RANCHES | Rio Grande | Brewster |
| 3041 | App/Perm | 331 | TEXAS PARKS & WILDLIFE DEPT | 1017 | Irr | 12/9/1974 | | | | Rio Grande | Hudspeth |
| 3041 | App/Perm | 331 | TEXAS PARKS & WILDLIFE DEPT | | Other | 12/9/1974 | | | | Rio Grande | Hudspeth |
| 3092 | App/Perm | 339 | LUCIA H RUSSELL ESTATE | 100 | Irr | 1/12/1970 | | | | Rio Grande | Presidio |
| 3112 | App/Perm | 339 | TEXAS PARKS & WILDLIFE DEPT | 156 | Irr | 2/10/1975 | | | | Rio Grande | Presidio |
| 3113 | App/Perm | 340 | WALTER TRAVIS POTTER | 200 | Irr | 2/24/1975 | | | | Rio Grande | Brewster |
| 3133 | App/Perm | 336 | NEVILLE RANCH | 18 | Irr | 6/24/1975 | | | | Rio Grande | Brewster |
| 3133 | App/Perm | 336 | ELINOR FRANCES GREEN | 162 | Irr | 1/20/1975 | | 9 | | Rio Grande | Brewster |
| 3144 | App/Perm | 340 | JACKSON B LOVE JR | 400 | Irr | 3/3/1975 | | | | Rio Grande | Brewster |
| 3153 | App/Perm | 340 | J FRANK WOODWARD JR | 12.5 | Irr | 3/3/1975 | | | | Rio Grande | Brewster |

## APPENDIX 3A. (Continued) AUTHORIZED SURFACE WATER RIGHTS

| Water Right Number | Water Right Type | Application Number | Owner | Diversion Amount (ac-ft) | Use | Priority Date | Reservoir Name | Reservoir Capacity (ac-ft) | Site Name | Basin | County |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5375 | App/Perm | 5375 | BREWSTER COUNTY | | Rec | 8/16/1991 | | 7 | | Rio Grande | Brewster |
| 5439 | Cert of Adj | | CITY OF BALMORHEA | 644 | Mun | 1/29/1930 | | 109 | | Rio Grande | Jeff Davis |
| 5440 | Cert of Adj | | JAMES P ESPY JR ET AL | 45 | Irr | 12/31/1939 | 2 1-AF RESERVOIRS | 2 | | Rio Grande | Jeff Davis |
| 5451 | Cert of Adj | | MISSOURI PACIFIC RAILROAD | | Stor | 6/16/1914 | LEVINSON RES | 597 | | Rio Grande | Jeff Davis |
| 5451 | Cert of Adj | | MISSOURI PACIFIC RAILROAD | | Stor | 7/25/1960 | LEVINSON RES | 327 | | Rio Grande | Jeff Davis |
| 5451 | Cert of Adj | | J L DAVIS | 223 | Irr | 7/25/1960 | | | | Rio Grande | Jeff Davis |
| 5452 | Cert of Adj | | BARRY A BEAL | 50 | Irr | 11/13/1915 | | 2 | | Rio Grande | Jeff Davis |
| 5462 | Cert of Adj | | ESTATE OF JOE B CHANDLER ET AL | 125.09 | Irr | 2/17/1920 | 2 RES; 8 AF & 6 AF | 14 | | Rio Grande | Terrell |
| 5462 | Cert of Adj | | JOBETH ELROD & CHARLENA J CHANDLER | 10.72 | Irr | 2/17/1920 | | | | Rio Grande | Terrell |
| 5462 | Cert of Adj | | THE NATURE CONSERVANCY | 4.19 | Irr | 2/17/1920 | | | | Rio Grande | Terrell |
| 5463 | Cert of Adj | | THE NATURE CONSERVANCY | 530 | Irr | 12/31/1900 | 3 RESERVOIRS | 192 | | Rio Grande | Terrell |
| 5464 | Cert of Adj | | WILSON HARDIN "CY" BANNER | 150 | Irr | 12/31/1919 | | | | Rio Grande | Terrell |
| 5465 | Cert of Adj | | JOHN EDWARD ROBBINS | 8.25 | Irr | 7/12/1919 | | | | Rio Grande | Terrell |
| 5465 | Cert of Adj | | JOHN CLARK | | Irr | 7/12/1919 | | | | Rio Grande | Terrell |
| 5466 | Cert of Adj | | WILSON HARDIN "CY" BANNER | 44.4 | Irr | 12/31/1917 | | 15 | | Rio Grande | Terrell |
| 5466 | Cert of Adj | | MATTIE BANNER BELL | 0.6 | Irr | 12/31/1917 | | | | Rio Grande | Terrell |
| 5467 | Cert of Adj | | C L RANCH PARTNERSHIP | 2200 | Irr | 9/15/1980 | | 775 | | Rio Grande | Hudspeth |
| 5467 | Cert of Adj | | CONNECTICUT MUTUAL LIFE INS CO | | Irr | 9/15/1980 | | | | Rio Grande | Hudspeth |
| 5467 | Cert of Adj | | JAMES & MARY LYNCH JR | | Irr | 9/15/1980 | | | | Rio Grande | Hudspeth |
| 5468 | Cert of Adj | | C L MACHINERY CO ET AL | 2400 | Irr | 9/15/1980 | | 458 | | Rio Grande | Hudspeth |
| 5468 | Cert of Adj | | CONNECTICUT MUTUAL LIFE INS CO | | Irr | 9/15/1980 | | | | Rio Grande | Hudspeth |
| 5469 | Cert of Adj | | C L RANCH PARTNERSHIP | 2100 | Irr | 9/15/1980 | | 588 | | Rio Grande | Hudspeth |
| 5940 | Cert of Adj | | UNITED STATES OF AMERICA | 376000[1] | Mun | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | 26388 | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | UNITED STATES OF AMERICA | | Ind | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | UNITED STATES OF AMERICA | | Irr | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | UNITED STATES OF AMERICA | | Min | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | UNITED STATES OF AMERICA | | Rec | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | EL PASO CO WID 1 | | Mun | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | EL PASO CO WID 1 | | Ind | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | EL PASO CO WID 1 | | Irr | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | EL PASO CO WID 1 | | Min | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5940 | Cert of Adj | | EL PASO CO WID 1 | | Rec | 7/6/1899 | ELEPHANT BUTTE RES & CABALLO RES | | MESILLA, AMERICAN, RIVERSIDE | Rio Grande | El Paso |
| 5941 | Cert of Adj | | CEMEX EL PASO INC | 178 | Ind | 1/1/1910 | CEMENT LAKE | 178 | | Rio Grande | El Paso |
| 5942 | Cert of Adj | | CITY OF EL PASO | 11000 | Mun | 11/1/1948 | | | | Rio Grande | El Paso |
| 5943 | Cert of Adj | | INDIAN CLIFFS RANCH INC | | Rec | 10/11/1977 | | 52 | | Rio Grande | El Paso |
| 5944 | Cert of Adj | | UNITED STATES OF AMERICA | 27,000[2] | Irr | 11/22/1917 | | | | Rio Grande | El Paso |
| 5944 | Cert of Adj | | HUDSPETH COUNTY CRD 1 | | Irr | 11/22/1917 | | | | Rio Grande | El Paso |
| 5944 | Cert of Adj | | HUDSPETH COUNTY CRD 1 | | Ind | 11/22/1917 | | | | Rio Grande | El Paso |
| 5944 | Cert of Adj | | HUDSPETH COUNTY CRD 1 | | Min | 11/22/1917 | | | | Rio Grande | El Paso |
| 5944 | Cert of Adj | | HUDSPETH COUNTY CRD 1 | | Rec | 11/22/1917 | | | | Rio Grande | El Paso |

1. TCEQ indicated that CA 5940 has an authorization for water in addition to the 376,000 acre-feet of project water in the amount of 1,899 acre-feet per year that is not reflected in the Active Water Rights Master File.

2. TCEQ's Active Water Rights Master File says permitted diversion of CA 5944 is 26,600 ac-ft/yr but TCEQ confirmed that the value in the WAM, 27,000 ac-ft/yr, is correct.

# CHAPTER 4

# IDENTIFICATION OF WATER NEEDS

*This page intentionally left blank.*

# 4 IDENTIFICATION OF WATER NEEDS

Chapter 4 provides projections (Table 4-1) of water supply surpluses or deficits by decade based on a comparison of projected water demands by decade for each water-use entity from Chapter 2 (Table 2-2) with water supplies available to meet those demands from Chapter 3 (Table 3-2). Entities are then identified that, in any decade within the 50-year planning period, develop a water-supply need (deficit) that is greater than that entity's ability to provide a supply to meet that need. A water supply deficit may develop for individual water-use entities for numerous reasons including supply availability limits, infrastructure limitations, or legal limits. Table 4-2 provides the needs/surpluses analysis for all major water providers within the Far West Texas Region.

Water supply deficits are identified for several municipalities, manufacturing use and steam power electric generation in El Paso County; for irrigation supply use in Culberson and El Paso Counties, and for mining supply in El Paso, Hudspeth and Terrell Counties.

A secondary water needs analysis for all water user groups and wholesale water providers for which conservation or direct reuse water management strategies are recommended is provided in Table 4-3. This secondary water needs analysis calculates the water needs that would remain after assuming all recommended conservation and reuse water management strategies are fully implemented. Table 4-4 presents unmet needs resulting from insufficient supplies to meet certain strategies.

Water supply strategy recommendations are then made in Chapter 5 for those water users that have projected water supply deficits based on the comparison between demand and supply. In addition, strategies are also developed for specific entities that although they are not projected to have future shortages, they do have anticipated water-supply projects that deserve to be recognized in the *Regional Plan*. A socioeconomic impact of unmet water needs analysis prepared by the Texas Water Development Board is provided in Chapter 6, Appendix 6A.

**Table 4-1. Identified Water (Needs)/Surpluses**
**(Acre Feet per Year)**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Brewster County** | | | | | | |
| Alpine | 597 | 587 | 596 | 598 | 594 | 591 |
| Lajitas Municipal Services | 228 | 227 | 228 | 228 | 227 | 227 |
| Marathon Water Supply | 118 | 116 | 116 | 115 | 115 | 115 |
| County-Other | 275 | 255 | 253 | 250 | 247 | 244 |
| Livestock | 19 | 19 | 19 | 19 | 19 | 19 |
| Irrigation | 1,381 | 1,381 | 1,381 | 1,381 | 1,381 | 1,381 |
| **Brewster County Total Needs/Surplus** | 2,618 | 2,585 | 2,593 | 2,591 | 2,583 | 2,577 |
| **Culberson County** | | | | | | |
| Van Horn | 354 | 305 | 279 | 256 | 242 | 233 |
| County-Other | 92 | 88 | 86 | 84 | 83 | 82 |
| Manufacturing | 1 | 0 | 0 | 0 | 0 | 0 |
| Mining | 1,926 | 1,192 | 1,039 | 1,322 | 1,589 | 1,792 |
| Livestock | 15 | 15 | 15 | 15 | 15 | 15 |
| Irrigation | (333) | (333) | (333) | (333) | (333) | (333) |
| **Culberson County Total Needs/Surplus** | 2,055 | 1,267 | 1,086 | 1,344 | 1,596 | 1,789 |
| **El Paso County** | | | | | | |
| Anthony | 762 | 627 | 499 | 369 | 241 | 120 |
| East Biggs Water System | 444 | 444 | 444 | 444 | 444 | 444 |
| East Montana Water System | 435 | 350 | 267 | 177 | 86 | 0 |
| El Paso County Tornillo WID | 487 | 495 | 501 | 504 | 504 | 503 |
| El Paso WCID #4 | 1,045 | 1,062 | 1,074 | 1,072 | 1,057 | 1,039 |
| El Paso Water | 20,428 | 10,685 | 1,287 | (8,978) | (19,601) | (29,792) |
| Federal Correctional Institution La Tuna | 1,664 | 1,671 | 1,674 | 1,676 | 1,677 | 1,677 |
| Fort Bliss Water Services | 2,277 | 2,237 | 2,134 | 1,976 | 1,827 | 1,677 |
| Haciendas Del Norte WID | 110 | 88 | 66 | 44 | 21 | 0 |
| Horizon Regional MUD | (2,709) | (5,816) | (8,735) | (11,641) | (14,403) | (17,008) |
| Lower Valley Water District | (1,358) | (2,207) | (3,042) | (3,934) | (4,833) | (5,689) |
| Paseo Del Este MUD 1 | 575 | (462) | (351) | 232 | 114 | 0 |
| County-Other \| Vinton Hills Estates | 56 | 35 | 16 | (4) | (24) | (42) |
| County-Other \| Vinton Hills Subdivision | 131 | 83 | 38 | (10) | (54) | (96) |
| County-Other | 4,192 | 3,520 | 2,883 | 2,223 | 1,598 | 1,006 |
| Manufacturing | 269 | (860) | (860) | (860) | (860) | (860) |
| Mining | (1,851) | (2,469) | (3,105) | 3,791 | (4,536) | (5,382) |
| Steam Electric Power | (7,260) | (7,260) | (7,260) | (7,260) | (7,260) | (7,260) |
| Livestock | 67 | 67 | 67 | 67 | 67 | 67 |
| Irrigation | (41,404) | (41,404) | (41,404) | (41,404) | (41,404) | (41,404) |
| **El Paso County Total Needs/Surplus** | (21,640) | (38,190) | (53,105) | (69,098) | (85,339) | (101,000) |
| **Hudspeth County** | | | | | | |
| Esperanza Water Service | 342 | 332 | 331 | 330 | 329 | 328 |
| Hudspeth County WCID 1 | 390 | 381 | 380 | 379 | 378 | 377 |
| County-Other \| Dell City | 18 | 16 | 16 | 16 | 16 | 16 |
| County-Other \| Fort Hancock WCID | 156 | 151 | 151 | 151 | 150 | 149 |
| County-Other | (35) | (38) | (38) | (38) | (38) | (39) |
| Mining | (196) | (168) | (185) | (200) | (209) | (219) |
| Livestock | 23 | 23 | 23 | 23 | 23 | 23 |
| Irrigation | 10,412 | 10,412 | 10,412 | 10,412 | 10,412 | 10,412 |
| **Hudspeth County Total Needs/Surplus** | 1,114 | 11,109 | 11,090 | 11,073 | 11,061 | 11,047 |

**Table 4-1. (continued) Identified Water (Needs)/Surpluses**
**(Acre Feet per Year)**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Jeff Davis County** | | | | | | |
| Fort Davis | 149 | 154 | 159 | 161 | 161 | 161 |
| County-Other \| City of Valentine | 0 | 1 | 1 | 2 | 2 | 2 |
| County-Other | 191 | 195 | 198 | 200 | 200 | 200 |
| Mining | 0 | 0 | 0 | 0 | 0 | 0 |
| Livestock | 73 | 73 | 73 | 73 | 73 | 73 |
| Irrigation | 701 | 701 | 701 | 701 | 701 | 701 |
| **Jeff Davis County Total Needs/Surplus** | 1,114 | 1,124 | 1,132 | 1,137 | 1,137 | 1,137 |
| **Presidio County** | | | | | | |
| Marfa | 1,407 | 1,362 | 1,316 | 1,256 | 1,202 | 1,150 |
| Presidio | 3,028 | 2,994 | 2,958 | 2,910 | 2,861 | 2,813 |
| County-Other | 382 | 370 | 359 | 343 | 329 | 316 |
| Mining | 0 | 403 | 403 | 403 | 403 | 403 |
| Livestock | 38 | 38 | 38 | 38 | 38 | 38 |
| Irrigation | 4,995 | 4,995 | 4,995 | 4,995 | 4,995 | 4,995 |
| **Presidio County Total Needs/Surplus** | 9,850 | 10,162 | 10,069 | 9,945 | 9,828 | 9,715 |
| **Terrell County** | | | | | | |
| Terrell County WCID 1 | 298 | 298 | 298 | 299 | 299 | 299 |
| County-Other | 54 | 54 | 55 | 55 | 55 | 55 |
| Mining | (483) | (586) | (550) | (416) | (293) | (195) |
| Livestock | 55 | 55 | 55 | 55 | 55 | 55 |
| Irrigation | 163 | 163 | 163 | 163 | 163 | 163 |
| **Terrell County Total Needs/Surplus** | 87 | (16) | 21 | 156 | 279 | 377 |
| **Region E Total Needs/Surplus** | **29,969** | **16,344** | **1,189** | **(14,549)** | **(30,552)** | **(46,055)** |

Note: ( ) Indicates an identified water need.

**Table 4-2. Wholesale Water Provider (Needs)/Surpluses**
**(Acre-Feet per Year)**

| **Wholesale Water Provider** | | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
|---|---|---|---|---|---|---|---|
| El Paso County WID#1 | Total Supply | 167,633 | 169,570 | 171,430 | 173,553 | 174,328 | 174,328 |
| | Total Demand | 291,418 | 293,850 | 289,713 | 290,612 | 291,967 | 293,358 |
| | **Surplus / (Need)** | **(123,785)** | **(124,280)** | **(118,283)** | **(117,059)** | **(117,639)** | **(119,030)** |
| El Paso Water Utilities | Total Supply | 147,614 | 148,891 | 150,016 | 151,240 | 152,396 | 153,702 |
| | Total Demand | 137,479 | 150,245 | 161,496 | 173,735 | 185,304 | 198,364 |
| | **Surplus / (Need)** | **10,135** | **(1,354)** | **(11,480)** | **(22,495)** | **(32,908)** | **(44,662)** |
| Lower Valley Water District | Total Supply | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 |
| | Total Demand | 6,842 | 7,884 | 8,886 | 9,966 | 11,069 | 12,122 |
| | **Surplus / (Need)** | **(2,486)** | **(3,528)** | **(4,530)** | **(5,610)** | **(6,713)** | **(7,766)** |
| Horizon MUD | Total Supply | 5,546 | 5,546 | 5,546 | 5,546 | 5,546 | 5,546 |
| | Total Demand | 8,131 | 11,331 | 14,338 | 17,330 | 20,171 | 22,850 |
| | **Surplus / (Need)** | **(2,585)** | **(5,785)** | **(8,792)** | **(11,784)** | **(14,625)** | **(17,304)** |

**Table 4.3 Second-Tier Identified Water Needs**
**(Acre Feet per Year)**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Brewster County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Alpine | 0 | 0 | 0 | 0 | 0 | 0 |
| Lajitas Municipal Services | 0 | 0 | 0 | 0 | 0 | 0 |
| Marathon WSSS | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other | 0 | 0 | 0 | 0 | 0 | 0 |
| Livestock | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | 0 | 0 | 0 | 0 | 0 | 0 |
| **Culberson County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Van Horn | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other | 0 | 0 | 0 | 0 | 0 | 0 |
| Manufacturing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mining | 0 | 0 | 0 | 0 | 0 | 0 |
| Livestock | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | 226 | 226 | 5,751 | 5,751 | 5,751 | 5,751 |
| **El Paso County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Anthony | 0 | 0 | 0 | 0 | 0 | 0 |
| East Biggs WS | 0 | 0 | 0 | 0 | 0 | 0 |
| East Montana WS | 0 | 0 | 0 | 0 | 0 | 0 |
| El Paso County Tornillo WID | 0 | 0 | 0 | 0 | 0 | 0 |
| El Paso WCID #4 | 0 | 0 | 0 | 0 | 0 | 0 |
| El Paso Water | 0 | 0 | 0 | 0 | 0 | 0 |
| Federal Correctional Institution La Tuna | 0 | 0 | 0 | 0 | 0 | 0 |
| Fort Bliss Water Services | 0 | 0 | 0 | 0 | 0 | 0 |
| Haciendas Del Norte WID | 0 | 0 | 0 | 0 | 0 | 0 |
| Horizon Regional MUD | 2,433 | 5,432 | 8,249 | 11,054 | 13,720 | 16,235 |
| Lower Valley WD | 1,301 | 2,141 | 2,968 | 3,851 | 4,741 | 5,589 |
| Paseo Del Este MUD 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other \| Vinton Hills Estates | 0 | 0 | 0 | 4 | 24 | 42 |
| County-Other \| Vinton Hills Subdivision | 0 | 0 | 0 | 10 | 54 | 96 |
| Manufacturing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mining | 1,573 | 2,099 | 2,639 | 3,222 | 3,856 | 4,575 |
| Livestock | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | 12,941 | 12,941 | 12,941 | 12,941 | 12,941 | 12,941 |
| **Hudspeth County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Esperanza Water Service | 0 | 0 | 0 | 0 | 0 | 0 |
| Hudspeth County WCID #1 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 4.3 (Continued) Second-Tier Identified Water Needs**
**(Acre Feet per Year)**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Hudspeth County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| County-Other | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other \| Dell City | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other \| Fort Hancock WCID | 0 | 0 | 0 | 0 | 0 | 0 |
| Mining | 167 | 143 | 157 | 170 | 178 | 186 |
| Livestock | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | 0 | 0 | 0 | 0 | 0 | 0 |
| **Jeff Davis County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Fort Davis WSC | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other \| City of Valentine | 0 | 0 | 0 | 0 | 0 | 0 |
| Mining | 0 | 0 | 0 | 0 | 0 | 0 |
| Livestock | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | 0 | 0 | 0 | 0 | 0 | 0 |
| **Presidio County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Marfa | 0 | 0 | 0 | 0 | 0 | 0 |
| Presidio | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other | 0 | 0 | 0 | 0 | 0 | 0 |
| Mining | 0 | 0 | 0 | 0 | 0 | 0 |
| Livestock | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | 0 | 0 | 0 | 0 | 0 | 0 |
| **Terrell County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Terrell County WCID #1 | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other | 0 | 0 | 0 | 0 | 0 | 0 |
| Mining | 411 | 498 | 467 | 354 | 249 | 166 |
| Livestock | 0 | 0 | 0 | 0 | 0 | 0 |
| Irrigation | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 4.4 WUG Unmet Needs**
**(Acre Feet per Year)**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Culberson County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Irrigation | 0 | 0 | 5,418 | 5,418 | 5,418 | 5,418 |
| **El Paso County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Horizon Regional MUD | 0 | 0 | 0 | 0 | 0 | 0 |
| County-Other \| Vinton Hills Subdivision | 0 | 0 | 0 | 10 | 54 | 96 |
| Mining | 0 | 0 | 0 | 0 | 0 | 324 |
| Irrigation | 4,691 | 4,691 | 4,691 | 4,691 | 4,691 | 4,691 |
| **Terrell County** | | | | | | |
| **Rio Grande Basin** | | | | | | |
| Mining | 411 | 498 | 467 | 354 | 249 | 166 |

*This page is intentionally left blank*

# CHAPTER 5

# WATER MANAGEMENT STRATEGIES AND CONSERVATION RECOMMENDATIONS

*This page intentionally left blank.*

# 5 WATER MANAGEMENT STRATEGIES AND CONSERVATION RECOMMENDATIONS

A water management strategy is a plan to meet an identified water need for additional water by an entity, which can mean increasing the total water supply or maximizing an existing supply, including through reducing demand. When a water management strategy project is implemented, it is intended to develop, deliver, and/or treat additional water supply volumes, or conserve water for an entity (TWDB-Exhibit C General Guidelines-April 2018).

The Far West Texas Water Planning Group (FWTWPG) has identified and evaluated a total of 65 water management strategies. Of this total, 58 strategies are recommended and 7 are designated as alternate strategies. Water management strategies are developed for entities where future water supply needs exist (as required by statute and administrative rules 31 TAC §357.34; 357.35). A need for water is identified when existing water supplies are less than projected water demands for that same water user group (WUG) within any planning decade. In addition, water management strategies were developed for other entities requesting specific water supply projects, even though these entities did not have a projected water supply shortage. All planning analyses applied and recommendations made in the development of this *Plan* honor all existing water rights, contracts, and option agreements; and have no impact on navigation on any of the Region's surface water streams and rivers.

## 5.3 IDENTIFICATION OF POTENTIALLY FEASIBLE WATER MANAGEMENT STRATAGIES

The first step in developing a list of recommended water management strategies is to take a "big picture" look at possible projects that could reasonably be expected to result in water-supply improvements. As required by TWC §16.053(d)(5) and TAC §357.34(c) the regional water plan shall consider, but not be limited to, the following potentially feasible water management strategies:

1. Conservation
2. Drought management
3. Reuse
4. Management of existing water supplies
5. Conjunctive use
6. Acquisition of available existing water supplies
7. Development of new water supplies
8. Developing regional water supply facilities or providing regional management of water supply facilities
9. Developing large-scale desalination facilities for seawater or brackish groundwater that serve local or regional brackish groundwater production zones identified and designated under TWC §16.060(b)(5)34
10. Developing large-scale desalination facilities for marine seawater that serve local or regional entities
11. Voluntary transfer of water within the region using, but not limited to, contracts, water marketing, regional water banks, sales, leases, options, subordination agreements, and financing agreements
12. Emergency transfer of water under TWC §11.139
13. Interbasin transfers of surface water
14. System optimization
15. Reallocation of reservoir storage to new uses
16. Enhancements of yields
17. Improvements to water quality
18. New surface water supply
19. New groundwater supply
20. Brush control
21. Precipitation enhancement
22. Aquifer storage and recovery
23. Cancellation of water rights
24. Rainwater harvesting

Other potential projects considered for the initial list included:

- appropriate strategies from the *2016 Plan*
- water-loss audits and line replacement
- projects suggested by municipalities through a survey
- projects that are currently or have recently applied to the TWDB for funding

The following process was used by the FWTWPG to identify *potentially feasible water management strategies*.

1. Receive a *Needs Analysis Report* from the TWDB, which provides a comparison of existing water supplies and projected water demands for each water user group (WUG) and wholesale water provider (WWP) in the region. Based on this comparison, the report identifies WUGs and WWPs that are expected to experience needs for additional water supplies within the 50-year time frame of the regional water plan. Using the following process, identify and select potentially feasible water management strategies for each of these entities.
2. Review and consider recommended water management strategies adopted by the water planning group for the *2016 Far West Texas Water Plan*.
3. Review and consider any issues identified in the most current TWDB Water Loss Audit Report, including leak detection and supply side analysis.
4. Solicit current water planning information, including specific water management strategies of interest from WUGs and WWPs with identified needs.
5. Review and consider the most recent Water Supply Management, Water Conservation, and/or Drought Contingency Plans, where available, from WUGs and WWPs with identified needs.
6. Consider potentially feasible water management strategies that may include, but are not limited to (Chapter 357 Subchapter C §357.34):
    - Extended use of existing supplies including:
        a. System optimization and conjunctive use of water resources
        b. Reallocation of reservoir storage to new uses
        c. Voluntary redistribution of water resources including contracts, water marketing, regional water banks, sales, leases, options, subordination agreements, and financing agreements
        d. Subordination of existing water rights through voluntary agreements
        e. Enhancement of yields of existing sources
        f. Improvement of water quality including control of naturally occurring chlorides
        g. Drought management
    - New supply development including:
        a. Construction and improvement of surface water and groundwater resources
        b. Brush control
        c. Precipitation enhancement
        d. Desalination
        e. Water supply that could be made available by cancellation of water rights
        f. Rainwater harvesting

g. Aquifer storage and recovery

- Conservation and drought management measures including demand management
- Reuse of wastewater
- Interbasin transfers of surface water
- Emergency transfers of surface water

7. Consider other *potentially feasible water management strategies* suggested by planning group members, stakeholders, and the public.
8. Based on the above reviews and considerations, establish a preliminary list of *potentially feasible water management strategies*. At a discussion level, consider the following feasibility concerns for each strategy:
    - Water supply source availability during drought-of-record conditions
    - Cost/benefit
    - Water quality
    - Threats to agriculture and natural resources
    - Impacts to the environment, other water resources, and basin transfers
    - Socio-economic impacts
9. Based on the above discussion level analysis, select a final list of *potentially feasible water management strategies* for further technical evaluation using detailed analysis criteria.

Using the above criteria and process, the FWTWPG selected the initial *potentially feasible water management strategies* listed in Table 5-1 for further detailed analysis. As the water management strategy analysis progressed, it became evident that the initial list would require modification of project descriptive names, and the possible addition of new strategies and the elimination or transfer of others. Much time was spent in communication with individual WUGs (municipalities, irrigation districts, etc.) to ensure that the strategies discussion met with their approval. The evaluation and final recommendation of water management strategies are provided in the following Section 5.2.

Although these strategy types were considered by the FWTWPG, not all of them were considered viable options for addressing long-term needs in the region. The FWTWPG does not consider drought management as a feasible strategy to meet long-term growth in demands or current needs. This strategy is considered a temporary measure aimed at conserving available water supplies during times of drought or emergencies. Drought management is most adequately addressed in the region through the implementation of local drought contingency plans. The FWTWPG is supportive of the development and use of these plans during periods of drought or emergency water needs.

**Table 5-1. Far West Texas Potentially Feasible Water Management Strategies**

| County | Water User Group | WMS# | Strategy | Source |
|---|---|---|---|---|
| Brewster | Brewster County Other (Marathon WSSService) | E-1 | Water loss audit and main-line repair | Conservation |
| | Lajitas Municipal Services | E-2 | Water loss audit and main-line repair | Conservation |
| | Brewster County Other (Study Butte Terlingua WS) | E-3 | Water loss audit and main-line repair | Conservation |
| Culberson | **Culberson County Irrigation | E-4a | Conservation - Irrigation scheduling | Conservation |
| | | E-4b | Conservation - Tailwater reuse | Conservation |
| | | E-4c | Conservation - Improvements to water district delivery system | Conservation |
| | | E-5 | Additional groundwater wells | West Texas Bolsons Aquifer / Wild Horse Flat |
| El Paso | Town of Anthony | E-6 | Arsenic treatment facility | Mesilla Bolson Aquifer |
| | | E-7 | Additional groundwater well | Hueco-Mesilla Bolson Aquifer |
| | **El Paso Water | E-8 | Municipal conservation programs | Conservation |
| | | E-9 | Advanced water purification at the Bustamante WWTP | Reuse Treated Wastewater |
| | | E-10 | Expansion of current Hueco Bolson ASR | Rio Grande |
| | | E-18 | Lower Valley well-head RO | Hueco-Mesilla Bolson Aquifer |
| | | E-12 | Expansion of the Kay Bailey Hutchison Desal Plant | Hueco Bolson Aquifer |
| | | E-13 | Riverside Regulating Reservoir | Rio Grande & Stormwater Run-off |
| | | E-14 | Groundwater from Dell City Area (Phase 1) | Capitan Reef Complex Aquifer |
| | | E-15 | Groundwater from Dell City Area (Phase 2) | Bone Spring-Victorio Peak Aquifer |
| | **Lower Valley Water District | E-23 | Public conservation education | Conservation |
| | | E-24 | Purchased water from EPW | EPW Blended Source |
| | | E-25 | Surface water treatment plant & transmission line | Rio Grande |
| | | E-26 | Groundwater from proposed Well field | Other Aquifer / Rio Grande Alluvium |
| | | E-27 | Groundwater from proposed Well field | Hueco Bolson Aquifer |

**Table 5-1. (Continued) Far West Texas Potentially Feasible Water Management Strategies**

| County | Water User Group | WMS# | Strategy | Source |
|---|---|---|---|---|
| El Paso | | E-28 | Wastewater treatment facility and ASR | Reuse Treated Wastewater |
| | **Horizon Regional MUD | E-29 | Water loss audit and main-line repair | Conservation |
| | | E-30 | Public conservation education | Conservation |
| | | E-31 | Additional wells & expansion of desal plant | Hueco Bolson & Other Aquifer / Rio Grande Alluvium Aquifer |
| | Haciendas Del Norte WID | E-32 | Water loss audit and main-line repair | Conservation |
| | East Montana WS | E-33 | Water loss audit and main-line repair | Conservation |
| | El Paso County Tornillo WID | E-34 | Additional groundwater well & transmission line | Hueco Bolson Aquifer |
| | | E-35 | Arsenic treatment facility | Hueco Bolson Aquifer |
| | **El Paso County Other (Vinton Hills) | E-36 | Public conservation education | Conservation |
| | | E-37 | Purchased water from EPW | EPW Blended Source |
| | | E-38 | High capacity water lines for improved distribution of water from EPW | EPW Blended Source |
| | **El Paso County Irrigation (EPCWID #1) | E-39 | Irrigation scheduling | Rio Grande Run-of-River |
| | | E-40 | Tailwater reuse | Rio Grande Run-of-River |
| | | E-41 | Improvements to water district delivery system | Rio Grande Run-of-River |
| | **El Paso County Manufacturing | E-42 | Manufacturing Conservation | Conservation |
| | | E-43 | Purchased water from EPW | EPW Blended Source |
| | **El Paso County Mining | E-44 | Mining Conservation | Conservation |
| | | E-45 | Additional groundwater wells | Hueco-Mesilla Bolson Aquifer |
| | **El Paso County Steam Electric Power | E-46 | Power Conservation | Conservation |
| | | E-47 | Purchased water from EPW | EPW Blended Source |
| Hudspeth | Hudspeth County Other (Dell City) | E-48 | Brackish groundwater desal facility | Bone Spring-Victorio Peak Aquifer |
| | Hudspeth County Other (Fort Hancock WCID) | E-49 | Additional well & RO treatment facility | Hueco-Mesilla Bolson Aquifer |
| | **Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1) | E-50 | Public conservation education | Conservation |
| | | E-51 | Additional transmission line to supply connections outside of the District | West Texas Bolsons Aquifer / Salt Basin |
| | **Hudspeth County Mining | E-52 | Mining Conservation | Conservation |
| | | E-53 | Additional groundwater well | West Texas Bolsons Aquifer / Eagle Flat |

**Table 5-1. (Continued) Far West Texas Potentially Feasible Water Management Strategies**

| County | Water User Group | WMS# | Strategy | Source |
|---|---|---|---|---|
| Jeff Davis | Fort Davis WSC | E-54 | Additional transmission line to connect Fort Davis WSC to Fort Davis Estates | Igneous Aquifer |
| | Jeff Davis County Other (Town of Valentine) | E-55 | Additional groundwater well | West Texas Bolsons Aquifer / Salt Basin |
| Presidio | **City of Presidio | E-56 | Water loss audit and main-line repair | Conservation |
| | | E-57 | Additional groundwater well | West Texas Bolsons Aquifer / Presidio-Redford |
| Terrell | **Terrell County Mining | E-58 | Mining Conservation | Conservation |

** WUGs with supply needs

# 5.4 EVALUATION AND RECOMMENDATION OF WATER MANAGEMENT STRATEGIES

### 5.2.1 Strategy Evaluation Procedure

The strategy evaluation procedure is designed to provide a side-by-side comparison such that all strategies can be assessed based on the same quantifiable factors as shown in Tables 5-2, 5-3 and 5-4. An explanation of the qualitative and quantifiable rankings is provided in Appendix 5B. All strategy analyses recognize and protect existing water rights, water contracts, and option agreements. For planning purposes, it is assumed that all strategies experience a two percent water loss over the life of the strategy project. Specific factors considered in each Table were:

Table 5-2

- Quantity of new water supply produced
- Total capital cost
- Chemical quality
- Reliability of supply
- Impacts to water, agricultural, and natural resources, and to ecologically unique stream segments

Table 5-3

- Financial cost (total capital cost, annual cost, and cost per acre-foot)

Table 5-4

- Environmental impacts
    - Environmental water needs
    - Wildlife habitat
    - Cultural resources
    - Environmental water quality
    - Inflows to bays and estuaries

Cost evaluations for all strategies include capital cost, debt service, and annual operating and maintenance (O&M) expenses. Capital costs are estimated based on September 2018 US dollars. The length of debt service is 20 years unless otherwise stated. An annual unit cost is also calculated based on the O&M cost per acre-foot of water supplied. The TWDB Unified Costing Tool was used for all strategy evaluations except for when specific municipalities provided engineering design studies that included cost estimates.

Water quality is recognized as an important component in this 50-year water plan. To ensure that this *Plan* fully considers water quality, the Federal Clean Water Act and the State Clean Rivers Program were reviewed and considered when developing water management strategies and water quality impacts. Development of water management strategies were also guided by the principal that the designated water quality and related water uses described in the Water Quality Management Plans (WQMPs) of TCEQ and the Texas State Soil and Water Conservation Board (TSSWCB) were improved or maintained. TCEQ's WQMP is tied to the State's water quality assessments that identify and direct planning for implementation measures that control and/or prevent priority water quality problems. Elements contained

in the WQMP include effluent limitations of wastewater facilities, total maximum daily loads (TMDLs), nonpoint source management controls, identification of designated management agencies, and ground water and source water protection planning. TSSWCB's WQMP is a site-specific plan developed through and approved by soil and water conservation districts for agricultural or sylvicultural lands. The plan includes appropriate land treatment practices, production practices, management measures, and technologies.

The development of water management strategies is intended to assist entities with their future water supply needs based on drought-of-record conditions. Recommendations of the Drought Preparedness Council for the 2016 Plans consisted of four activities: (1) Drought Monitoring; (2) Impact Assessment; (3) Research and Educational Programs; and (4) Drought Mitigation Strategies. For the current 2021 Plan, the Council prepared a drought-chapter outline to be followed by all Regions to ensure similar procedures were followed state wide in the preparation of Drought Chapter 7. Also, WUGs conservation and drought management plans (see Chapters 5 and 7) were reviewed to identify potential strategies that are currently under consideration by the entity.

El Paso Water's water management strategies (E-10 through E-23) are described as "Integrated Strategies" meaning that the operation of the entire water supply system is not dependent on any one or more individual facilities, but rather draws from each source at a rate that is optimal for the entire system under the existing circumstances. Although the strategy facilities will work together to provide necessary supplies, each strategy is independent of the others and does not rely on or mutually exclude any other strategy. All other strategies in this *Plan* likewise do not rely on or mutually exclude any other strategies.

### 5.2.2 Emphasis on Conservation and Reuse

In terms of recommending strategies to meet future water needs, it is most practical and often most economical to consider potential conservation and reuse projects. Conservation generally includes best management practices that are undertaken either voluntarily by water customers or as mandated by a water supplier. Conservation savings are the result of "active" water conservation strategies that conserve water over and beyond what would happen anyway as a result of "passive" water conservation measures that stem from federal and state legislation requiring more efficient plumbing fixtures in new building construction. Existing WUG conservation and drought management plans were reviewed, and conservation strategies selected for this *Plan* were often identified from these plans.

Reported municipal use generally includes a variable amount of water that does not reach the intended consumer due to water leaks in the distribution lines, unauthorized consumption, storage tank overflows, and other wasteful factors. For some communities, attending to these issues can be a proactive conservation strategy that may result in significant water savings.

Over the last few years, the TWDB has seen a growing number of requests from municipalities throughout Texas to finance smart meters and advanced metering infrastructure (AMI). This technology allows meters to be read electronically via a fixed network that enables two-way communication with the utility system. More importantly, AMI's biggest advancement is the ability to monitor meters in real time to obtain more accurate data on water usage throughout the system. With the distribution network in constant communication, leaks and water loss can be detected earlier. This technological upgrade is more efficient than its counterpart, the automatic meter readers (AMR), that are still widely used and require meters to be manually read.

Reuse of treated wastewater is also an excellent strategy for producing additional water supplies from existing developed sources, or for use in areas where drinking water is not required such as irrigation. Reuse strategies were particularly considered for El Paso Water.

### 5.2.3 Water Loss Audit Strategies

To address the lack of information on water loss, the 78th Texas Legislature passed House Bill 3338, which requires retail public utilities that provide potable water to perform and file with the TWDB a water audit computing the utility's most recent annual system water loss every five years (see further discussion in Chapter 1 Section 1.9). Entities reporting more than a 10 percent water loss were selected to receive a water-loss audit and line replacement strategy.

Across Far West Texas, it is estimated that around 373 acre-feet of supply could be obtained through a water loss audits and leak repairs program in 2020. The reliability of this supply is low due to uncertainty associated with estimated savings and the extent to which this strategy relies on individual utilities to adopt a water loss audits and leak repairs program, which can be costly and time intensive, especially for smaller users. Due to the relatively high costs of implementing this strategy, especially for smaller or rural water user groups, this strategy may not be feasible.

System water audits and water loss programs are effective methods of accounting for all water usage by a public utility within its service area. The structured approach of a water audit allows a utility to reliably track water uses and provide the information to address unnecessary water and revenue losses. The resulting information from a water audit will be valuable in setting performance indicators and in establishing goals and priorities for cost-effectively reducing water losses. By adopting this Best Management Practice (BMP), utilities will more frequently implement water auditing and loss reduction techniques than required by HB 3338. A more detailed description of this best management practice is available in TWDB Report 362, Water Conservation Best Management Practices Guide, and in the TWDB Water Loss Manual, or at https://www.twdb.texas.gov/conservation/BMPs/index.asp and https://www.twdb.texas.gov/conservation/resources/waterloss-resources.asp. The reliability of this water savings is contingent on the aggressive implementation of this BMP and the public's willingness to do their part.

### 5.2.4 Assessment of ASR Potential

Texas Water Code §16.053(e)(10) requires that "if a RWPA has significant identified water needs, the RWPG shall provide a specific assessment of the potential for aquifer storage and recovery (ASR) projects to meet those needs". The FWTWPG considers municipal utilities as the only WUGs in the Far West Texas Region that would have the resources available to initiate an ASR project; and that the threshold for "significant" identified water needs are defined by the FWTWPG as any municipal utility with greater than 20,000 acre-feet per year need over the 50-year planning horizon. This horizon only occurs with El Paso Water. All other municipal water needs are at a less significant level. El Paso Water is currently exercising an ASR project, and an expansion of this project is a recommended water management strategy in this *Plan*.

### 5.2.5 Recommended Water Management Strategies

A comparative listing of all water management strategies that the FWTWPG subsequently recommends in total for inclusion in the 2021 Far West Texas Water Plan is provided in Table 5-2. Table 5-3 provides a breakdown of the cost estimate for each strategy, and Table 5-4 shows potential impacts of enacting each strategy. Strategy evaluations are presented in Appendix 5A at the end of this chapter. The total capital cost for development of all water management strategies is $2,169,328,445.00

To adequately consider the unique challenges faced by municipal and industrial water users in El Paso County, a conjunctive approach was used to establish feasible strategies capable of identifying sufficient future supplies to meet the needs of El Paso Water, the largest wholesale water provider in the county.

The evaluation of some irrigation strategies for El Paso and Hudspeth Counties differs slightly in that these strategies consider recommended management practices and are discussed in detail in a regional planning study titled *Evaluation of Irrigation Efficiency Strategies for Far West Texas: Feasibility, Water Savings and Cost Considerations (2009)*.

### 5.4.6 Alternate Water Management Strategies

Alternate water management strategies are projects that are not part of the package of Recommended strategies, but can be substituted for any Recommended strategy that is later determined to be non-viable. Alternate water management strategies are evaluated in the same way as Recommended strategies based on criteria specified in [31 TAC §357.7(a)(7-9, 12)] and are tabulated along with "Recommended" strategies in Tables 5-2, 5-3 and 5-4. Upon conclusion of a thorough evaluation process, the FWTWPG identified seven Alternate water management strategies for El Paso Water.

### 5.4.7 Unmet Needs

Sufficient water management strategy supplies are recommended to meet the identified projected needs of all water user groups (WUGs) in the Region except for the irrigation category in El Paso Counties. The El Paso County WID#1 depends on flow in the Rio Grande as its primary irrigation supply source, and during drought-of-record conditions this source is significantly diminished or nonexistent. There are no other supply sources that can be tapped to make up the total needed volume of supply when the Rio Grande is at this stage.

### 5.2.8 Unqualified Strategies

The TWDB requires that water management strategies listed in regional water plans develop "new" water supplies to be applicable for SWIFT funding. Projects that involve items such as; replacing and/or repairing old infrastructure, and wastewater collection and treatment do not qualify. However, the TWDB offers many other types of financing options. Additional details pertaining to the different types of grants and loans offered can be accessed here: https://www.twdb.texas.gov/financial/index.asp.

*This page intentionally left blank.*

**Table 5-2. Summary of Recommended and Alternate Water Management Strategy Evaluations**
**(All strategies are in the Rio Grande River Basin)**

| County | Water User Group | Strategy | Source | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost (Table 5-3) | Quantity[1] | Quality[2] | Reliability[3] | Strategy Impacts[4] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | | | | | Water Resources (1-5) | Agricultural Resources (1-5) | Natural Resources (1-5) | Ecologically Unique Stream Segments (1-5) |
| Brewster | City of Alpine | Modification to wastewater treatment facility & irrigation system | Reuse Treated Wastewater | E-1 | 25 | 25 | 25 | 25 | 25 | 25 | $74,400 | NA | 3 | 1 | 1 | 2 | 1 | 2 |
| | | Irrigation application of captured rainwater runoff | Conservation | E-2 | 70 | 70 | 70 | 70 | 70 | 70 | $14,500 | NA | 3 | 2 | 1 | 2 | 1 | 2 |
| | Marathon WSSService | Water loss audit and main-line repair | Conservation | E-3 | 12 | 12 | 12 | 12 | 12 | 12 | $255,000 | NA | NA | NA | 1 | 2 | 2 | 2 |
| | Lajitas Municipal Services | Water loss audit and main-line repair | Conservation | E-4 | 51 | 51 | 51 | 51 | 51 | 51 | $2,545,000 | NA | NA | NA | 1 | 2 | 2 | 2 |
| | Brewster County Other (Study Butte Terlingua WS) | Water loss audit and main-line repair | Conservation | E-5 | 25 | 25 | 25 | 25 | 25 | 25 | $3,054,000 | NA | NA | NA | 1 | 2 | 2 | 2 |
| Culberson | *Culberson County Irrigation | Conservation - Irrigation scheduling | Conservation | E-6 | 107 | 107 | 107 | 107 | 107 | 107 | $0 | 3 | NA | NA | 1 | 1 | 1 | 2 |
| | | Additional groundwater wells | West Texas Bolsons Aquifer / Upper Salt Flat | E-7 | 333 | 333 | 333 | 333 | 333 | 333 | $510,000 | 1 | 3 | 1 | 3 | 1 | 2 | 2 |
| El Paso | Town of Anthony | Arsenic treatment facility | Mesilla Bolson Aquifer | E-8 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | $10,334,000 | NA | 1 | 1 | NA | NA | NA | 2 |
| | | Additional groundwater well | Hueco-Mesilla Bolson Aquifer | E-9 | 960 | 960 | 960 | 960 | 960 | 960 | $1,913,000 | NA | 2 | 1 | 3 | 2 | 2 | 2 |
| | *El Paso Water | Municipal conservation programs | Conservation | E-10 | 4,950 | 5,530 | 5,080 | 9,940 | 13,140 | 17,820 | $1,071,000 | 2 | NA | NA | 1 | NA | NA | 2 |
| | | Advanced water purification at the Bustamante WWTP | Reuse Treated Wastewater | E-11 | 8,500 | 9,200 | 9,900 | 10,600 | 10,600 | 10,600 | $142,608,000 | 3 | 1 | 1 | 2 | 2 | 2 | 2 |
| | | Advanced water purification at the Haskell Street RWP | Municipal wastewater | E-12 | | | | | | 8,900 | $189,356,000 | 3 | 1 | 1 | 2 | 2 | 2 | 2 |
| | | Expansion of the Kay Bailey Hutchison Desal Plant | Hueco Bolson Aquifer | E-13 | | | | | 5,000 | 5,000 | $26,490,000 | 3 | 1 | 1 | 2 | 2 | 2 | 2 |
| | | Hueco Bolson Artificial Recharge | Hueco Bolson Aquifer | E-14 | | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $38,003,000 | 3 | 2 | 2 | 1 | 2 | 3 | 2 |
| | | Riverside Regulating Reservoir | Rio Grande & Stormwater Run-off | E-15 | | | 3,250 | 3,250 | 3,250 | 3,250 | $6,754,036 | 3 | 2 | 2 | 2 | 2 | 1 | 2 |
| | | Groundwater from Dell City Area (Phase 1) | Capitan Reef Complex Aquifer | E-16 | | | 10,000 | 10,000 | 10,000 | 10,000 | $569,357,000 | 3 | 1 | 1 | 2 | 5 | 2 | 2 |
| | | Groundwater from Dell City Area (Phase 2) | Bone Spring-Victorio Peak Aquifer | E-17 | | | | 10,000 | 10,000 | 10,000 | $320,226,000 | 3 | 1 | 1 | 2 | 5 | 2 | 2 |
| | *El Paso Water ALTERNATE STRATEGIES | Treatment and reuse of agricultural drain water | Agricultural drain water | E-18 | | | 2,700 | 2,700 | 2,700 | 2,700 | $21,466,000 | 3 | 2 | 2 | 1 | 2 | 2 | 2 |
| | | Expansion of Canutillo Mesilla Bolson Well Field | Hueco-Mesilla Bolson Aquifer | E-19 | | 7,760 | 11,640 | 15,520 | 19,400 | 23,280 | $6,444,000 | 2 | 1 | 1 | **3** | 2 | 2 | 2 |
| | | Lower Valley well head RO | Rio Grande Alluvium Aquifer | E-20 | | | 5,000 | 5,000 | 5,000 | 5,000 | $52,681,000 | 3 | 1 | 1 | 3 | 2 | 2 | 2 |
| | | Expansion of Jonathan Rogers WTP | Rio Grande | E-21 | | | 6,500 | 6,500 | 6,500 | 6,500 | $88,679,000 | 3 | 1 | 2 | 2 | 2 | 2 | 2 |

**Table 5-2. (Continued) Summary of Recommended and Alternate Water Management Strategy Evaluations**
**(All strategies are in the Rio Grande River Basin)**

| County | Water User Group | Strategy | Source | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost (Table 5-3) | Quantity[1] | Quality[2] | Reliability[3] | Strategy Impacts[4] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | | | | | Water Resources (1-5) | Agricultural Resources (1-5) | Natural Resources (1-5) | Ecologically Unique Stream Segments (1-5) |
| El Paso | *El Paso Water ALTERNATE STRATEGIES | Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP | Rio Grande | E-22 | | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | $72,873,000 | 3 | 1 | 2 | 2 | 2 | 2 | 2 |
| | | Advanced water purification at the Fred Hervey WWTP | Municipal wastewater | E-23 | | | 10,000 | 10,000 | 10,000 | 10,000 | $140,394,000 | 3 | 1 | 1 | 2 | 2 | 2 | 2 |
| | *Lower Valley Water District | Public conservation education | Conservation | E-24 | 57 | 66 | 74 | 83 | 92 | 100 | $237,461 | 3 | NA | NA | 1 | NA | NA | 2 |
| | | Loop lines inside current connections | Conservation | E-25 | | | | | | | | NA | NA | NA | 1 | 2 | 2 | 2 |
| | | Purchase water from EPW | EPW Blended Source | E-26 | 1,344 | 2,185 | 3,012 | 3,895 | 4,785 | 5,632 | $591,000 | 2 | 1 | 1 | 2 | 2 | 2 | 2 |
| | | Surface water treatment plant & transmission line | Rio Grande | E-27 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $74,338,000 | 2 | 1 | 2 | 2 | 5 | 2 | 2 |
| | | Groundwater from proposed Well field | Rio Grande Alluvium Aquifer | E-28 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | $39,240,000 | 1 | 1 | 1 | 3 | 2 | 2 | 2 |
| | | Groundwater from proposed Well field | Hueco Bolson Aquifer | E-29 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | $36,110,000 | 1 | 1 | 1 | 3 | 2 | 2 | 2 |
| | | Wastewater treatment facility and ASR | Reuse Treated Wastewater | E-30 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 | $23,509,000 | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| | *Horizon Regional MUD | Water loss audit and main-line repair | Conservation | E-31 | 197 | 274 | 346 | 418 | 487 | 551 | $255,000 | 3 | NA | NA | 1 | 2 | 2 | 2 |
| | | Public conservation education | Conservation | E-32 | 79 | 110 | 140 | 169 | 196 | 222 | $136,793 | 3 | NA | NA | 1 | NA | NA | 2 |
| | | Additional wells & expansion of desal plant | Hueco Bolson & Rio Grande Alluvium Aquifers | E-33 | 16,786 | 16,786 | 16,786 | 16,786 | 16,786 | 16,786 | $71,809,000 | 2 | 1 | 1 | 3 | 2 | 2 | 2 |
| | Haciendas Del Norte WID | Water loss audit and main-line repair | Conservation | E-34 | 12 | 13 | 15 | 16 | 17 | 19 | $764,000 | NA | NA | NA | 1 | 2 | 2 | 2 |
| | East Montana WS | Water loss audit and main-line repair | Conservation | E-35 | 41 | 46 | 50 | 54 | 59 | 63 | $1,018,000 | NA | NA | NA | 1 | 2 | 2 | 2 |
| | El Paso County Tornillo WID | Additional groundwater well & transmission line | Hueco Bolson Aquifer | E-36 | 333 | 333 | 333 | 333 | 333 | 333 | $2,060,000 | NA | 1 | 1 | 3 | 2 | 2 | 2 |
| | *El Paso County Other (Vinton Hills) | Public conservation education | Conservation | E-37 | 2 | 3 | 3 | 4 | 5 | 5 | $6,072 | 3 | NA | NA | 1 | NA | NA | 2 |
| | | Purchase water from EPW | EPW Blended Source | E-38 | 0 | 0 | 0 | 14 | 77 | 137 | $143,000 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| | | High capacity water lines for improved distribution of water from EPW | EPW Blended Source | E-39 | 0 | 0 | 0 | 400 | 400 | 400 | $17,075,000 | 1 | NA | NA | 2 | 2 | 2 | 2 |
| | *El Paso County Irrigation (EPCWID #1) | Irrigation scheduling | Conservation | E-40 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 | $102,595 | 3 | NA | NA | 1 | 1 | 2 | 2 |
| | | Tailwater reuse | Conservation | E-41 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 | $973,368 | 3 | NA | NA | 1 | 1 | 2 | 2 |
| | | Improvements to water district delivery system | Conservation | E-42 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | $157,777,783 | 1 | NA | NA | 1 | 1 | 2 | 2 |
| | | Riverside Regulating Reservoir | Rio Grande & Stormwater Run-off | E-43 | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 | $6,754,036 | 3 | 3 | 2 | 2 | 1 | 1 | 2 |

**Table 5-2. (Continued) Summary of Recommended and Alternate Water Management Strategy Evaluations**
**(All strategies are in the Rio Grande River Basin)**

| County | Water User Group | Strategy | Source | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost (Table 5-3) | Quantity[1] | Quality[2] | Reliability[3] | Strategy Impacts[4] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | | | | | Water Resources (1-5) | Agricultural Resources (1-5) | Natural Resources (1-5) | Ecologically Unique Stream Segments (1-5) |
| El Paso | *El Paso County Irrigation (EPCWID #1) | New Wasteway 32 River Diversion Pumping Point | Rio Grande | E-44 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $4,055,887 | 3 | 3 | 2 | 1 | 1 | 2 | 2 |
| | *El Paso County Manufacturing | Manufacturing Conservation | Conservation | E-45 | 0 | 430 | 430 | 430 | 430 | 430 | $0 | 3 | NA | NA | 1 | 2 | 2 | 2 |
| | | Purchase water from EPW | EPW Blended Source | E-46 | 0 | 860 | 860 | 860 | 860 | 860 | $1,049,000 | 1 | 3 | 1 | 2 | 2 | 2 | 2 |
| | *El Paso County Mining | Mining Conservation | Conservation | E-47 | 278 | 370 | 466 | 569 | 680 | 807 | $0 | 3 | NA | NA | 1 | 2 | 2 | 2 |
| | | Additional groundwater wells | Hueco-Mesilla Bolson Aquifer | E-48 | 4,251 | 4,251 | 4,251 | 4,251 | 4,251 | 4,251 | $1,208,000 | 2 | 3 | 1 | 3 | 2 | 2 | 2 |
| | *El Paso County Steam Electric Power | Power Conservation | Conservation | E-49 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 | $0 | 3 | NA | NA | 1 | 2 | 2 | 2 |
| | | Purchase water from EPW | EPW Blended Source | E-50 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | $951,000 | 1 | 3 | 1 | 2 | 2 | 2 | 2 |
| Hudspeth | Hudspeth County Other Dell City) | Brackish groundwater desal facility | Bone Spring-Victorio Peak Aquifer | E-51 | 111 | 111 | 111 | 111 | 111 | 111 | $1,636,000 | NA | 1 | 1 | 2 | 2 | 2 | 2 |
| | *Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1) | Public conservation education | Conservation | E-52 | 1 | 2 | 2 | 2 | 2 | 2 | $3,513 | NA | NA | NA | 1 | 2 | 2 | 2 |
| | | Replace water-supply line from Van Horn | Conservation | E-53 | 39 | 39 | 39 | 39 | 39 | 39 | $18,432,000 | NA | NA | NA | 1 | 2 | 2 | 2 |
| | | Local groundwater well | Diablo Plateau Aquifer | E-54 | 16 | 16 | 16 | 16 | 16 | 16 | $940,000 | NA | 1 | 1 | 3 | 2 | 2 | 2 |
| | | Groundwater well NE of Van Horn | West Texas Bolsons Aquifer / Wild Horse Flat | E-55 | 39 | 39 | 39 | 39 | 39 | 0 | $2,132,000 | NA | 1 | 1 | 2 | 2 | 2 | 2 |
| | | Groundwater well West of Van Horn | Diablo Plateau Aquifer | E-56 | 39 | 39 | 39 | 39 | 39 | 39 | $636,000 | NA | 2 | 1 | 3 | 2 | 2 | 2 |
| | *Hudspeth County Mining | Mining Conservation | Conservation | E-57 | 29 | 25 | 28 | 30 | 31 | 33 | $0 | 3 | NA | NA | 1 | 2 | 1 | 2 |
| | | Additional groundwater well | West Texas Bolsons Aquifer / Eagle Flat | E-58 | 219 | 219 | 219 | 219 | 219 | 219 | $306,000 | 1 | 3 | 1 | 3 | 2 | 2 | 2 |
| Jeff Davis | Fort Davis WSC | Additional groundwater well | Igneous Aquifer | E-59 | 274 | 274 | 274 | 274 | 274 | 274 | $584,000 | NA | 1 | 1 | 3 | 2 | 2 | 2 |
| | | Transmission line to connect Fort Davis WSC to Fort Davis Estates | Igneous Aquifer | E-60 | 114 | 114 | 114 | 114 | 114 | 114 | $1,671,000 | NA | NA | NA | NA | 2 | 2 | 2 |
| | Jeff Davis County Other (Town of Valentine) | Additional groundwater well | West Texas Bolsons Aquifer / Salt Basin | E-61 | 129 | 129 | 129 | 129 | 129 | 129 | $783,000 | NA | 1 | 1 | 3 | 2 | 2 | 2 |
| Presidio | City of Presidio | Water loss audit and main-line repair | Conservation | E-62 | 35 | 37 | 38 | 41 | 43 | 45 | $509,000 | NA | NA | NA | 1 | 2 | 2 | 2 |
| | | Additional groundwater well | West Texas Bolsons Aquifer / Presidio-Redford | E-63 | 120 | 120 | 120 | 120 | 120 | 120 | $5,509,000 | NA | 1 | 1 | 3 | 2 | 2 | 2 |
| Terrell | *Terrell County Mining | Mining Conservation | Conservation | E-64 | 72 | 88 | 83 | 62 | 44 | 29 | $0 | 3 | NA | NA | 1 | 2 | 2 | 2 |
| | *Terrell County Mining ALTERNATE STRATEGY | Additional groundwater wells | Edwards-Trinity (Plateau) Aquifer | E-65 | 470 | 470 | 470 | 470 | 470 | 470 | $921,000 | 2 | 1 | 3 | 3 | 2 | 2 | 2 |

* WUG with a projected future supply deficit. (*See Table 4-1 for list of shortages)*

*See Appendix 5B for quantification description of impact ranges.*

1 Quantity Range: 1 = Meets 100% of shortage; 2 = Meets 50% to 99% of shortage; 3 = Meets <50% of shortage (*See Table 4-1 for list of shortages)*

2 Quality Range: 1 = Meets safe drinking water standards, 2 = Must be treated or mixed to meet safe drinking water standards; 3 = Usable for intended use

3 Reliability Range: 1 = Sustainable; 2 = Interruptible during droughts; 3 = Non-sustainable

4 Impact Range: 1 = Positive; 2 = No New; 3 = Minimal Negative; 4 = Moderate Negative; 5 = Significant Negative

**Table 5-3. Summary of Recommended and Alternate Water Management Strategy Cost**

| County | Water User Group | Strategy | 2021 Strategy ID | Total Capital Cost** | Total Annual Cost | | | | | | Cost per Acre-Foot/Year | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| Brewster | City of Alpine | Modification to wastewater treatment facility & irrigation system | E-1 | $74,400 | $4,460 | $4,460 | $1,860 | $1,860 | $1,860 | $1,860 | $178 | $178 | $74 | $74 | $74 | $74 |
| | | Irrigation application of captured rainwater runoff | E-2 | $14,500 | $2,500 | $2,500 | $2,000 | $2,000 | $2,000 | $2,000 | $30 | $30 | $24 | $24 | $24 | $24 |
| | Brewster County Other (Marathon WSSService) | Water loss audit and main-line repair | E-3 | $255,000 | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 | $1,500 | $1,500 | $1,500 | $1,500 | $1,500 | $1,500 |
| | Lajitas Municipal Services | Water loss audit and main-line repair | E-4 | $2,545,000 | $179,000 | $179,000 | $179,000 | $179,000 | $179,000 | $179,000 | $3,510 | $3,510 | $3,510 | $3,510 | $3,510 | $3,510 |
| | Brewster County Other (Study Butte Terlingua WS) | Water loss audit and main-line repair | E-5 | $3,054,000 | $215,000 | $215,000 | $215,000 | $215,000 | $215,000 | $215,000 | $8,600 | $8,600 | $8,600 | $8,600 | $8,600 | $8,600 |
| Culberson | *Culberson County Irrigation | Conservation - Irrigation scheduling | E-6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | | Additional groundwater wells | E-7 | $510,000 | $54,000 | $54,000 | $18,000 | $18,000 | $18,000 | $18,000 | $162 | $162 | $54 | $54 | $54 | $54 |
| El Paso | Town of Anthony | Arsenic treatment facility | E-8 | $10,334,000 | $1,574,000 | $1,574,000 | $847,000 | $847,000 | $847,000 | $847,000 | $562 | $562 | $302 | $302 | $302 | $302 |
| | | Additional groundwater well | E-9 | $1,913,000 | $192,000 | $192,000 | $72,000 | $72,000 | $72,000 | $72,000 | $200 | $200 | $65 | $65 | $65 | $65 |
| | *El Paso Water | Municipal conservation programs (1) | E-10 | $1,071,000 | $1,071,000 | $1,071,000 | $1,071,000 | $1,071,000 | $1,071,000 | $1,071,000 | $216 | $194 | $211 | $108 | $82 | $60 |
| | | Advanced water purification at the Bustamante WWTP (3) | E-11 | $142,608,000 | $18,206,000 | $18,206,000 | $8,172,000 | $8,172,000 | $8,172,000 | $8,172,000 | $1,718 | $1,718 | $771 | $771 | $771 | $771 |
| | | Advanced water purification at the Haskell WWTP (2) | E-12 | $189,356,000 | -- | -- | -- | -- | -- | $26,234,000 | -- | -- | -- | -- | -- | $2,948 |
| | | Expansion of the Kay Bailey Hutchison Desal Plant (8) | E-13 | $26,490,000 | -- | -- | -- | -- | $4,441,000 | $4,441,000 | -- | -- | -- | -- | $888 | $888 |
| | | Hueco Bolson Artificial Recharge (4) | E-14 | $38,003,000 | -- | $2,367,000 | $2,367,000 | $416,000 | $416,000 | $416,000 | -- | $473 | $473 | $251 | $251 | $251 |
| | | Riverside Regulating Reservoir (12) | E-15 | $6,754,036 | -- | -- | $475,221 | $475,221 | $77,120 | $77,120 | -- | -- | $368 | $368 | $51 | $51 |
| | | Groundwater from Dell City Area (Phase 1) (13) | E-16 | $569,357,000 | -- | -- | $46,984,000 | $46,984,000 | $6,923,000 | $6,923,000 | -- | -- | $4,698 | $4,698 | $692 | $692 |
| | | Groundwater from Dell City Area (Phase 2) (13) | E-17 | $320,226,000 | -- | -- | -- | $38,010,000 | $38,010,000 | $15,479,000 | -- | -- | -- | $3,801 | $3,801 | $1,548 |
| | *El Paso Water ALTERNATE STRATEGIES | Treatment and reuse of agriculteral drain water (5) | E-18 | $21,466,000 | -- | -- | $2,538,000 | $2,538,000 | $1,028,000 | $1,028,000 | -- | -- | $940 | $940 | $381 | $381 |
| | | Expansion of Canutillo Mesilla Bolson Well Field (6) | E-19 | $6,444,000 | -- | $521,000 | $521,000 | $68,000 | $68,000 | $68,000 | -- | $537 | $537 | $70 | $70 | $70 |
| | | Lower Valley well head RO (7) | E-20 | $52,681,000 | -- | -- | $6,995,000 | $6,995,000 | $3,288,000 | $3,288,000 | -- | -- | $1,399 | $1,399 | $658 | $658 |
| | | Expansion of Jonathan Rogers WTP (11) | E-21 | $88,679,000 | -- | -- | $9,000,000 | $9,000,000 | $2,761,000 | $2,761,000 | -- | -- | $1,385 | $1,385 | $425 | $425 |
| | | Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP (14) | E-22 | $72,873,000 | -- | $8,476,000 | $8,476,000 | $3,714,000 | $3,714,000 | $3,714,000 | -- | $848 | $848 | $347 | $347 | $347 |
| | | Advanced water purification at the Fred Hervey WWTP (15) | E-23 | $140,394,000 | -- | -- | $17,957,000 | $17,957,000 | $8,079,000 | $8,079,000 | -- | -- | $1,796 | $1,796 | $808 | $808 |
| | *Lower Valley Water District | Public conservation education | E-24 | $7,641,000 | $595,000 | $595,000 | $538,000 | $538,000 | $538,000 | $538,000 | $5,950 | $5,950 | $570 | $570 | $570 | $570 |
| | | Install loop lines inside existing connections | E-25 | | | | | | | | | | | | | |
| | | Purchased water from EPWU | E-26 | $591,000 | $591,000 | $961,000 | $1,325,000 | $1,714,000 | $2,105,000 | $2,478,000 | $440 | $440 | $440 | $440 | $440 | $440 |

**Table 5-3. (Continued) Summary of Recommended and Alternate Water Management Strategy Cost**

| County | Water User Group | Strategy | 2021 Strategy ID | Total Capital Cost** | Total Annual Cost | | | | | | Cost per Acre-Foot/Year | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| El Paso | *Lower Valley Water District | Surface water treatment plant & transmission line | E-27 | $74,338,000 | $7,455,000 | $7,455,000 | $2,225,000 | $2,225,000 | $2,225,000 | $2,225,000 | $1,491 | $1,491 | $445 | $445 | $445 | $445 |
| | | Groundwater from proposed Well field | E-28 | $39,236,000 | $10,232,000 | $10,232,000 | $7,471,000 | $7,471,000 | $7,471,000 | $7,471,000 | $1,505 | $1,505 | $1,099 | $1,099 | $1,099 | $1,099 |
| | | Groundwater from proposed Well field | E-29 | $36,108,000 | $9,996,000 | $9,996,000 | $7,455,600 | $7,455,600 | $7,455,600 | $7,455,600 | $1,470 | $1,470 | $1,096 | $1,096 | $1,096 | $1,096 |
| | | Wastewater treatment facility and ASR | E-30 | $23,509,000 | $2,839,000 | $2,839,000 | $1,185,000 | $1,185,000 | $1,185,000 | $1,185,000 | $508 | $508 | $212 | $212 | $212 | $212 |
| | *Horizon Regional MUD | Water loss audit and main-line repair | E-31 | $255,000 | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 | $91 | $66 | $52 | $43 | $37 | $33 |
| | | Public conservation education | E-32 | $136,793 | $19,714 | $25,467 | $23,917 | $23,153 | $22,509 | $22,033 | $248 | $231 | $171 | $137 | $115 | $99 |
| | | Additional wells & expansion of desal plant | E-33 | $71,809,000 | $15,031,000 | $15,031,000 | $9,978,000 | $9,978,000 | $9,978,000 | $9,978,000 | $895 | $895 | $594 | $594 | $594 | $594 |
| | Haciendas Del Norte WID | Water loss audit and main-line repair | E-34 | $764,000 | $54,000 | $54,000 | $54,000 | $54,000 | $764,000 | $54,000 | $4,500 | $4,154 | $3,600 | $3,375 | $3,176 | $2,842 |
| | East Montana WS | Water loss audit and main-line repair | E-35 | $1,018,000 | $72,000 | $72,000 | $72,000 | $72,000 | $72,000 | $72,000 | $1,756 | $1,565 | $1,440 | $1,333 | $1,220 | $1,143 |
| | El Paso County Tornillo WID | Additional groundwater well & transmission line | E-36 | $2,060,000 | $0 | $0 | $225,000 | $225,000 | $80,000 | $80,000 | $0 | $0 | $676 | $676 | $240 | $240 |
| | *EL Paso County Other (Vinton Hills) | Public conservation education | E-37 | $6,072 | $883 | $1,119 | $1,059 | $1,028 | $1,002 | $982 | $919 | $878 | $678 | $551 | $464 | $404 |
| | | Purchased water from EPW | E-38 | $143,000 | -- | -- | -- | $15,000 | $80,000 | $143,000 | -- | -- | -- | $1,041 | $1,041 | $1,041 |
| | | High capacity water lines for improved distribution of water from EPW | E-39 | $17,075,000 | -- | -- | -- | $17,075,000 | $1,329,000 | $1,329,000 | -- | -- | -- | $3,323 | $3,323 | $320 |
| | *El Paso County Irrigation (EPCWID #1) | Irrigation scheduling | E-40 | $0 | $102,595 | $102,595 | $102,595 | $102,595 | $102,595 | $102,595 | $59 | $59 | $59 | $59 | $59 | $59 |
| | | Tailwater reuse | E-41 | $0 | $973,368 | $973,368 | $973,368 | $973,368 | $973,368 | $973,368 | $565 | $565 | $565 | $565 | $565 | $565 |
| | | Improvements to water district delivery system | E-42 | $157,777,783 | $216,155 | $216,155 | $216,155 | $216,155 | $216,155 | $216,155 | $9 | $9 | $9 | $9 | $9 | $9 |
| | | Riverside Regulating Reservoir | E-43 | $6,754,036 | $475,221 | $475,221 | $77,120 | $77,120 | $77,120 | $77,120 | $368 | $368 | $51 | $51 | $51 | $51 |
| | | New Wasteway 32 River Diversion Pumping Point | E-44 | $4,055,887 | $348,861 | $348,861 | $55,235 | $55,235 | $55,235 | $55,235 | $18 | $18 | $3 | $3 | $3 | $3 |
| | *El Paso County Manufacturing | Manufacturing Conservation | E-45 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | | Purchased water from EPW | E-46 | $1,049,000 | -- | $1,049,000 | $1,049,000 | $1,049,000 | $1,049,000 | $1,049,000 | -- | $1,220 | $1,220 | $1,220 | $1,220 | $1,220 |
| | *El Paso County Mining | Mining Conservation | E-47 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | | Additional groundwater wells | E-48 | $1,208,000 | $173,000 | $173,000 | $88,000 | $88,000 | $88,000 | $88,000 | $41 | $41 | $21 | $21 | $21 | $21 |
| | *El Paso County Steam Electric Power | Power Conservation | E-49 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | | Purchased water from EPW | E-50 | $951,000 | $951,000 | $951,000 | $951,000 | $951,000 | $951,000 | $951,000 | $131 | $131 | $131 | $131 | $131 | $131 |
| Hudspeth | Hudspeth County Other (Dell City) | Brackish groundwater desal facility | E-51 | $1,636,000 | $329,000 | $329,000 | $214,000 | $214,000 | $214,000 | $214,000 | $2,964 | $2,964 | $1,928 | $1,928 | $1,928 | $1,928 |
| | *Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1) | Public conservation education | E-52 | $3,513 | $571 | $622 | $587 | $583 | $576 | $575 | $402 | $412 | $386 | $381 | $374 | $371 |
| | | Replace water-supply line from Van Horn | E-53 | $18,432,000 | $1,454,000 | $1,454,000 | $157,000 | $157,000 | $157,000 | $157,000 | $37,282 | $37,282 | $4,026 | $4,026 | $4,026 | $4,026 |
| | | Additional groundwater well (local option) | E-54 | $914,000 | $134,000 | $134,000 | $70,000 | $70,000 | $70,000 | $70,000 | $8,375 | $8,375 | $4,375 | $4,375 | $4,375 | $4,375 |
| | | Groundwater well NE of Van Horn | E-55 | $2,132,000 | $171,000 | $171,000 | $21,000 | $21,000 | $21,000 | $21,000 | $4,385 | $4,385 | $538 | $538 | $538 | $538 |
| | | Groundwater well West of Van Horn | E-56 | $636,000 | $52,000 | $52,000 | $7,000 | $7,000 | $7,000 | $7,000 | $1,333 | $1,333 | $179 | $179 | $179 | $179 |

**Table 5-3. (Continued) Summary of Recommended and Alternate Water Management Strategy Cost**

| County | Water User Group | Strategy | 2021 Strategy ID | Total Capital Cost** | Total Annual Cost | | | | | | Cost per Acre-Foot/Year | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| Hudspeth | *Hudspeth County Mining | Mining Conservation | E-57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | | Additional groundwater well | E-58 | $306,000 | $32,000 | $32,000 | $10,000 | $10,000 | $10,000 | $10,000 | $146 | $146 | $46 | $46 | $46 | $46 |
| Jeff Davis | Fort Davis WSC | Additional groundwater well | E-59 | $584,000 | $78,000 | $78,000 | $37,000 | $37,000 | $37,000 | $37,000 | $285 | $285 | $135 | $135 | $135 | $135 |
| | | Additional transmission line to connect Fort Davis WSC to Fort Davis Estates | E-60 | $1,671,000 | $144,000 | $144,000 | $26,000 | $26,000 | $26,000 | $26,000 | $1,263 | $1,263 | $228 | $228 | $228 | $228 |
| | Jeff Davis County Other (Town of Valentine) | Additional groundwater well | E-61 | $783,000 | $74,000 | $74,000 | $19,000 | $19,000 | $19,000 | $19,000 | $574 | $574 | $147 | $147 | $147 | $147 |
| Presidio | City of Presidio | Water loss audit and main-line repair | E-62 | $509,000 | $36,000 | $36,000 | $36,000 | $36,000 | $36,000 | $36,000 | $1,029 | $973 | $947 | $878 | $837 | $800 |
| | | Additional groundwater well | E-63 | $5,509,000 | $490,000 | $490,000 | $102,000 | $102,000 | $102,000 | $102,000 | $4,083 | $4,083 | $850 | $850 | $850 | $850 |
| Terrell | *Terrell County Mining | Mining Conservation | E-64 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | *Terrell County Mining ALTERNATE STRATEGY | Additional groundwater wells | E-65 | $921,000 | $78,000 | $78,000 | $13,000 | $13,000 | $13,000 | $13,000 | $166 | $166 | $28 | $28 | $28 | $28 |

* WUG with a projected future supply deficit. (*See Table 4-1 for list of shortages)*

Total capital costs are estimated based on September 2018 US dollars.

**Table 5-4. Summary of Recommended and Alternate Water Management Strategy Environmental Assessments (Rio Grande River Basin)**

| County | Water User Group | Strategy | Strategy ID | Environmental Impact Factors ** | | | | | Area Impacted and Resulting Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Water Needs (1-5) | Habitat (1-5) | Cultural Resources (1-5) | Water Quality (1-5) | Bays & Estuaries *** (1-5) | |
| Brewster | City of Alpine | Modification to wastewater treatment facility & irrigation system | E-1 | 1 | 1 | 2 | 1 | NA | Intended to reduce water use. |
| | | Irrigation application of captured rainwater runoff | E-2 | 1 | 1 | 2 | 1 | NA | Intended to reduce water use. Temporary land disturbance during construction of facilities. |
| | Brewster County Other Marathon WSSService | Water loss audit and main-line repair | E-3 | 2 | 2 | 2 | 2 | NA | Intended to reduce water loss. |
| | Lajitas Municipal Services | Water loss audit and main-line repair | E-4 | 2 | 2 | 2 | 2 | NA | Intended to reduce water loss. |
| | Brewster County Other (Study Butte Terlingua WS) | Water loss audit and main-line repair | E-5 | 2 | 2 | 2 | 2 | NA | Intended to reduce water loss. |
| Culberson | *Culberson County Irrigation | Conservation - Irrigation scheduling | E-6 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Additional groundwater wells | E-7 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| El Paso | Town of Anthony | Arsenic treatment facility | E-8 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | | Additional groundwater well | E-9 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | *El Paso Water | Municipal conservation programs | E-10 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Advanced purified water at the Bustamante WWTP | E-11 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | | Advanced water purification at the Haskell WWTP | E-12 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | | Expansion of the Kay Bailey Hutchison Desal Plant | E-13 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline and plant expansion. |
| | | Hueco Bolson Artificial Recharge | E-14 | 2 | 1 | 2 | 2 | NA | Six spreading basins will be excavated on EPWU property, which will temporarly hold surface water for infilltration. |
| | | Riverside Regulating Reservoir | E-15 | 1 and 3 | 1 and 3 | 2 | 2 | NA | Construction of a 4,100 acre-foot ring levy regulating reservoir. Formally the location of several wastewater disposal ponds. Surface water impoundment habitat will be created; however, a minor amount of flood overflow will be diverted from downstream flow. |
| | | Groundwater from Dell City Area (Phase 1) | E-16 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | | Groundwater from Dell City Area (Phase 2) | E-17 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | *El Paso Water ALTERNATE STRATEGIES | Treatment and reuse of agriculteral drain water | E-18 | 2 and 3 | 2 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. Reduced water in drains may occur. |
| | | Expansion of Canutillo Mesilla Bolson Well Field | E-19 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline and plant expansion. |
| | | Lower Valley well head RO | E-20 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline and plant expansion. |
| | | Expansion of Jonathan Rogers WTP | E-21 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | | Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP | E-22 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | | Advanced water purification at the Fred Hervey WWTP | E-23 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |

**Table 5-4. (Continued) Summary of Recommended and Alternate Water Management Strategy Environmental Assessments (Rio Grande River Basin)**

| County | Water User Group | Strategy | Strategy ID | Environmental Impact Factors ** | | | | | Area Impacted and Resulting Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Water Needs (1-5) | Habitat (1-5) | Cultural Resources (1-5) | Water Quality (1-5) | Bays & Estuaries *** (1-5) | |
| El Paso | *Lower Valley Water District | Public conservation education | E-24 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Loop lines inside current connections | E-25 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Purchased water from EPWU | E-26 | 2 | 2 | 2 | 2 | NA | Causes no change in existing conditions. |
| | | Surface water treatment plant & transmission line | E-27 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | | Groundwater from proposed Well field | E-28 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | | Groundwater from proposed Well field | E-29 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | | Wastewater treatment facility and ASR | E-30 | 2 | 2 | 3 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | *Horizon Regional MUD | Water loss audit and main-line repair | E-31 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | | Public conservation education | E-32 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Additional wells & expansion of desal plant | E-33 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of nine well and construction of connecting pipeline and plant expansion. |
| | Haciendas Del Norte WID | Water loss audit and main-line repair | E-34 | 2 | 2 | 2 | 2 | NA | Intended to reduce water loss. |
| | East Montana WS | Water loss audit and main-line repair | E-35 | 2 | 2 | 2 | 2 | NA | Intended to reduce water loss. |
| | El Paso County Tornillo WID | Additional groundwater well & transmission line | E-36 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | *EL Paso County Other (Vinton Hills) | Public conservation education | E-37 | 2 | 3 | 2 | 2 | NA | Intended to reduce water use. |
| | | Purchased water from EPW | E-38 | 2 | 2 | 2 | 2 | NA | Causes no change in existing conditions. |
| | | High capacity water lines for improved distribution of water from EPW | E-39 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during construction of facilities. |
| | *El Paso County Irrigation (EPCWID #1) | Conservation - Irrigation scheduling | E-40 | 2 | 3 | 2 | 2 | NA | Intended to reduce water use. |
| | | Conservation - Tailwater reuse | E-41 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Conservation - Improvements to water district delivery system | E-42 | 2 | 3 | 2 | 2 | NA | Minor land disturbance will occur as existing canals are concrete lined. |
| | | Riverside Regulating Reservoir | E-43 | 1 and 3 | 1 and 3 | 2 | 2 | NA | Construction of a 4,100 acre-foot ring levy regulating reservoir. Formally the location of several wastewater disposal ponds. Surface water impoundment habitat will be created; however, a minor amount of flood overflow will be diverted from downstream flow. |
| | | New Wasteway 32 River Diversion Pumping Point | E-44 | 2 | 3 | 2 | 2 | NA | Intended to reduce water loss. Minor land disturbance will occur as existing canals are concrete lined. |
| | *El Paso County Manufacturing | Manufacturing Conservation | E-45 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Purchased water from EPW | E-46 | 2 | 2 | 2 | 2 | NA | Causes no change in existing conditions. |
| | *El Paso County Mining | Mining Conservation | E-47 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Additional groundwater wells | E-48 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | *El Paso County Steam Electric Power | Power Conservation | E-49 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Purchased water from EPW | E-50 | 2 | 2 | 2 | 2 | NA | Causes no change in existing conditions. |
| Hudspeth | Hudspeth County Other (Dell City) | Brackish groundwater desal facility | E-51 | 2 | 2 | 2 | 2 | NA | Causes no change in existing conditions. |

**Table 5-4. (Continued) Summary of Recommended and Alternate Water Management Strategy Environmental Assessments (Rio Grande River Basin)**

| County | Water User Group | Strategy | Strategy ID | Environmental Impact Factors ** | | | | | Area Impacted and Resulting Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Water Needs (1-5) | Habitat (1-5) | Cultural Resources (1-5) | Water Quality (1-5) | Bays & Estuaries *** (1-5) | |
| Hudspeth | *Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1) | Public conservation education | E-52 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Replace water-supply line from Van Horn | E-53 | 2 | 2 | 2 | 2 | NA | Temporary land disturbance during construction of connecting pipeline. |
| | | Local groundwater well | E-54 | 2 | 2 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | | Groundwater well NE of Van Horn | E-55 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | | Groundwater well West of Van Horn | E-56 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | *Hudspeth County Mining | Mining Conservation | E-57 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | | Additional groundwater well | E-58 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| Jeff Davis | Fort Davis WSC | Additional groundwater well | E-59 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| | | Additional transmission line to connect Fort Davis WSC to Fort Davis Estates | E-60 | 2 | 2 | 2 | 2 | NA | Temporary land disturbance during construction of connecting pipeline. |
| | Jeff Davis County Other (Town of Valentine) | Additional groundwater well | E-61 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| Presidio | City of Presidio | Water loss audit and main-line repair | E-62 | 2 | 2 | 2 | 2 | NA | Intended to reduce water loss. |
| | | Additional groundwater well | E-63 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |
| Terrell | *Terrell County Mining | Mining Conservation | E-64 | 2 | 2 | 2 | 2 | NA | Intended to reduce water use. |
| | *Terrell County Mining ALTERNATE STRATEGY | Additional groundwater wells | E-65 | 2 | 3 | 2 | 2 | NA | Temporary land disturbance during drilling of well and construction of connecting pipeline. |

* WUG with a projected future supply deficit. (*See Table 4-1 for list of shortages)*

Texas Parks & Wildlife Department's Natural Diversity Database of Rare, Threatened and Endangered Species. Individual species impact is not determined.
*See Appendix 5B for quantification description of impact ranges.*

** Environmental impact range: 1 = Positive; 2 = No New; 3 = Minimal Negative; 4 = Moderate Negative; 5 = Significant Negative

*** All strategies occur beyond the distance of potential impact to flows into the coastal bay and estuary systems.

# 5.5 WATER CONSERVATION

Water conservation is one of the most important components of water supply management. According to the 2017 State Water Plan, the state's existing water supply is not sufficient to meet all future demands during times of drought. To meet the water demand in the year 2070, Texas would need to provide 8.9 million acre-feet of additional supplies, including water savings through conservation. Conservation was by far the most recommended strategy in all 16 regional water plans that formed the basis of the 2017 State Water Plan. Recognizing its impact, setting realistic goals and aggressively enforcing implementation may significantly extend the time when new supplies and associated infrastructure are needed. This chapter explores conservation opportunities and provides a road map for integrating conservation planning into long-range water supply management goals.

### 5.3.1 Water Conservation Overview

The Texas Water Development Board (TWDB) defines 'conservation' as those practices, techniques, programs, and technologies that will protect water resources, reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling or reuse of water so that a water supply is made available for future or alternative uses. The mission of the water conservation staff is to provide leadership, planning, financial assistance, information and education for water conservation processes in Texas.

Effective conservation programs implement best management practices to try to meet the targets and goals identified within the plan and are important to water conservation planning for all entities such as: municipal, agricultural, industrial, and commercial. Water conservation management planning implemented by municipalities, water providers, and other water users supersede recommendations in this *Plan* and are considered consistent with this *Plan*.

The TWDB and the Texas State Soil and Water Conservation Board (TSSWCB) jointly conducted a study of ways to improve or expand water conservation efforts in Texas. The results of that study are available in a joint 2018 report titled "An Assessment of Water Conservation in Texas, Prepared for the 85th Texas Legislature" (http://www.twdb.texas.gov/publications/reports/special_legislative_reports/doc/TWDBTSSWCB_80th.pdf) and contains the following:

- An assessment of both agricultural and municipal water conservation issues;
- Information on existing conservation efforts by the TWDB and the TSSWCB;
- Information on existing conservation efforts by municipalities receiving funding from the TWDB, as specified in water conservation plans submitted by the municipalities as part of their applications for assistance;
- A discussion of future conservation needs;
- An analysis of programmatic approaches and funding for additional conservation efforts;
- An assessment of existing statutory authority and whether changes are needed to more effectively promote and fund conservation projects; and
- An assessment of the TWDB's agricultural water conservation program.

In addition, the TWDB in 2015 received funding from the Texas Legislature and hired a firm to perform a research project with the intent of measuring and quantifying the municipal water conservation efforts statewide. Interviews were conducted in each of the 16 regional planning areas with two primary goals: 1) Assist regional planners and the TWDB to quantify ongoing municipal conservation activities throughout the state and estimate regional water savings from activities adopted by the utilities; 2) To provide individual utilities with detailed reports and recommendations that will assist them to meet their own water conservation goals.

The TWDB Statewide Municipal Water Conservation Quantification Project surveyed two of the 22 municipalities within the Far West Texas region. Surveyed entities were El Paso Water and Horizon Regional MUD. Although only two entities were surveyed, these participating utilities portion of the recommended conservation supply accounts for approximately 94 percent of the annual savings to meet the 2070 supply volume for municipal water conservation region wide.

The report highlights a variety of conservation activities these two utilities have implemented and made recommendations to continue the effort, however it is not required by statute and administrative rules (31 TAC §357.34; 357.35) to develop strategies based on the findings of this report.

The Far West Texas water planning group has included the TWDB Statewide Municipal Water Conservation Quantification Project report as Appendix 5C, and considers the document to be a valid resource for integrating conservation planning into long-range water supply management goals.

Texas Water Code §11.1271 requires water conservation plans for all municipal and industrial water users with surface water rights of 1,000 acre-feet per year or more and irrigation water users with surface water rights of 10,000 acre-feet per year or more. Water conservation plans of three entities in Far West Texas that meet these criteria were reviewed for this *Plan* including El Paso Water, El Paso County Water Improvement District No.1, and Hudspeth County Conservation and Reclamation District No.1. Water conservation plans are also required for all other water users applying for a State water right, and may also be required for entities seeking State funding for water supply projects.

### 5.3.2 Model Water Conservation Plans

Water Conservation Plan forms are available from TCEQ in WordPerfect and PDF formats. The forms for the following entity types listed below are available at:
http://www.twdb.texas.gov/conservation/municipal/plans/index.asp

http://www.tceq.state.tx.us/permitting/water_supply/water_rights/conserve.htmlYou can receive a print copy of a form by calling 512/239-4691 or by email to wras@tceq.texas.gov.

**Municipal Use** – Utility Profile and Water Conservation Plan Requirements for Municipal Water Use by Public water Suppliers (TCEQ-10218) Word

**Wholesale Public Water Suppliers** – Profile and Water Conservation Plan Requirements for Wholesale Public Water Suppliers (TCEQ-20162) Word

**Industrial Use** – Industrial Water Conservation Plan (TCEQ-20839) Word

**Mining Use** – Mining Water Conservation Plan (TCEQ-20840) Word

**Agricultural Uses** – Agriculture Water Conservation Plan-Non-Irrigation (TCEQ-10541) Word

System Inventory and Water Conservation Plan for Individually-Operated Irrigation System (TCEQ-10238) Word

System Inventory and Water Conservation Plan for Agricultural Water Suppliers Providing Water to More Than One User (TCEQ-10244) Word

### 5.3.3 State Water Conservation Programs and Guides

The TWDB provides a significant amount of information and services pertaining to water conservation that can be accessed at: http://www.twdb.texas.gov/conservation/municipal/plans/index.asp

Likewise, water conservation tips developed by the TCEQ and made available through their Take Care of Texas educational campaign can be accessed at the following website: http://takecareoftexas.org/conservation-tips/conserve-our-water

#### Water-Saving Plumbing Fixture Program

The Texas Legislature created the Water-Savings Plumbing Fixture Program in 1992 to promote water conservation. Manufacturers of plumbing fixtures sold in Texas must comply with the Environmental Performance Standards for Plumbing Fixtures, which requires all plumbing fixtures such as showerheads, toilets and faucets sold in Texas to conform with specific water use efficiency standards.

As of January 1, 2014, Texas (HB 2667) mandates all toilets and urinals sold in Texas must meet new efficiency standards.

- Bath faucets cannot exceed 2.2 gallons per minute (GPM)
- Showerheads cannot exceed 2.5 gallons per minute (GPM)
- Kitchen faucets cannot exceed 2.2 gallons per minute (GPM)
- Toilets cannot exceed 1.28 gallons per flush (GPF)
- Urinals cannot exceed 0.5 gallons per flush (GPF)

Since more water is used in the bathroom than any other place in the home, water-efficient plumbing fixtures play an integral role in reducing water consumption, wastewater production, and consumers' water bills. It is estimated that switching to water-efficient fixtures can save the average household between $50 and $100 per year on water and sewer bills. Many hotels and office buildings find that water-efficient fixtures can save 20 percent on water and wastewater costs.

The EPA's WaterSense program labels water-efficient products that meet most of the criteria above, and on average are certified to use at 20 percent less water than legacy fixtures. Their website also provides a product search tool and a rebate finder, and can be accessed here: https://www.epa.gov/watersense

#### Water Conservation Best Management Practices

The 78th Texas Legislature under Senate Bill 1094 created the Texas Water Conservation Implementation Task Force and charged the group with reviewing, evaluating, and recommending optimum levels of water use efficiency and conservation for the State. The TWDB and TCEQ in coordination with the Water Conservation Advisory Council prepared TWDB Report 362, Water Conservation Best

Management Practices Guides for agricultural, commercial, institutional, and industrial water users. In addition, guides were developed for both municipal and wholesale water providers. These suggested BMPs are structured for delivering a conservation measure or series of measures that are useful, proven, cost-effective, and generally accepted among conservation experts. Each BMP structure has several elements that describe the efficiency measures, implementation techniques, schedule of implementation, scope, water savings estimating procedures, cost effectiveness considerations, and references to assist end-users in implementation. These documents can be accessed at the following TWDB website:

http://www.twdb.texas.gov/publications/reports/numbered_reports/doc/R362_BMPGuide.pdf

An update to the introduction in TWDB Report 362 can be found here:
http://www.twdb.texas.gov/conservation/BMPs/Ubmps/doc/MiniGuide.pdf?d=19543.519999831915

## Public Water Conservation Education

Public education may be one of the most productive actions that can result in the greatest amount of water savings. Most citizens are willing to actively do their part to conserve water once the need is communicated and how to accomplish the most benefit is explained. Numerous state, county, and academic agencies provide educational material and demonstrations. Groundwater conservation districts also provide water conservation activities.

The TWDB provides a significant amount of information and services pertaining to water conservation that can be accessed at: http://www.twdb.texas.gov/conservation/municipal/plans/index.asp

Likewise, water conservation tips developed by the TCEQ and made available through their Take Care of Texas educational campaign can be accessed at the following website:
http://takecareoftexas.org/conservation-tips/conserve-our-water

TPWD also offers programs geared toward the appreciation and conservation of the state's outdoor natural resources ( https://tpwd.texas.gov/landwater/water/conservation/ /) which include:

- Freshwater Inflows and Estuaries
- Coastal Studies
- River Studies
- Texas Gulf Ecological Management Sites

Education of our youth may be one of the best ways to spread the word about conservation of water. The TWDB provides excellent educational programs for all grade levels K-12th. Information pertaining to this program can be accessed at: https://www.twdb.texas.gov/conservation/education/kids/index.asp.

The Groundwater Conservation Districts in the Plateau Region have water conservation management goals that include:

- Publishing conservation articles in local newspapers;
- Providing conservation presentations and demonstrations at county shows;
- Conducting school programs relating to conservation issues; and
- Working with river authorities to promote the clean rivers program.

### 5.3.4 Regional Conservation Water Management Strategies

Many of the recommended water management strategies listed in Table 5-2 are classified as "Conservation". Conservation strategies are considered the first method of management when considering meeting future water needs. Conservation strategies include:

- Water loss audit and main-line repair
- Public conservation awareness
- Municipal supply conservation distribution
- Specified Irrigation, manufacturing and mining conservation practices

The *2021 Far West Texas Water Plan* recommends the following 24 conservation related strategies presented in Table 5-5.

**Table 5-5. Summary of Recommended Conservation Water Management Strategy Evaluations**

| County | Water User Group | Strategy | 2021 Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| Brewster | City of Alpine | Irrigation application of captured rainwater runoff | E-2 | 70 | 70 | 70 | 70 | 70 | 70 |
| | Brewster County Other Marathon WSSService | Water loss audit and main-line repair | E-3 | 12 | 12 | 12 | 12 | 12 | 12 |
| | Lajitas Municipal Services | Water loss audit and main-line repair | E-4 | 51 | 51 | 51 | 51 | 51 | 51 |
| | Brewster County Other (Study Butte Terlingua WS) | Water loss audit and main-line repair | E-5 | 25 | 25 | 25 | 25 | 25 | 25 |
| Culberson | Culberson County Irrigation | Irrigation scheduling | E-6 | 107 | 107 | 107 | 107 | 107 | 107 |
| El Paso | City of El Paso (EPW) | Municipal conservation programs | E-10 | 4,950 | 5,530 | 5,080 | 9,950 | 13,140 | 17,820 |
| | Lower Valley Water District | Public conservation education | E-24 | 57 | 66 | 74 | 83 | 92 | 100 |
| | | Install loop lines inside existing connections | E-25 | | | | | | |
| | Horizon Regional MUD | Water loss audit and main-line repair | E-31 | 197 | 274 | 346 | 418 | 487 | 551 |
| | | Public conservation education | E-32 | 79 | 110 | 140 | 169 | 196 | 222 |
| | Haciendas del Norte WID | Water loss audit and main-line repair | E-34 | 12 | 13 | 15 | 16 | 17 | 19 |
| | East Montana WS | Water loss audit and main-line repair | E-35 | 41 | 46 | 50 | 54 | 59 | 63 |

**Table 5-5. (Continued) Summary of Recommended Conservation Water Management Strategy Evaluations**

| County | Water User Group | Strategy | 2021 Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| El Paso | El Paso County Other | Public conservation education | E-37 | 2 | 3 | 3 | 4 | 5 | 5 |
| | *El Paso County Irrigation (EPCWID #1) | Irrigation scheduling | E-40 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 |
| | | Tailwater reuse | E-41 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 |
| | | Improvements to water district delivery system | E-42 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 |
| | EL Paso County Manufacturing | Manufacturing Conservation | E-45 | 0 | 430 | 430 | 430 | 430 | 430 |
| | El Paso County Mining | Mining Conservation | E-47 | 278 | 370 | 466 | 569 | 680 | 807 |
| | El Paso County Steam Electric Power | Steam Electric Power Conservation | E-49 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 |
| Hudspeth | Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1) | Public conservation education | E-52 | 1 | 2 | 2 | 2 | 2 | 2 |
| | | Replace water-supply line from Van Horn | E-53 | 39 | 39 | 39 | 39 | 39 | 39 |
| | Hudspeth County Mining | Mining Conservation | E-57 | 29 | 25 | 28 | 30 | 31 | 33 |
| Presidio | City of Presidio | Water loss audit and main-line repair | E-62 | 35 | 37 | 38 | 41 | 43 | 45 |
| Terrell | Terrell County Mining | Mining Conservation | E-64 | 72 | 88 | 83 | 62 | 44 | 29 |

### 5.3.5 Gallons Per Capita Daily Goals

Effective municipal conservation can best be monitored in terms of reduction in gallons per day per capita (gpcd). The FWTWPG recommends the gpcd reduction goals listed in Table 5-6, which provides a listing of projected gpcd reductions anticipated as water efficiency and recommended conservation savings occur on a decadal basis. Entities listed in the table with higher gpcds than 200 are likely impacted by water loss issues in their distribution systems. It is highly recommended that these entities take advantage of a water-loss audit to guide needed repairs.

**Table 5-6. Gallons Per Capita Daily Goals**

| Water User Group | Base GPCD 2020 | Adjusted 2020 GPCD | Adjusted 2030 GPCD | Adjusted 2040 GPCD | Adjusted 2050 GPCD | Adjusted 2060 GPCD | Adjusted 2070 GPCD |
|---|---|---|---|---|---|---|---|
| Alpine | 294 | 285 | 281 | 277 | 275 | 275 | 275 |
| Anthony | 173 | 162 | 159 | 157 | 156 | 156 | 156 |
| County-Other, Brewster | 147 | 113 | 111 | 108 | 107 | 107 | 107 |
| County-Other, Culberson | 164 | 154 | 150 | 148 | 146 | 146 | 146 |
| County-Other, El Paso | 165 | 154 | 149 | 147 | 147 | 146 | 146 |
| County-Other, Hudspeth | 104 | 92 | 88 | 85 | 84 | 84 | 84 |
| County-Other, Jeff Davis | 141 | 132 | 128 | 124 | 122 | 122 | 122 |
| County-Other, Presidio | 147 | 137 | 132 | 129 | 129 | 128 | 128 |
| County-Other, Terrell | 118 | 107 | 102 | 102 | 102 | 102 | 102 |
| East Biggs Water System | 67 | 60 | 60 | 60 | 60 | 60 | 60 |
| East Montana Water System | 118 | 109 | 106 | 104 | 103 | 103 | 102 |
| El Paso County Tornillo WID | 97 | 89 | 87 | 85 | 83 | 83 | 83 |
| El Paso County WCID#4 | 91 | 82 | 78 | 74 | 73 | 72 | 72 |
| El Paso Water | 144 | 132 | 128 | 127 | 124 | 122 | 122 |
| Esperanza Water Service | 150 | 140 | 136 | 133 | 132 | 131 | 131 |
| Federal Correctional Institution La Tuna | 197 | 188 | 185 | 183 | 182 | 182 | 181 |
| Fort Bliss Water Service | 175 | 164 | 159 | 157 | 157 | 156 | 156 |
| Fort Davis WSC | 218 | 209 | 206 | 203 | 201 | 201 | 201 |
| Hacienda Del Norte WID | 152 | 143 | 140 | 138 | 137 | 137 | 136 |
| Horizon Regional MUD | 141 | 133 | 131 | 130 | 130 | 130 | 130 |
| Hudspeth County WCID#1 | 143 | 133 | 129 | 126 | 125 | 124 | 124 |
| Lajitas Municipal Services | 179 | 170 | 166 | 162 | 160 | 160 | 160 |
| Lower Valley Water District | 107 | 96 | 91 | 89 | 88 | 88 | 88 |
| Marathon Water Supply & Sewer Service | 258 | 249 | 245 | 241 | 239 | 239 | 239 |
| Marfa | 249 | 238 | 234 | 231 | 230 | 230 | 230 |
| Paseo Del Este MUD#1 | 125 | 116 | 113 | 111 | 110 | 110 | 109 |
| Presidio | 130 | 119 | 116 | 113 | 112 | 112 | 112 |
| Terrell County WCID#1 | 194 | 183 | 178 | 178 | 178 | 178 | 178 |
| Van Horn | 266 | 243 | 239 | 239 | 239 | 239 | 239 |

El Paso Water decadal projection is provided by the Utility as illustrated in El Paso Water Strategy E-9 in Appendix 5A. All other utilities in the Plan have acceptable gpcds considering implementation of recommended water management strategies.

### 5.3.6 Municipal Conservation

El Paso Water (EPW) is the largest supplier of municipal water in Far West Texas, supplying approximately 72 percent of all municipal needs in 2020. The City of El Paso through EPW has been implementing an aggressive water conservation program for the past two decades and has reduced the per capita demand from 200 gpcd in 1990 to a current level of less than 130 gpcd. The overall per capita potable water use for EPW and its wholesale customers, including steam electric and industrial use, was about 130 gpcd in 2013. EPW intends to continue its aggressive water conservation efforts, and estimates that demand can be reduced by about 3 gpcd per decade by conservation efforts. The continuation of the conservation effort is a key component of the El Paso Integrated Water Management Strategy discussed in Chapter 5.

El Paso Water maintains a robust conservation website that provides conservation tips, a guide to native plants, a step-by-step guide on how to use your water meter to check for leaks, a water use calculator, and several other topics that focus on conservation. https://www.epwater.org/conservation

El Paso's TecH2O Learning Center has numerous educational exhibits geared towards school-aged students that focus on conservation, groundwater, desalination, xeriscape and several other topics. They maintain a conservation website, provide classroom activities for elementary, middle and high school, and offer Water Smart workshops for the public and for educators. https://www.tech2o.org/

### 5.3.7 Irrigation Conservation

Irrigation represents approximately 57 percent of all the water used in Far West Texas. Most of this water is diverted from the Rio Grande and is applied to crops on farms located along the Rio Grande floodplain in El Paso, Hudspeth, and Presidio Counties. During significantly dry periods, insufficient water is available in upstream reservoirs to meet the full permitted allotments, and farmers in these areas have generally approached this situation by reducing acreage irrigated, changing types of crops planted, or possibly not planting crops until water becomes available during the following season. In some cases, farmers may benefit from management practices described in Chapter 5, which are a mixture of site-specific management, educational, and physical procedures that have proven to be effective and are cost-effective for conserving water.

The implementation of water conservation programs that are cost effective, meet state mandates, and result in permanent real reductions in water use will be a challenge for the citizens of Far West Texas. Smaller communities that lack financial and technical resources will be particularly challenged and will look to the State for assistance. Irrigation conservation may result in significant reductions in water use. However, without financial and technical assistance, it is unlikely that aggressive irrigation conservation programs will be implemented.

Staff of the Texas AgriLife Research Center at El Paso evaluated the applicability, water savings potential, implementation feasibility, and cost effectiveness of seventeen irrigated agriculture water conservation practices in Far West Texas during both drought and full water supply conditions. Agricultural, hydrologic, engineering, economic, and institutional conditions are identified and examined

for the three largest irrigated agricultural areas which account for over 90 percent of total irrigated agricultural acreage in Far West Texas. Factors considered in evaluating conservation strategies included water sources, use, water quality, cropping patterns, current irrigation practices, delivery systems, technological alternatives, market conditions and operational constraints.

The overall conclusion is that very limited opportunities exist for significant additional water conservation in Far West Texas irrigated agriculture. The primary reasons can be summarized by:

- the most effective conservation practices have already been implemented and associated water savings realized throughout the region;
- reduced water quality and the physical nature of gravity flow delivery limit or prohibit implementation of higher efficiency pressurized irrigation systems;
- increased water use efficiency upstream has the net effect of reducing water supplies and production of downstream irrigators; and,
- water conservation implementation costs for many practices exceed the agricultural value and benefits of any water saved.

Those practices that suggest economic efficient additional water conservation included lining or pipelining district canals and the very small potential for additional irrigation scheduling and tail water recovery systems. In nearly all cases, these practices have been adopted if applicable, further emphasizing the very limited opportunities for additional conservation. If these strategies were implemented, the water conserved would satisfy a small percentage of the projected unmet agricultural water demand in 2060 during drought-of-record conditions.

The full report on the irrigation conservation analysis is available at http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0704830690_RegionE/TxAgriLifeResearchIrrigationEfficiency-FinalReport.pdf.

### 5.3.8 Manufacturing Conservation

Most groundwater used for manufacturing in El Paso County is for petroleum refining. Refinery water consumption depends primarily on which of three configurations (cracking, light coking, and heavy coking) is utilized. These processes consume 14 to 20 gallons of water per barrel of crude processed.

Water consumption at most refineries includes cooling water evaporation loss, water embedded with product, steam trap losses, steam vent losses firewater main leaks to ground, evaporation f from usage during maintenance, and evaporation from open water ponds in the wastewater treatment plant.

Recent improved practices across the industry include the following:

- Monitoring of steam used to purge and disperse flare tips
- Replacing turbines that vent steam to the atmosphere with non-vented options
- Capturing blowdown water from boilers in lower-pressure drum and cooling before sending to WWTP
- Identifying and minimizing steam leaks
- Rerouting steam traps that vent to ground to condensate recovery headers, and

- Capturing steam lost through top of de-aerators.

### 5.3.9 Water Loss Audit and Main-line Repair

Reported municipal use generally includes a variable amount of water that does not reach the intended consumer due to water leaks in the distribution lines, unauthorized consumption, storage tank overflows, and other wasteful factors. For some communities, attending to these issues can be a proactive conservation strategy that may result in significant water savings.

To address the lack of information on water loss, the 78th Texas Legislature passed House Bill 3338, which required retail public utilities that provide potable water to perform and file with the TWDB a water audit computing the utility's most recent annual system water loss every five years. In response to the mandate of House Bill 3338, TWDB developed a water audit methodology for utilities to quantify water losses, standardize water loss reporting and help measure water efficiency. This TWDB report 376 titled 'Water Loss Audit Manual for Texas Utilities' can be accessed at: http://www.twdb.texas.gov/conservation/municipal/waterloss/index.asp A summary of the first audit, An Analysis of Water Loss as Reported by Public Water Suppliers – 2007 was provided to the Far West Texas Water Planning Group (FWTWPG) for consideration in developing water supply management strategies. This document can be accessed from the TWDB website in its entirety at:

Volume I - https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0600010612_WaterLossinTexas.pdf

Volume II - https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0600010612_waterlossintexas_appendix.pdf

Table 1-2 in Chapter 1, Section 1.9 provides a listing of reported utility audits performed in Far West Texas in 2010.

#### Water Loss Audit Resources

The TWDB provides a significant amount of information and services pertaining to water loss audit that can be accessed at: https://www.twdb.texas.gov/conservation/resources/waterloss-resources.asp. Additional resources and appropriate forms provided by TWDB include:

Water Audit Worksheet Instructions

Guidelines for Setting a Target Infrastructure Leakage Index (ILL)

Water Loss Manual for Texas Utilities (Updated March 2008)

Main Line Water Loss Calculator

Monthly Water Loss Report

Leak Detection Equipment Loan Form

Ultrasonic Flow Meter Equipment Loan Form

Troubleshooting for Negative Water Loss Audit Components

Over the last few years, smart meters and advanced metering infrastructure (AMI) have become quite popular. AMI meters allow real-time monitoring of water usage. The AMI systems can help pinpoint water loss and allows for more interactive and responsive water management by the water provider. A growing number of cities (including Dallas and Granbury) are requesting SWIFT funding to help with the installation of updated AMI.

### 5.3.10 Water User Group Conservation Management Plans

In the consideration of regional conservation, the Far West Texas Water Planning Group reviewed active water conservation management plans provided to the planning group by the following entities.

**Public Supply Entities**

City of Alpine - *Water Conservation Management Plan* http://www.cityofalpine.com/

Dell City – *Water Conservation and Drought Contingency Plan*

El Paso County WCID #4 – *Drought Contingency Plan*

El Paso Water Utilities – *EPWU Water Conservation Management Plan* https://www.epwater.org/

Esperanza Water Service Company – *Drought Contingency Plan*

Fort Bliss WSC – *Water Conservation Management Plan* http://www.asusinc.com

Fort Davis WSC – *Drought Contingency Plan* http://www.fortdavis.com

Fort Davis Estates – *Drought Contingency Plan*

Green Acres/River View Water Works – *Drought Contingency Plan*

Horizon Regional MUD – *Water Conservation Management Plan* http://horizonregional.com/

Lajitas Utility Company – *Drought Contingency Plan*

Lower Valley Water District – *Water Conservation Management Plan* http://www.lvwd.org/

Marfa City Water Works – *Water Conservation Management Plan*

Marathon Water Supply and Sewer Service Corp. – *Drought Contingency Plan*

City of Presidio – *Water Conservation Management Plan* http://presidiotx.us/

City of Sanderson – *Comprehensive Plan* http://www.sandersonchamber.com/

Study Butte WSC – *Drought Contingency Plan*

Terrell County WCID No.1 – *Water Conservation Management Plan* http://www.sandersontx.info/services/tcwcid.html

Turf Water System – *Drought Contingency Plan*

Town of Anthony – *Water Conservation Management Plan* http://www.anthonytx.org/

Town of Valentine – *Drought Contingency Plan*

Town of Van Horn – *Water Conservation and Drought Contingency Plan* https://www.vanhorntexas.org/

Villa Alegre Estates – *Drought Contingency Plan*

Vinton Hills Water System – *Drought Contingency Plan*

Vinton Village Estates – *Drought Contingency Plan*

Village of Vinton – http://www.vintontx.govoffice2.com/

**Irrigation Districts**

El Paso County Water Improvement District No.1 – *Management Plan* http://www.epcwid1.org/

Hudspeth County Conservation and Reclamation District No.1 – *Management Plan*

### 5.3.11 Groundwater Conservation Districts Management Plans

The Texas Legislature has established a process for local management of groundwater resources through Groundwater Conservation Districts. The Districts are charged with managing groundwater by providing for the conservation, preservation, protection, recharging and prevention of waste of groundwater within their jurisdictions. An elected board governs these districts and establishes rules, programs and activities specifically designed to address local problems and opportunities. Texas Water Code §36.0015 states, in part, "Groundwater Conservation Districts created as provided by this chapter are the State's preferred method of groundwater management." Six districts are currently in operation within the planning region:

- Brewster County Groundwater Conservation District
- Culberson County Groundwater Conservation District
- Hudspeth County Underground Water Conservation District#1
- Jeff Davis County Underground Water Conservation District
- Presidio County Underground Water Conservation District
- Terrell County Groundwater Conservation District

In recent sessions, the Texas Legislature has redefined the way groundwater is to be managed by Groundwater Management Areas http://www.twdb.texas.gov/groundwater/management_areas/index.asp. The joint planning process is summarized in Chapter 1, Section 1.1.5.

As part of the joint planning process, groundwater conservation districts are responsible for determining the desired future conditions within a management area. Desired future conditions are defined in Title 31, Part 10, §35601. (6) of the Texas Administrative Code as "the desired, quantified condition of groundwater resources (such as water levels, spring flows, or volumes) within a management area at one or more specified future times as defined by participating groundwater conservation districts." Desired future conditions are implemented to help meet the planning goal for the conservation of water that is to be used for future uses. The following link provides information on desired future conditions. http://www.twdb.texas.gov/groundwater/management_areas/DFC.asp.

The Brewster, Culberson, Hudspeth, Jeff Davis and Presidio districts are in GMA 4. Terrell County Groundwater Conservation District is in GMA 7. As of August 13, 2010, *desired future conditions* have been adopted for the following aquifers: Capitan Reef, Edwards Trinity, Marathon, Rustler, Igneous, Upper Salt Basin, Bone Springs-Victorio Peak, West Texas Bolsons and Presidio-Redford Bolson.

#### 5.3.11.1 Brewster County Groundwater Conservation District

The Brewster County Groundwater Conservation District (http://westtexasgroundwater.com/) was confirmed in 2001 and serves all of Brewster County, the largest county in the State. The mission of the District is to manage, protect, and conserve the groundwater resources of Brewster County, while protecting private property rights and promoting constructive and sustainable development in the county. The table below presents the adopted DFCs for the aquifers in Brewster County. The approved 2015 Management Plan is available here.

**Adopted Desired Future Conditions for Brewster County**

| **Aquifer** | Capitan Reef Complex | Edwards-Trinity (Plateau) | Igneous | Marathon | Rustler |
|---|---|---|---|---|---|
| **DFC** | 0-foot drawdown | 3-foot drawdown | 10-foot drawdown | 0-foot drawdown | Aquifer non-relevant |

#### 5.3.11.2 Culberson County Groundwater Conservation District

The Culberson County Groundwater Conservation District was confirmed in May 1998 and occupies the southwestern half of Culberson County. Aquifers managed by the District primarily include the Wild Horse Flat, Michigan Flat, and Lobo Flat of the West Texas Bolsons, and the Capitan Reef. The table below presents the adopted DFCs for the aquifers in Culberson County. The approved 2019 Management Plan can be accessed at: http://www.twdb.texas.gov/groundwater/docs/GCD/culbersoncgcd/culbersoncgcd_mgmt_plan2014.pdf.

**Adopted Desired Future Conditions for Culberson County**

| **Aquifer** | Capitan Reef Complex | Edwards-Trinity (Plateau) | Igneous | West Texas Bolsons | Upper Salt Basin |
|---|---|---|---|---|---|
| **DFC** | 50-foot drawdown | Aquifer non-relevant | 66-foot drawdown | 78-foot drawdown | Aquifer non-relevant |

#### 5.3.11.3 Hudspeth County Underground Water Conservation District #1

The Hudspeth County Underground Water Conservation District #1 was created in 1956 and is in the Dell Valley irrigation area of northeast Hudspeth County, with the Community of Dell City lying approximately in the center of the District. The principal aquifer in the District is the Bone Spring-Victorio Peak. The District recently installed eight continuous water-level recorders and has placed flow gauges on irrigation wells. The table presents the adopted DFCs for the aquifer in Hudspeth County. The latest District management plan adopted in May of 2013October of 2018 can be accessed here.

**Adopted Desired Future Conditions for Hudspeth County**

| **Aquifer** | Bone Spring – Victorio Peak | Capitan Reef Complex |
|---|---|---|
| **DFC** | 0-foot drawdown | Aquifer non-relevant |

#### 5.3.11.4 Jeff Davis County Underground Water Conservation District

The Jeff Davis County Underground Water Conservation District was formed in August 1994 (HB 2866) and includes all of Jeff Davis County. Primary aquifers managed by the District include the Ryan Flat and Lobo Flat of the West Texas Bolsons and the Davis Mountains Igneous. District activities include the registration of all new wells and the permitting of wells that can produce 25,000 gallons per day or

more. State well-construction standards are enforced and water levels are monitored in 28 observation wells located in high use areas. The District is involved in a wellhead protection program with the Fort Davis Water Supply Corp. and provides educational programs for schools and the public. The table presents the adopted DFCs for the aquifers in Jeff Davis County. The latest District management plan adopted in 2019 can be accessed here.

**Adopted Desired Future Conditions for Jeff Davis County**

| **Aquifer** | Edwards-Trinity (Plateau) | Igneous | West Texas Bolsons | Pecos Valley | Capitan Reef Complex | Rustler |
|---|---|---|---|---|---|---|
| **DFC** | Aquifer non-relevant | 20-foot drawdown | 72-foot drawdown | Aquifer non-relevant | Aquifer non-relevant | Aquifer non-relevant |

### 5.3.11.5 Presidio County Underground Water Conservation District

Presidio County residents approved the formation of the Presidio County Underground Water Conservation District in an election held August 31, 1999. Primary aquifers to be managed in the District include the Presidio-Redford Bolson, the Ryan Flat West Texas Bolson, and the Davis Mountains Igneous. District activities include well permitting, recharge enhancement, and public education. The table presents the adopted DFCs for the aquifers in Presidio County. The latest District management plan adopted in January of 2015 can be accessed here. .

**Adopted Desired Future Conditions for Presidio County**

| **Aquifer** | Igneous | Presidio – Redford Bolsons | West Texas Bolsons |
|---|---|---|---|
| **DFC** | 14-foot drawdown | 72-foot drawdown | 72-foot drawdown |

### 5.3.11.6 Terrell County Groundwater Conservation District

The creation of the Terrell County Groundwater Conservation District was approved and confirmed by the voters of Terrell County at the confirmation election held on November 6, 2012. The Edwards-Trinity (Plateau) Aquifer is the primary aquifer managed by the district. The district accomplishes its objectives by working to lessen interference between water wells, minimize drawdown of groundwater levels, prevent the waste of groundwater, and reduce the degradation of groundwater quality. The District is focused on helping the local economy maintain and improve its current condition. District activities include the protection of existing wells, permitting of new wells and public education. The table presents the adopted DFCs for the aquifer in Terrell County. The approved management plan adopted October 2018 can be accessed here.

**Adopted Desired Future Conditions for Terrell County**

| **Aquifer** | Edwards-Trinity (Plateau) |
|---|---|
| **DFC** | 2-foot drawdown |

*This page intentionally left blank.*

# APPENDIX 5A
# RECOMMENDED AND ALTERNATE WATER MANAGEMENT STRATEGIES

*This page intentionally left blank.*

# INTRODUCTION

"A water management strategy is a plan to meet an identified water need for additional water by an entity, which can mean increasing the total water supply or maximizing an existing supply, including through reducing demand. When a water management strategy project is implemented, it is intended to develop, deliver, and/or treat additional water supply volumes, or conserve water for an entity" (TWDB-Exhibit C General Guidelines-April 2018). The Far West Texas Regional Water Planning Group has identified and evaluated a total of 65 water management strategies. Of this total, seven are "Alternate" strategies, which can be substituted for "Recommended" strategies that are later determined to be non-viable.

Water management strategies described in this appendix are proposed recommended and alternate projects to meet projected water supply shortages in future decades, and projects of specific interest by water-user entities participating in this planning process. Section 5.2 of this chapter provides an explanation of the strategy evaluation procedure and Tables 5-2, 5-3, and 5-4 provide a side-by-side comparison such that all strategies can be assessed based on the same quantifiable factors.

Table 5-2

- Quantity of new water produced
- Chemical quality
- Reliability of supply
- Impacts to water, agricultural, and natural resources, and to ecologically unique stream segments

Table 5-3

- Financial cost (total capital cost, annual cost, and cost per acre-foot)

Table 5-4

- Environmental impacts
    - Environmental water needs
    - Wildlife habitat
    - Cultural resources
    - Environmental water quality
    - Inflows to bays and estuaries

Water management strategies recommended for this *2021 Plan* include specific projects or programs related to conservation and reuse, water-loss audit and main-line repair for entities with more than a reported 10-percent water loss, and projects requiring infrastructure construction, upgrades or modifications.

# 5A-1 WATER MANAGEMENT STRATEGIES FOR BREWSTER COUNTY

## 5A-1.1 MANAGEMENT STRATEGIES FOR CITY OF ALPINE

The City of Alpine relies on groundwater from the Davis Mountains Igneous Aquifer, which is significantly impacted by local pumping during drought years. The following two strategies are intended to:

1. Utilize all available water (rainwater runoff and treated effluent) for restoration of Alpine Creek, which will improve wild life habitat, and increase outdoor recreation in the area;
2. To develop a water source that is available to recharge the underlying aquifer system (ASR);
3. To diminish the amount of treated groundwater that is currently used for landscape irrigation;
4. To provide for more reuse-efficient landscape irrigation of the Country Club golf course, baseball fields, Kokernot Park (pool and picnic areas), and Poets Grove.

- (E-1) Modification to wastewater treatment facility & irrigation system
- (E-2) Irrigation application of captured rainwater runoff

### E-1 Modification to Wastewater Treatment Facility & Irrigation System

The City of Alpine Wastewater Treatment Plant receives up to 400,000 gallons per day and discharges 75,000 gallons per day. Currently the WWTP treated effluent can irrigate the north section of the *project area* (Golf Course) from a 35,000-gallon surface storage tank. Modifications and additions to the infrastructure include installation of an additional 50,000-gallon storage tank (for a total of 85,000-gallon storage capacity) and extension of the irrigation system to supply the south side of the Golf Course. An additional irrigation system is proposed to use the additional treated effluent to irrigate around the baseball fields, Kokernot Park (pool, picnic areas), and Poets Grove, all located in the pilot project area. This would allow the City to efficiently reuse all the treated effluent available for irrigation, with any surplus supplied to Alpine Creek, enhancing bird habitat by establishing native trees and vegetation as well as providing a water feature for a nature trail along the creek between the golf course and the loop road. A hydrological analysis will explore the possibility of additionally using some of the treated effluent for Aquifer Storage Recovery (ASR). The City will submit an amendment to the TCEQ Wastewater permit (WQ0014349001) to include the proposed plan to reuse 100 percent of the treated effluent.

**Quantity, Reliability and Cost** - The project will allow the City to use 100 percent of treated wastewater discharge, an increase of 30 percent or 25 acre-feet per year to irrigate project properties. The project is planned for construction within the 2020 decade and the estimated capital cost of infrastructure modification and irrigation system is $74,400.

### E-2 Irrigation Application of Captured Rainwater Runoff

In a good year, the City of Alpine receives approximately 17 inches of rain, much of which is lost to runoff. High-intensity thunderstorms contribute to greater runoff into nearby Alpine Creek, causing higher peak flooding. This prevents the creek from functioning properly as evidenced by the scoured, cut and straightened channel that exists today which must be armored with engineered banks. Additionally, runoff transports pollutants into the creek, which eventually flows into the Rio Grande. As with many

towns in West Texas, the streets act as a storm water drainage system. These water catchments take that liability and turn it into an asset.

This strategy proposes constructing rainwater catchment basins at three locations around Kokernot Park to reduce down-stream flooding. Impounding a large volume of water from the road will allow it time to infiltrate the soil, recharge the underlying aquifer, and remediate pollutants. These basins will also be landscaped with water-efficient plants without tapping into the city's aquifer water for irrigation. These catchments will also demonstrate how residents can reduce water use and cost by capturing rainwater and landscaping with water-efficient native plants.

The project also aims to address future water shortages. The tremendous drought of 2011 saw many water wells in the area go dry. A large percentage of municipal water supply currently goes to landscaping. With growing populations and a warming climate, this water supply will be subject to even more demand. This native landscaping is very resilient to natural drought and is extremely self-sustaining.

**Quantity, Reliability and Cost** - The three catchment basins are calculated to capture approximately 70 acre-feet during an average drought (75% of average annual rainfall) year. The project supply is considered interruptible during severe drought conditions. The project is planned for construction within the 2020 decade and the estimated capital cost to construct the thee catchment basins and retention dams is $14,500.

## 5A-1.2 MANAGEMENT STRATEGIES FOR BREWSTER COUNTY - OTHER

Although the supply-demand analysis (Chapter 4) does not project a future water supply deficit for Brewster County Other, the following water management strategies are recommended to enhance the reliability of the future water supply availability for rural and small town residents within Brewster County:

- (E-3) Water loss audit and main-line repair for Marathon Water Supply & Sewer Service Co.
- (E-4) Water loss audit and main-line repair for Lajitas Municipal Services
- (E-5) Water loss audit and main-line repair for Study Butte Terlingua WS

### E-3 Marathon Water Supply & Sewer Service Company - Water Loss Audit and Main-line Repair

According to the 2016 TWDB Public Water System Water Loss Survey, the Marathon Water Supply & Sewer Service Company had real water losses (as opposed to apparent "paper" losses) of 19 acre-feet in 2016 (19.6%) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

**Quantity, Reliability and Cost** - The strategy assumes 1 mile of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $255,000. The strategy is estimated to generate a potential savings of 12 acre-feet of water per year throughout the planning period.

### E-4 Lajitas Municipal Services - Water Loss Audit and Main-line Repair

According to the 2016 TWDB Public Water System Water Loss Survey, the Lajitas Municipal Services Company had real water losses (as opposed to apparent "paper" losses) of 98 acre-feet in 2016 (59.3%) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

**Quantity, Reliability and Cost** - The strategy assumes 10 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $2,545,000. The strategy is estimated to generate a potential savings of 51 acre-feet of water per year throughout the planning period.

### E-5 Study Butte Terlingua Water System - Water Loss Audit and Main-line Repair

According to the 2015 TWDB Public Water System Water Loss Survey, the Study Butte Water Supply Corporation, the Terlingua water utility, had real water losses (as opposed to apparent "paper" losses) of 31 acre-feet in 2015 (50.5%) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

**Quantity, Reliability and Cost** - The strategy assumes 12 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $3,054,000. The strategy is estimated to generate a potential savings of 25 acre-feet of water per year throughout the planning period. The Study Butte Terlingua Water System is not an official Water User Group for regional water planning purposes, so demand projections were not developed for them by TWDB. The potential savings identified in this strategy are based the amount used in 2015.

# 5A-2 WATER MANAGEMENT STRATEGIES FOR CULBERSON COUNTY

## 5A-2.1 WATER MANAGEMENT STRATEGIES FOR CULBERSON COUNTY IRRIGATION

Culberson County has a water supply deficit for irrigation use projected at 333 acre-feet per year in 2020 through 2070. The following water management strategies are recommended to enhance the reliability of the future water supply availability for the irrigation water supply shortages within Culberson County:

- (E-6) Irrigation Conservation: Scheduling
- (E-7) Additional well in the West Texas Bolsons Aquifer (Upper Salt Basin)

### E-6 Irrigation Conservation: Scheduling

This strategy is intended for producers with an adequate supply of water throughout the growing season. It involves scheduling the time and amount of water that is applied to a crop based on the amount of water present in the crop root zone, the amount of water consumed by the crop since the last irrigation, and other considerations. Water savings are difficult to quantify and vary from year to year based on cropping practices, water quality, and quantity. It is estimated that 0.3 to 0.5 acre-feet of water per acre may be saved. (Modified from TWDB BMPs at: http://www.twdb.texas.gov/conservation/BMPs/Ag/index.asp)

**Quantity, Reliability and Cost -** According to the 2017 U.S. Ag Census, Culberson County had sixteen farms with irrigated land in 2017 and 5,730 acres of irrigated land, which gives an average of 358 acres per farm using the process described below, and assuming that scheduling would conserve 0.3 acre-feet per acre, this results in a conservation savings of approximately 107 acre-feet per farm. The reliability of this supply is low due to uncertainty associated with estimated implementation of BMPs. There is no capital cost associated with implementing this strategy.

### E-7 Additional Well in the West Texas Bolsons Aquifer (Upper Salt Basin)

This strategy assumes that one new well will need to be drilled to approximately 400 feet below the surface. Historical agriculture use indicates that the Upper Salt Basin aquifer is a viable source. The Upper Salt Basin Aquifer is the northern most aquifer of the West Texas Bolsons Aquifer System and is a potential source of water to meet irrigation supply shortages within Culberson County. Groundwater within the Upper Salt Basin varies from fresh to moderately saline ranging between 1,000 and 4,000 milligrams per liter of total dissolved solids.

**Quantity, Reliability, and Cost -** One new well is assumed to supply 333 acre-feet per year. The reliability of this supply is medium to high, based on competing demands. The total capital cost of this project is approximately $510,000.

# 5A-3 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY

## 5A-3.1 WATER MANAGEMENT STRATEGIES FOR THE TOWN OF ANTHONY

The Town of Anthony and many other residents of El Paso County rely on the Hueco-Mesilla Bolson Aquifer for municipal, domestic, livestock, and irrigation water supply needs. The Town's population is projected to increase from 4,206 in 2020 to 8,052 by 2070. As the population increases, water demands increase. This creates a significant amount of strain on the Hueco-Mesilla Bolson Aquifer. Continued withdrawals from the Aquifer may negatively impact the Aquifer's ability to meet the long-term water supply needs of the area.

The Town of Anthony does not have a projected water supply deficit this planning cycle. The following water management strategies are recommended to enhance the reliability of the City's future water supply availability:

- (E-8) Arsenic treatment facility
- (E-9) Additional groundwater well

The City of Anthony is currently being funded for a wholesale water treatment plant replacement and expansion through the TWDB's Clean Water State Revolving Fund (CWSRF).

### E-8 Arsenic Treatment Facility

Naturally occurring arsenic is found in the groundwater relied upon by the residents of the Town of Anthony. The community's groundwater supply from the Mesilla Bolson Aquifer hovers around the maximum contaminant limit of 10 ppb. Aided by financial assistance from the TWDB, utilizing the Drinking Water State Revolving Fund, the Town has plans to install an arsenic treatment system to meet the State's water supply and public safety standards. The community has been performing pilot studies on two arsenic removal technologies: absorption and oxidation/removal.

The funding received is also intended to construct a 250,000-gallon elevated storage tank, upgrade pumping stations, install re-chlorination facilities in the distribution system, and rehabilitate or replace water lines. Currently, the Town of Anthony has inadequate storage capacity. Wells and booster stations are in critical need of system upgrades and alternate power supplies, in addition to old and undersized distribution lines.

Capital cost is derived from taking the total project cost reported in the 2019 TWDB Drinking Water State Revolving Fund Intended Use Plan ($7,449,947) and incorporating it into the TWDB Costing Tool to add contingencies and develop annual costs.

**Quantity, Reliability, and Cost** - The new arsenic treatment facility is assumed to supply 2,800 acre-feet per year of potable water. Reliability of the project is high since the Mesilla Bolson Aquifer has historically been found as a reliable source. The total capital cost for this project is estimated to be $10,334,000.

## E-9 Additional Groundwater Well

Due to ongoing drought resulting in lower aquifer water levels and condition of existing wells because of age, the Town of Anthony has experienced a decrease in water production from their three existing municipal water wells. Additionally, one of the three wells has been taken out of service. Preliminary inspection of the well shows that the casing is corroded and fractured allowing sand to enter and fill the well screen. The Town is pursuing rehabilitation of this well. However, based on existing and future water demands, in addition to the condition of the Town's existing wells, a new municipal water well is required to reliably supply additional water. Anticipated depth of the well is 800 feet and a capacity of 1,200 GPM.

**Quantity, Reliability and Cost** – The well is anticipated to reliably provide an additional supply of 960 acre-feet per year from the Mesilla Bolson Aquifer, even though some long-term water level decline can be expected. According to Parkhill Smith & Cooper (project engineers), the estimated budget cost of a new well for the Town of Anthony is $1,913,000.

# 5A-4 EL PASO WATER INTEGRATED STRATEGIES

El Paso Water (EPW) is the City's municipal water-supply utility as well as wholesale water-supply provider for several other municipal entities and industries. EPW supply sources include both surface water (Rio Grande) and groundwater (Hueco and Mesilla Bolson aquifers), which are managed in an "integrated" approach that balances each source's availability throughout the year. EPW further manages these primary sources with innovative approaches including advanced purification treatment, reuse of previously used water, and desalination of brackish groundwater. And of critical importance, the various management practices are all preceded by one of the state's most successful conservation programs.

The projected demand for water provided by EPW, including the City of El Paso and all wholesale clients, is projected to increase from 137,479 acre-feet per year in 2020 to 198,364 acre-feet per year in 2070. With current infrastructure and supply availability, EPW is projected to see a need for the development of additional supplies by the 2030 decade, which will increase to approximately 58,498 acre-feet per year by 2070.

To meet the future need for additional water supply, EPW continues to update its *Integrated Water Management Plan*. The Plan involves the design of new project strategies to be implemented at appropriate time periods to ensure that EPW maintains sufficient water supplies in advance of projected need. The *Integrated Water Management Plan* evolved from an analysis of integrated water-development strategies for the City and County of El Paso in the *2006 Far West Texas Water Plan*, which was subsequently updated in the *2011 and 2016 Plans*. The strategies considered are termed "integrated" because they represent combinations of individual sources due to the unique nature of water management in El Paso. Taken separately, each source can be evaluated and analyzed. However, combining all sources into an integrated strategy provides an opportunity to evaluate the interrelationship of the individual components and provides a regional context to the *Regional Plan*. For this *2021 Far West Texas Plan*, the recommended Integrated Water Management Strategy in the *2016 Plan* has again been updated and several new component strategies have been added. The recommended Integrated Strategy adopted to meet the needs for additional water supply for EPW is comprised of the following individual projects listed below. The first eight strategies are "recommended" to meet EPW's future demand needs, while the remaining six are considered as "alternate" strategies available to be considered if any of the "recommended" strategies fail to fully meet future projected needs.

**EPW Integrated Water Management Strategies**

| Strategy Number | Strategy Name |
|---|---|
| **Recommended Strategies** | |
| E-10 | Municipal conservation programs |
| E-11 | Advanced water purification at the Bustamante WWTP |
| E-12 | Advanced water purification at the Haskell WWTP |
| E-13 | Expansion of the Kay Bailey Hutchison Desal Plant |
| E-14 | Hueco Bolson Artificial Recharge |
| E-15 | Riverside regulating reservoir |
| E-16 | Groundwater from Dell City area (Phase 1) |
| E-17 | Groundwater from Dell City area (Phase 2) |
| **Alternate Strategies** | |
| E-18 | Treatment and reuse of agricultural drain water |
| E-19 | Expansion of Canutillo Mesilla Bolson wellfield |
| E-20 | Lower Valley wellhead RO |
| E-21 | Expansion of Jonathan Rogers WTP |
| E-22 | Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP |
| E-23 | Advanced water purification at the Fred Hervey WWTP |

## E-10 Municipal Conservation Programs

Reduction of municipal water consumption may be achieved with the implementation of conservation programs that reduce per capita usage and prevent water waste. El Paso Water (EPW) has been implementing an aggressive water conservation program for nearly 30 years with actions such as adoption of a rate structure that penalizes high consumption, restrictions on residential watering, rebate programs for replacing appliances and bathroom fixtures for low consumption units, plumbing fixtures to reduce leaks, native landscaping programs to reduce landscape irrigation, public education, control of water losses, and enforcement.

Since 1990, the City has had a water conservation department with at least seven full time staff members overseen by a Water Conservation Manager (for a total of eight full time staff members). The department develops and oversees the City's conservation program, collects data, provides enforcement, and develops public outreach programs.

Reuse is considered a conservation strategy by the TWDB. The City currently has a 'purple pipe' water reuse program that provides treated wastewater for irrigation of golf courses, city parks, school grounds, and apartment landscapes, construction and industrial use, as well as indirect reuse by using treated wastewater for artificial recharge. The City is also in the process of implementing a direct reuse strategy, which is evaluated separately.

EPW's water conservation efforts have reduced per capita municipal use in El Paso from about 225 gallons per capita per day (gpcd) in the late 1970s to a current level of 128 gpcd. Residential per capita consumption was 72 gpcd in 2018. The overall per capita potable water use for EPW and its wholesale customers, including steam electric and industrial use, was about 128 gpcd in 2018. This strategy assumes the continuation of EPW's aggressive water conservation efforts and estimates that demand can be reduced by conservation efforts to approximately 112 gpcd by 2070.

**Quantity, Reliability, and Cost** – The table below presents the additional supplies that would result from this strategy's projected level of conservation.

**Projected Conservation Supply (Acre-Feet)**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Projected Population Served by El Paso Water WUG | 734,031 | 822,625 | 904,900 | 986,455 | 1,063,672 | 1,136,275 |
| TWDB Projected gpcd[1] | 134 | 131 | 128 | 127 | 126 | 126 |
| EPW Expected gpcd[2] | 128 | 125 | 123 | 118 | 115 | 112 |
| **Savings above TWDB Projections (acre-feet/year)** | **4,950** | **5,530** | **5,080** | **9,940** | **13,140** | **17,820** |

1. TWDB Project gpcd includes savings from plumbing code
2. Expected gpcd goals are based on conversations with EPW and are equal to or lower than the 2019 Water Conservation Plan (WCP) goals

**Projected Cost of El Paso Water Utilities Conservation Strategy**

| | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Annual Cost | $1,071,000 | $1,071,000 | $1,071,000 | $1,071,000 | $1,071,000 | $1,071,000 |
| Cost per Acre-Foot | $216 | $194 | $211 | $108 | $82 | $60 |
| Cost per 1,000 gallons | $0.66 | $0.59 | $0.65 | $0.33 | $0.25 | $0.18 |

EPW has successfully reduced per capita demands resulting in considerable water savings. Water demand projections prepared by TWDB already account for water efficiency savings through time due primarily to plumbing code savings. The savings reported in the Table above are the result of "active" water conservation strategies that conserve water above and beyond what would happen anyway as a result of "passive" water conservation measures that stem from federal and state legislation requiring more efficient plumbing fixtures in new building construction. The trend in expected gpcd is consistent with EPW's 2019 Water Conservation Plan (WCP) through the 2040 decade. Beginning in 2050, the gpcd goals are lower than the goals laid out in the 2019 WCP.

EPW budgeted $1,071,000 for water conservation programs in their annual budget for fiscal year 2019-2020. Because of the importance of conservation, it was assumed that EPW will invest a similar amount in conservation over the planning period. The projects annual costs for water conservation are shown in the table above.

## E-11 Advanced Water Purification at the Bustamante WWTP

The Roberto R. Bustamante Wastewater Treatment Plant (Bustamante WWTP) is located in southern El Paso near the community of Socorro. The plant is adjacent to the Jonathan Rogers Water Treatment Plant and the Rio Bosque wetlands. The wastewater plant currently discharges approximately 27 million gallons per day (MGD) into the Riverside Irrigation canal and 1.5 MGD to reclaimed water "purple pipe" customers as part of the Mission Valley Reclaimed Water Project.

The Bustamante Advanced Water Purification strategy has been studied in detail by Arcadis and Carollo Engineers. Project components recommended by Arcadis include additional conventional wastewater treatment at the existing plant to remove nutrients, an advanced treatment facility (microfiltration/ultrafiltration, nanofiltration or reverse osmosis, ultraviolet/advanced oxidation process, activated carbon and chlorine disinfection) and storage. The purified water will be placed directly into the distribution system.

Carollo estimated that the amount treated by the advanced treatment facility would be 10.7 MGD initially and increase to 13.3 MGD at build-out. Approximately 70% of this influent would become finished drinking water. For this evaluation, disposal of the waste stream was assumed to be by deep well injection and to be approximately 30% of the amount treated. Construction costs and annual operation and maintenance costs for the Advanced Water Treatment Facility (AWTF) were based on a 2019 cost estimate by Carollo Engineers. Construction costs for the additional wastewater treatment plant improvements and for conveyance from the Bustamante WWTP to the AWTF were based on a 2014 cost estimate by Arcadis and indexed up to 2018 costs. For this evaluation, costs were added for the necessary connection piping to the distribution system and the disposal well system.

Currently, most of the wastewater from the Bustamante WWTP that is not being reused is discharged into a canal system. Much of that water is then used for downstream irrigation, although some of the flow may also serve to maintain environmental functions. Reuse of additional water may impact those functions, but the overall impact is expected to be small. The current conceptual design for this project uses deep well injection to dispose of the brine waste stream, which should have minimal environmental impact. If this was to change and the brine was released to a stream, impacts to the receiving water body would need to be evaluated.

The Advanced Water Purification strategy will treat only part of the effluent from the Bustamante WWTP. EPW will continue to meet its contractual obligations to purple pipe customers and to provide a portion of the wastewater that originates as surface water for downstream irrigators. There may be other impacts from reducing the amount of wastewater that is not covered by contractual obligations.

It is anticipated that this strategy will be implemented by 2030. After reviewing data from a pilot facility, the Texas Commission on Environmental Quality (TCEQ) gave EPW approval to proceed with design of the of the full-scale facility. EPW officials hope to break ground on the Advanced Water Treatment Facility in the next few years and supply their customers with reclaimed water within 10 years.

This project is part of EPW's Integrated Water Strategy and is inherently related to other EPW strategies and sources of supply. The availability of water from this strategy is affected by the portion of the treated effluent that originates as surface water, a portion of which is dedicated by contract to downstream irrigators. There may be some reduction in return flows that EPW is not obligated to discharge, but this impact is expected to be small.

**Quantity, Reliability, and Cost** – Based on estimates from Carollo, this strategy would initially provide approximately 8,500 acre-feet per year in 2020, stepping up by 2 MGD per decade, and expanding to approximately 10,600 acre-feet per year by 2070. Because of the quantity of wastewater treated at the plant, the supply should be very reliable, even after accounting for the portion of the supply committed to irrigators and purple pipe customers. The capital cost for this strategy is estimated at $142.6 million.

## E-12 Advanced Water Purification at the Haskell Street WRP

The Haskell R. Street Wastewater Treatment Plant (WRP) is located in south central El Paso on the Rio Grande and has a capacity of 27.7 MGD. A portion of the treated wastewater effluent from this plant is the source for the Central Reclaimed Water Project (purple pipe reuse), which is used to irrigate several central El Paso schools and parks, including Ascarete Park and Golf Course. Currently most of the remaining effluent from the Haskell Plant is discharged into either the American Canal, which may then be used for irrigation downstream, or the Rio Grande.

This strategy is assumed to treat additional wastewater effluent to potable safe drinking water standards. The purified water would flow directly into the EPW distribution system, while the remaining brine will be disposed by deep-well injection. EPW will continue to meet its contractual obligations to provide a portion of the wastewater that originates as surface water for downstream irrigators. It is anticipated that this strategy will be implemented in the 2070 decade.

The conceptual design and cost for the strategy were based on the Bustamante Advanced Purified Water Plant. The Haskell R. Street WRP Advanced Water Purification strategy includes additional conventional wastewater treatment at the existing plant to remove nutrients, and advanced treatment facility (microfiltration/ultrafiltration, nanofiltration or reverse osmosis, ultraviolet/advanced oxidation process, activated carbon and chlorine disinfection). Disposal wells and pump stations, assumed to be 30% of the amount treated, were added to expansion phases as needed. The purified water will be placed directly into the public supply distribution system.

**Quantity, Reliability, and Cost** – For this strategy analysis, it is assumed that the initial capacity of the project would be approximately 12 MGD, with the project on-line in 2070. Assuming a peaking factor of 1.5, this would provide a supply of approximately 8,900 acre-feet per year. The capital cost to build the project is approximately $189,356,000.

### E-13 Expansion of the Kay Bailey Hutchison Desalination Plant

The Kay Bailey Hutchison Desalination Plant is one of the world's largest inland desalination facilities. The facility is a joint project of El Paso Water (EPW) and Fort Bliss and currently has the capacity to treat 27.5 MGD of brackish groundwater. Disposal of brine reject from the facility is through deep well injection. The project not only provides a safe and reliable supply for the City of El Paso and Fort Bliss, but it also protects fresh groundwater supplies by intercepting the flow of brackish groundwater toward the freshwater wells.

This strategy would expand both the production of brackish groundwater and increase the capacity of the plant by 5.0 MGD for a total of 32.5 MGD. This will involve expanding the existing facility, adding four new source wells and associated piping. For planning purposes, it is assumed that this strategy will be implemented in a single phase. It is assumed that EPW's current disposal facilities are adequate for the project. It is anticipated that this strategy will be implemented in the 2060 decade.

**Quantity, Reliability, and Cost** – This project will provide additional water supply in EPW's conjunctive use portfolio. The combination of new wells and another 5.0 MGD of capacity will provide approximately 5,000 acre-feet of water per year. This supply is assumed to be very reliable. The project is expected to cost approximately $26,490,000.

### E-14 Hueco Bolson Artificial Recharge

Water treatment plant capacity and the timing of demand for water currently limit the use of surface water by EPW. Early in the irrigation season, the water available from the Rio Grande exceeds the demand that can be supplied by surface water. Later in the irrigation season, the demand can exceed the treatment plant capacity. In order to make use of the available surface water early in the irrigation season, EPW plans to develop a facility to recharge the Hueco Bolson Aquifer with treated surface water.

The Hueco Bolson Aquifer is the primary source of water for the City of El Paso, Fort Bliss, Ciudad Juarez and private industries in the area. Since 1903 groundwater levels have declined by as much as 150

feet in some areas of the Aquifer, thus developing a cone-of-depression around a major pumping center serving the City of El Paso. This area is located over an ancient watercourse of the Rio Grande and is well suited for both short- and long-term groundwater storage due to the high porosity and permeability of the de-saturated vertical portion of the Aquifer formation. The substantial depression in the water table surface thus affords ample underground storage space and reasonably high assurances of long-term recovery of stored water. The recharge basin area described in this strategy is in the northern portion of the cone-of-depression and water percolating downward through the basins will naturally gravity drain in the subsurface toward the existing production wells located approximately two miles away.

Previous projects and studies have shown the practicality of aquifer recharge in the El Paso area. The Hueco Bolson Aquifer has been successfully recharged with tertiary treated wastewater from the Fred Hervey Water Reclamation Plant that is treated to drinking water quality standards. Injection rates of up to about 10,000 acre-feet per year through deep injection wells and spreading basins have occurred since the mid-1980s. Aquifer recharge using both treated wastewater effluent and available surface water provide an opportunity to mitigate aquifer overdraft and potentially restore groundwater supplies for continued use.

The treated water strategy will expand the artificial-recharge basins and supplement the recharge supply with excess treated water from the Jonathan Rogers WTP, and does not include expansion of the Fred Hervey Plant. This strategy will require approximately 10,000 feet of 20-inch pipe and six new spreader basins for the treated water. It is anticipated that this strategy will be implemented in the 2030 decade.

**Quantity, Reliability, and Cost** - This strategy is estimated to provide 5,000 acre-feet of additional supply per year from the Hueco Bolson aquifer; however, the supply is contingent on surface water supplies availability. Capital costs for this project is approximately $38,003,000.

### E-15 Riverside Regulating Reservoir

In order to make more efficient use of surface water supplies, EPCWCID#1 has proposed purchasing the City of El Paso former Socorro Pond Sewage Treatment Facility located in the city limits of El Paso near the Bustamante Wastewater Facility. The project will then be developed into the Riverside Regulating Reservoir with project water and cost shared equally between EPW and the EPCWCID#1

The regulating reservoir will allow more efficient use of stored water releases from the Rio Grande Project storage reservoirs, as well as flows that originate as stormwater runoff below Caballo Reservoir. The primary source of water stored in the reservoir would be from excess flows diverted at American Dam and conveyed to the heading of the Riverside Canal. These excess flows primarily consist of storm runoff and operation spills from upstream water users. The temporary stored water would be used either from downstream irrigators or be pumped to the nearby Jonathan Rogers Water Treatment Plant for municipal use. All Rio Grande water is authorized through existing state and federal contracts, agreements and water rights.

The primary benefits of the project are: (1) Improved farm delivery scheduling and flows; (2) Conservation of water stored in upstream storage reservoir through using water captured in regulating reservoirs to meet downstream demands; and (3) A five-day supply of raw water for use by City of El Paso in case of an emergency such as failure or contamination of American Canal system.

Portions of the project have already been completed, including improvements to the Riverside Franklin Feeder Check Structure; a concreate bridge to the Jonathan Rogers WTP; - canal lining; and a flood waste-way to the river.

EPCWID#1 is collaborating with municipalities in El Paso County to make capacity upgrades to existing irrigation drain infrastructure to mitigate flooding while facilitating the capture and reuse of stormwater from local storm events. Stormwater capture and reuse would lead to the development of a new water source for EPCWID#1. Additional studies are needed to determine the quantity and quality of the stormwater that can be captured and the upgrades that are necessary for reuse. EPCWID#1 intends to pursue a mixture of funding options to develop stormwater capture and ruse infrastructure, such as any programs resulting from flood-related legislation passed by the 86th Texas Legislature, including Senate Bill (SB)7, SB 8, SB 500, and House Joint Resolution 4. While the project through EPCWCID#1 (Strategy E-43) is scheduled to come on line in the 2020 decade, EPW does not intend to draw water from the project until the 2040 decade.

**Quantity, Reliability, and Cost** - The primary benefit of this strategy is allowing for more efficient use of existing supplies of water. Previous studies of this project have estimated that the project could provide 6,500 acre-feet of water per year. However, there may be some years where the strategy could provide more or less water, depending on available river supplies and the amount of excess water in the canal. The total capital cost of approximately $13.5 million and supply of 6,500 acre-feet developed from this project is equally split between EPW and the EPCWID#1 ($6,750,000 and 3,250 acre-feet per year each). The strategy supply for EPW is anticipated to come online in 2040.

### E-16 Groundwater from Dell City Area (Phase I)

Importation of groundwater from the Dell City area has been part of the Far West Texas Water Plan since 2006. This strategy includes obtaining water rights through the purchase of properties, drilling and completion of public-supply permitted water wells, construction of a desalination water treatment facility, and installation of a pipeline to El Paso. Project water will be obtained from two wellfields, the first capturing Capitan Reef Aquifer underlying property referred to as Diablo Farms (Phase 1; E-16), and the second wellfield developed in the Bone Springs-Victorio Peak Aquifer underlying the local Dell Valley irrigated area (Phase 2; E-17).

In 2003 and 2004, EPW purchased about 28,000 acres of land (Diablo Farms) overlying the Capitan Reef Aquifer. The property straddles the Hudspeth and Culberson County lines adjacent to the Salt Basin southeast of Dell City. The property is currently leased out for irrigated agricultural use, and until the construction phase is started, the land will continue to be used for agricultural purposes. The proposed strategy calls for production of up to 10,000 acre-feet per year from six new wells beginning in 2040.

EPW has completed preliminary evaluations of groundwater availability in the area and estimates that recharge to this portion of the Capitan Reef Aquifer ranges from 10,000 to 20,000 acre-feet per year. TDS concentrations in the area range from 850 to 1,500 mg/L. All the currently operating irrigation wells on Diablo Farms have TDS values below 1,000 mg/L. However, it is expected that significant increases in pumping amounts would result in movement of poorer quality groundwater into the area.

The evaluation concluded that pumping less than 10,000 acre-feet per year would not require desalination. Pumping between 10,000 and 25,000 acre-feet per year would not result in mining of the Aquifer, but the

groundwater would likely have to be desalinated over time as the intrusion of poorer quality water into the wellfield area increases salinity.

It is assumed that the transmission facilities for this project would be shared with the Dell City groundwater project - Phase 2 (Strategy E-17), and that the pipeline will have sufficient capacity to carry the volume of water at full development of both projects (10,000 acre-feet per year from Diablo Farms and 10,000 acre-feet per year from Dell City). EPW already owns the property at Diablo Farms, so land acquisition is limited to pipeline right-of-way (100 foot).

**Quantity, Reliability, and Cost** – The volume of water generated from this strategy will be 10,000 acre-feet per year beginning in the 2040 decade. The capital cost of the project is approximately $569,357,000.

### E-17 Groundwater from Dell City Area (Phase II)

Dell City is located approximately 75 miles east of El Paso, near the New Mexico-Texas border and is underlain by the Bone Spring-Victorio Peak Aquifer, which covers 130 square miles on the Texas side of the state border. Importation of 10,000 acre-feet per year from the Bone Spring-Victorio Peak Aquifer is proposed by 2050.

The Hudspeth County Underground Water Conservation District No.1 (HCUWCD #1) sustainably manages the aquifer for through regulatory rules as established in the District's groundwater management plan. The modeled available groundwater (MAG) established for the aquifer is 101,400 acre-feet per year assuming an irrigation return flow of 30 percent. Aquifer withdrawals from the Bone Spring-Victorio Peak Aquifer at the proposed pumping rates for this strategy are at a sustainable level based on the current rules of the HCUWCD #1.

Approximately 45 acre-feet per year is withdrawn from the aquifer for municipal use by the community of Dell City, with the remainder used for irrigated agriculture. Water from this aquifer has concentrations of iron, chloride, nitrate, sulfate, and aluminum that exceed water quality standards for municipal supply. With total dissolved solids ranging from 1,810 to 3,900 mg/l, desalination would be required before the source could be used for municipal purposes.

The first decade (2060) of the Dell City project includes rehabilitation of seven wells plus one contingency well with accompanying pumps, pipelines and other appurtenances, a pump station, 12 miles of 42-inch pipeline, expansion of the existing pump stations on the Diablo Farms (Phase 1) to El Paso pipeline, and an 18 MGD desalination facility with disposal wells. The water from the desalination facility will be blended with untreated water to produce the desired water quality.

The second decade (2070) of the project adds rehabilitation of eight more wells with the associated facilities, another expansion of the pump stations on the pipeline to El Paso, and an 18 MGD expansion of the desalination facility. Also included is $55 million for purchase of additional property, for a total of $110 million between the two decades of the project

**Quantity, Reliability, and Cost** - The volume of water generated from this strategy will be 10,000 acre-feet per year beginning in the 2050 decade. The capital cost for this strategy is estimated at $320,226,000.

## E-18 Treatment and Reuse of Agricultural Drain Water (ALTERNATE)

The 2011 Far West Texas Water Plan included a strategy to develop two 5 MGD desalination plants at the Rogers and Canal Water Treatment Plants to treat agricultural drain water for municipal use. Hazen and Sawyer, P.C. since completed a study on the treatment of drain water near the Upper Valley Water Treatment Plant using conventional treatment and blending with other sources to meet water quality standards. This strategy in the 2016 Plan proposed using the same combination of conventional treatment and blending at the Rogers and Canal Plants for the facility at the Upper Valley WTP examined in the Hazen and Sawyer study. This current 2021 strategy now assumes that a 2.41 MGD (2,700 acre-feet per year) plant renovation (see strategy E-14) will be built at the Upper Valley WTP in the 2030 decade.

The use of conventional treatment eliminates the need for brine disposal. However, it does require the availability of lower TDS treated water source in sufficient quantity for blending. The Hazen and Sawyer study found that hardness was a controlling factor, along with TDS, in determining blending ratios with treated water from the Upper Valley WTP. Blend ratios varied from approximately 4 to 1 to more than 14 to 1, depending on target water quality. If additional treatment such as desalination becomes necessary, the strategy's cost estimate will be impacted. This strategy assumes that the treatment waste stream will most likely be discharged directly into the sewer system with solids going to a landfill.

**Quantity, Reliability, and Cost -** The volume of water generated from this strategy will be 2,700 acre-feet per year beginning in the 2040 decade. The total capital cost for the water treatment plant is estimated to be approximately $21,466,000.

## E-19 Expansion of Canutillo Mesilla Bolson Wellfield (ALTERNATE)

A portion of EPW's groundwater supply is obtained from their Canutillo wellfield in the Mesilla Bolson Aquifer on the west side of the Franklin Mountains. Groundwater in this location of the aquifer occurs in three separate horizons with varying water quality, including elevated levels of arsenic which must be treated to drinking-water standards. Groundwater retrieved from the Canutillo wellfield is transported to the Upper Valley WTP for further treatment including arsenic remediation (see Strategy E-14).

The strategy includes the completion of 10 new wells at an average depth of 200 feet and pumping capacity of 500 GPM in the existing wellfield and a pipeline to transport the groundwater to the Upper Valley WTP. Wellhead RO filtration is also being considered for wells contending with high arsenic levels, but is not included in this current analysis. The cost of drilling and equipping 10 new wells includes an additional contingency of 35 percent has been added to the cost, as well as allowances for permitting and mitigation, land acquisition, and interest during construction. The strategy also includes a pipeline to the Upper Valley WTP.

**Quantity, Reliability, and Cost -** This strategy is scheduled to begin initial implementation by 2030 with the production of 7,760 acre-feet per year of new supply and increases each decade to a total of 23,280 by the 2070 decade. Total capital cost for this strategy is $6,444,000 million. Pumping from the Canutillo wellfield can impact flows in the Rio Grande and is monitored by the Bureau of Reclamation.

## E-20 Lower Valley Wellhead RO Desalination (ALTERNATE)

This strategy assumes that five new water wells will be drilled and completed in the Rio Grande Alluvium Aquifer in the Lower Valley to provide an additional 5,000 acre-feet per year of municipal supply. As the raw groundwater from this aquifer is slightly brackish, each well will be equipped with a reverse osmosis desalination filtration system. The resulting supply that will meet safe drinking water standards will be connected directly to the nearest distribution pipeline. The brine concentrate generated from the wells will be discharged to the sewer system. The cost estimate includes the five new wells, associated pipelines, storage, pumps and power.

**Quantity, Reliability, and Cost** - The five new wells are assumed to be drilled to a depth of 500 feet to provide an additional supply of 5,000 acre-feet per year beginning in 2040. Historical municipal, agricultural and industrial use indicates that the Rio Grande Alluvium Aquifer is a viable source. The total capital cost of this project will be approximately $52,681,000.

## E-21 Expansion of Jonathan Rogers WTP (ALTERNATE)

EPW currently obtains surface water from the Rio Grande in accordance with a series of contracts with EPCWID #1, the U.S. Bureau of Reclamation, and the Lower Valley Water District. These contracts allow the conversion of water allocated for irrigation of lands owned or leased by EPW into municipal supply. Over time, EPW may increase the annual diversion from surface water by converting additional water allocated to irrigated lands in El Paso County. The conversion of water for municipal supply will require amendments to contracts or agreements with the U.S. Bureau of Reclamation and EPCWID #1.

This strategy assumes that the increased surface water supply will require additional treatment capacity. Currently, the Jonathan Rogers Water Treatment Plant capacity is 60 MGD. The proposed strategy will increase the capacity to 80 MGD by replacing and enhancing existing treatment facilities. A preliminary design of the plant expansion by CH2M Hill Engineers, Inc. is the basis for the cost estimates for this strategy. Costs associated with the acquisition of irrigation rights are not included.

**Quantity, Reliability, and Cost** - This strategy to be implemented by 2040 will provide up to 6,500 acre-feet of treated water per year, based on a 7-month irrigation season and assuming a peaking factor of 2. The actual quantity of water is dependent on new irrigation properties acquired by EPW and the availability of surface water from the Rio Grande Project, which varies from year to year. The estimated total capital cost for this strategy is approximately $88,679,000.

## E-22 Conjunctive Treatment of Groundwater and Surface Water at the Upper Valley WTP (ALTERNATE)

The Upper Valley Water Treatment Plant located north of Vinton is one of the largest water-treatment facilities in the nation built as a direct result of the EPA revision to the federal regulation of arsenic levels in drinking water. The areas served by the plant include Upper Valley, West Side, Canutillo, Vinton and Westway. The existing plant removes arsenic occurring within groundwater pumped from wells in the Canutillo Wellfield (see strategy E-6), and treats up to 30 MGD of this groundwater for blending with up to 30 MGD of untreated groundwater to produce a finished product with an arsenic concentration of 8 ppm or less. For this strategy, the existing plant will be enlarged and renovated to treat proposed new water sources including raw Rio Grande water delivered from a proposed new La Union diversion point (see EPCWCID#1 strategy) as well as other agricultural drain water sources (see strategy E-5).

The Upper Valley WTP Advanced Water Purification strategy includes additional conventional wastewater treatment at the existing plant to remove nutrients, an advanced treatment facility (microfiltration/ultrafiltration, nanofiltration or reverse osmosis, ultraviolet/advanced oxidation process, activated carbon and chlorine disinfection) and storage. The purified water will be placed directly into the distribution system. Costs associated with the acquisition of irrigation rights are not included

**Quantity, Reliability, and Cost -** The improvement to the plant will produce 10,000 acre-feet per year of additional water supply and is planned to go into operation in 2030. The estimated total capital cost for this strategy is approximately $72,873,000.

### E-23 Advanced Water Purification at the Fred Hervey WRP (ALTERNATE)

The Fred Hervey Water Reclamation Plant treats 12 MGD of wastewater from nearby homes, businesses and industries. The reclaimed water is sent to irrigation and industrial customers including the Newman Power Plant, Painted Dunes Golf Course and the Northeast Regional Park. The plant further treats reclaimed water to drinking water standards and uses it to replenish the aquifer through injection wells and infiltration basins. It was among the first in the nation to create drinking-quality water by treating used water and demonstrate the feasibility of artificial aquifer recharge.

The Fred Hervey Advanced Water Purification strategy includes additional conventional wastewater treatment at the existing plant to remove nutrients, an advanced treatment facility (microfiltration/ultrafiltration, nanofiltration or reverse osmosis, ultraviolet/advanced oxidation process, activated carbon and chlorine disinfection) and storage. The conceptual design and cost for the strategy were based on the Bustamante Advanced Water Purification Plant. The additional purified water will be placed directly into the distribution system. Disposal of the waste stream was assumed to be by deep well injection and to be approximately 30% of the amount treated.

**Quantity, Reliability, and Cost -** The improvement to the plant will produce around 10,000 acre-feet per year of additional water supply and is planned to go into operation in 2040. The capital cost for this strategy is estimated at $140,394,000.

# 5A-5 WATER MANAGEMENT STRATEGIES FOR THE LOWER VALLEY WATER DISTRICT

The Lower Valley Water District (LVWD) is located in the southeastern portion of El Paso County and currently offers water, wastewater and solid waste services to residents within a distribution system of 210 square miles east of the City of El Paso city limits. The City of Socorro, the community of San Elizario, the Town of Clint, El Paso County Sparks Addition, Sand Hills and other El Paso County Colonias are located within the LVWD's boundaries. The LVWD's sole source of water is purchased from the combined (blended) EPW sources developed in the previously described EPW Integrated Strategy (5A-4). The LVWD transfers its Rio Grande water rights to EPW and, in exchange, receives treated water ready for distribution. The LVWD is proposing several new sources of water that will help limit the supplies delivered by EPW to roughly current levels, and obtain additional supply needed for growth independently.

The LVWD has a projected water-supply deficit of 1,358 in 2020 increasing to 5,689 by 2070. The following water management strategies are recommended to enhance the reliability of the LVWD's future water supply availability:

- (E-24) Public conservation education
- (E-25) Install loop lines inside existing connections
- (E-26) Purchase water from El Paso Water (EPW)
- (E-27) Surface water treatment plant and transmission line
- (E-28) Groundwater from proposed wellfield – Rio Grande Alluvium Aquifer
- (E-29) Groundwater from proposed wellfield – Hueco Bolson Aquifer
- (E-30) Wastewater treatment facility and ASR

The LVWD has the following active projects, which are currently being funded through other financial measures offered by the TWDB.

- Collection system extensions
- Water main replacements

## E-24 Public Conservation Education

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short- and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling cause can be presented with sufficient frequency to be recognized and absorbed by the customers. There are many resources that can be consulted to provide insight into implanting effective information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned out and implemented in a consistent and continual manner. A more detailed description of conservation BMPs that might be encouraged is available in *TWDB Report 362, Water Conservation Best Management Practices Guide.* These BMPs can also be found at: http://www.twdb.texas.gov/conservation/outreach/index.asp

The LVWD is encouraged to emphasize conservation through public information programs. A total of one percent reduction in demand is anticipated, which would result in a water savings of 57 acre-feet per year in 2020; increasing to 100 acre-feet per year in 2070. The annual cost for implementing a public information conservation program is estimated at $35,956 in 2020; increasing to $41,954 in 2030. The total capital cost for this strategy is assumed to be $237,461.

### E-25 Loop Distribution Lines for Pressure Redundancy - Conservation

Several LVWD distribution lines dead end, which results in low pressure at the distal end of the lines. Low pressure is resulting in excessive use of water due to the need to flush toilets more than once to clear the sanitary lines. By looping the dead-end lines, adequate pressure can be maintained, thus conserving a significant volume of water.

**Quantity, Reliability, and Cost -** The LVWD distribution system can be looped (connected) with the addition of XXXX feet of XX-inch pipe at a cost of approximately $XXXX. Approximately XXX low-pressure impacted connection will benefit from this upgrade with an estimated water savings of approximately XXX acre-feet per year.

### E-26 Purchase Water from El Paso Water (EPW)

The LVWD has historically purchased its water supply from EPW and furnishes this supply to its wholesale and retail customers. This strategy provides for the purchase of additional water supplies from EPW to meet the projected future supply needs of its customers. The total volume of treated water available for purchase from EPW is contingent on the Rio Grande water-right volume transferred to EPW the LVWD. The purchased supply is also reliant on EPW maintaining its blended water supply and implementation of its Integrated Strategies (5A-4).

**Quantity, Reliability and Cost -**This strategy assumes that LVWD would purchase an additional 1,344 acre-feet per year of water in 2020 and increasing to 5,632 acre-feet per year by 2070 from EPW at a cost of $440 per acre-foot. The annual cost for the water purchase increases from $591,000 in 2020 to $2,478,000 in 2070. The estimated quantity of supply for this strategy is dependent on EPW maintaining its blended water supply and implementing its Integrated Strategies. The reliability of this supply is high, assuming EPW successfully implements their Integrated Strategies. In contrast to many other water management strategies, there are no capital costs associated with the purchase EPW water strategies.

### E-27 Surface Water Treatment Plant and Transmission Lines

The canals that serve as the primary surface water source in the El Paso area divert water from the Rio Grande upstream of El Paso wastewater discharges. Currently, the flows in the Rio Grande in the vicinity of the Lower Valley Water District (LVWD) contains a large percentage of wastewater discharges, originating from both the City of El Paso and the Mexican City of Juarez. The most feasible surface water supply alternative available to the LVWD is to build an intake on the American Canal upstream of the intake for the Jonathan Rogers Water Treatment Plant (WTP), which is owned by El Paso Water (EPW). This strategy assumes that the LVWD and the El Paso County WID #1 come to an agreement to deliver the water to the proposed intake location. Furthermore, this strategy assumes that the LVWD will hold all necessary future Rio Grande Project (RGP) leased water rights. In addition, the LVWD will need to inform EPW that they will be providing their own supplemental water supplies in the future. The

obligation of EPW to provide water via the Jonathan Rogers WTP would be limited to the pro rata share of the plant capital costs paid by the LVWD. From that point on, future RGP water rights obtained via lease from agricultural properties would not be traded to EPW, but rather the LVWD would utilize them directly. This source is currently used for agricultural purposes, and thus this strategy will reduce the amount of water currently available to agricultural users. It is assumed that the transfer of water rights will be between a willing buyer and a willing seller, and therefore minimal impact to agricultural users is anticipated.

This strategy assumes that the surface water supplies are only available seasonally, and therefore water will only be provided during the irrigation season (approximately March through October). The LVWD will need to either purchase water from EPW during the winter months, utilize a groundwater supply source, or construct an Aquifer Storage and Recovery (ASR) project to provide the balance of supplies needed to meet future system demands.

The Surface Water Treatment Plant and Transmission Lines Strategy has been studied in detail by the LVWD. Project components include the purchase of 24 acres, construction of a new intake and pump station on the American Canal, a 1.6 mile 24-inch pipeline to a new 10 MGD water treatment plant, a ground storage tank providing 4 hours of storage at peak flow and a pump station at the WTP, and finally a 0.4 mile 24-inch pipeline to transport water from the WTP to the existing distribution system. Exact locations for these facilities are presently undetermined. Engineering preliminary studies are recommended to determine the best location for these facilities. It is anticipated that the new treatment plant will be designed to treat approximately 10 MGD and be similar in design to the Jonathan Rogers WTP as it is important to produce water that is not significantly different in pH or corrosiveness in order to blend well with EPW water.

**Quantity, Reliability, and Cost** – This strategy will supply an additional 5,000 acre-feet per year of treated water. The proposed plant has a maximum operating capacity of 10 MGD. However, the plant will only provide water seasonally (approximately March through October). The new supply would go directly into customer distribution. The reliability of this project is medium to high depending on available river supplies. The total estimated capital cost for this strategy is $74,338,000.

### E-28 Groundwater from Proposed Wellfield – Rio Grande Alluvium Aquifer

For the LVWD to provide a balance of supplies needed to meet future system demands, the Surface Water Treatment Plant (Strategy E-27) will operate in conjunction with a groundwater project. Groundwater supply sources from both the Rio Grande Alluvium (E-28) and Hueco Bolson Aquifers (E-29) are being considered to acquire water supply for the four months that surface water is not available.

This strategy assumes that the wellfield will produce a supply of 10 MGD. A desalination facility (8.3 MGD) utilizing deep-well injection (1.5 MGD) for concentrate disposal will be required. It is recommended that the location of the wellfield be close to the existing distribution system to reduce the costs of transmission line. A 3-mile pipeline will transport the new supply to the storage facilities. Since the Rio Grande Alluvium Aquifer is high in total dissolved solids (TDS), advanced treatment will be required for municipal purposes, which includes a 2 MGD ground-storage tank and the purchase of 80 acres of land for the plant and another 280 acres for the wellfield.

Seven new wells, with approximately 2,200 feet of well-spacing, will be drilled to produce water from 150 feet below the surface. Each water well will have a capacity of approximately 1,000 gpm. The

design of the wellfield is to operate in conjunction with the Surface Water Treatment Plant (Strategy E-27) during the winter period when surface water is limited.

**Quantity, Reliability, and Cost** – The quantity of water produced from seven wells over a four-month period is approximately 6,800 acre-feet per year. Capital costs for public supply wells completed in the Rio Grande Alluvium Aquifer are based on 1,000 gpm wells with 16-inch production casing, drilled to an average total depth of 150 feet, pumping equipment and site improvement. The estimated cost for a single well completed in this Aquifer is $835,000. The total estimated capital cost for this project is $39,240,000, which includes the desalination facility.

The Rio Grande Alluvium Aquifer has shown that it can be considered reliable as a water supply if properly developed and is not compromised by additional water demands. This strategy could potentially compete for groundwater that at times is used for agricultural purposes; however, the aquifer is currently being used at less than sustainable capacity.

### E-29 Groundwater from Proposed Wellfield – Hueco Bolson Aquifer

Production from a wellfield completed in the Hueco Bolson Aquifer is a second groundwater alternative being considered by the LVWD as a feasible strategy to help supplement the proposed Surface Water Treatment Plant (Strategy E-27). In winter, surface water supplies cannot provide the water supply needed to accommodate the growing water demands. To acquire water supply for the four months that surface water is not available, the LVWD has studied in detail the feasibility of developing a new wellfield in the Hueco Bolson Aquifer.

This strategy assumes six new wells with approximately 2,500 feet of well spacing will be drilled to produce water from 650 feet below the surface. Each water well will have a capacity of approximately 1,000 gpm. It is assumed that the wellfield will produce a supply of 10 MGD. A desalination facility (8.3 MGD) utilizing deep-well injection (1.5 MGD) for concentrate disposal will be required. It is recommended that the location of the wellfield be close to the existing distribution system to reduce the costs of transmission line. A 3-mile pipeline will transport the new supply to the storage facilities. This strategy also includes a 2 MGD ground storage tank and the purchase of 80 acres of land for the plant and another 360 acres for the proposed wellfield.

**Quantity, Reliability, and Cost** –The LVWD is proposing to use this strategy in conjunction with the Surface Water Treatment Plant (Strategy E-27), only during the winter period when the availability of surface water is limited. The supply yield during this designated period of production will provide an additional supply of approximately 6,800 acre-feet per year.

The capital costs associated with this strategy are based on six 1,000 gpm wells with 16-inch production casing drilled to an average total depth of 650 feet, pumping equipment and site improvement. The estimated capital cost for a single well completed in the Hueco Bolson is approximately $835,000. The total estimated capital cost for this project is approximately $36,110,000. Production from the Hueco Bolson is more expensive compared to the Rio Grande Alluvium due to the increased capital costs required for deeper wells, increased pumping costs, and the increased costs associated with pumping from a confined aquifer. The Hueco Bolson Aquifer has shown that it can be considered reliable as a water supply if properly developed and is not compromised by additional water demands.

## E-30 Wastewater Treatment Facility and ASR

To provide the balance of supplies needed to meet future system demands, along with strategies E-27, E-28, and E-29), the LVWD is also considering the possibility of constructing a wastewater treatment facility and an aquifer storage and recovery (ASR) project similar to El Paso Water's Fred Hervey Water Reclamation Plant and aquifer recharge project. The concept of this strategy is to tertiary treat wastewater to near drinking-water standards, inject specified volumes into the distribution system, and store the surplus amount into the Hueco Bolson Aquifer for later recovery.

There are three potential sources of water that could be stored and recovered in the ASR project: (1) excess treated surface water (strategy E-27); (2) treated wastewater provided by EPW; or (3) excess LVWD treated wastewater. The first option would include pumping water from the American Canal at a rate equivalent to taking the full 6.8 MGD over eight months instead of the twelve and deposit the excess in the ASR for use in the winter. The second option would require that EPW modify its treatment train to produce water to a quality suitable for ASR. The third option requires the LVWD build its own wastewater treatment facility. It is recommended that additional studies be conducted to better determine the feasibility of each of these options.

The Hueco Bolson Aquifer is considered as the ASR repository as it has more potential storage volume and is less subject to outside pumping that might pirate a portion of the injected supply. However, the Rio Grande Alluvium may also be an option for the ASR if the Hueco Bolson is determined to be infeasible.

For this strategy, the third option is chosen for consideration in this strategy and thus considers the construction of a new 3 MGD tertiary wastewater treatment facility, an ASR facility consisting of two 650-foot wells capable of both injection and withdrawal, and 5,280 feet of 12-inch diameter wellfield piping.

**Quantity, Reliability, and Cost** – The strategy assumes that an estimated 5,589 acre-feet per year of treated water will be injected into the Hueco Bolson Aquifer. The total capital cost is approximately $23,509,000. Reuse of existing supplies makes this treated supply reliable.

# 5A-6 WATER MANAGEMENT STRATEGIES FOR HORIZON REGIONAL MUNICIPAL UTILITY DISTRICT (MUD)

The Horizon Regional MUD's mission is to provide affordable, high quality drinking water and environmentally sound wastewater treatment and disposal. The Utility District operates a state-of-the-art reverse osmosis water treatment plant servicing residents within an area of approximately 91,000 acres. The District relies on the Hueco Bolson Aquifer and the Rio Grande Alluvium Aquifer for its municipal water supply needs. Drawing from the Rio Grande Alluvium Aquifer, the District converts brackish groundwater into six million gallons of drinking water per day. The District has plans to expand production by an additional two million gallons per day.

Horizon Regional MUD has a projected water supply deficit of 2,709 in 2020; increasing to 17,008 by 2070. The following water management strategies are recommended to enhance the reliability of the Utility District's future water supply availability:

- (E-31) Water Loss Audit and Main-line Repair
- (E-32) Public conservation education
- (E-33) Drill additional wells and expansion of desalination plant

## E-31 Water Loss Audit and Main-line Repair

According to the 2015 TWDB Public Water System Water Loss Survey, the Horizon Regional Municipal Utility District had real water losses (as opposed to apparent "paper" losses) of 688 acre-feet in 2015 (12.5 percent) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

**Quantity, Reliability and Cost** - The strategy assumes 1 mile of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $255,000. The strategy is estimated to generate a potential savings of 197 acre-feet of water per year in 2020 and up to 551 acre-feet per year by 2070. The increase in estimated savings is due to a corresponding increase in demand over the planning period.

## E-32 Public Conservation Education

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short- and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling cause can be presented with sufficient frequency to be recognized and absorbed by the customers. There are many resources that can be consulted to provide insight into implanting effective information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned and implemented in a consistent and continual manner. A more detailed description of conservation BMPs that might be encouraged is available in *TWDB Report 362, Water Conservation Best Management Practices Guide.* These BMPs can also be found at: http://www.twdb.texas.gov/conservation/outreach/index.asp

Horizon Regional MUD is encouraged to emphasize conservation through public information programs. A total of one percent reduction in demand is anticipated, which would result in a water savings of 79 acre-feet per year in 2020; increasing to 222 acre-feet per year in 2070. The annual cost for implementing a public information conservation program is estimated at $19,714 in 2020; increasing to $25,467 in 2030. This project assumes a total capital cost of approximately $137,000.

### E-33 Additional Wells and Expansion of Desalination Plant

Brackish groundwater is supplied from wells in the Rio Grande Alluvium Aquifer and is desalinated through a 6.0 MGD plant. The MUD also has wells in the Hueco Bolsons Aquifer that do not require desalination. The Horizon Regional MUD will require additional infrastructure to produce the needed supply in the decade beginning in the year 2020. This strategy assumes that five additional wells will be drilled in the Rio Grande Alluvium and four in the Hueco Bolsons Aquifer. The five wells in the Rio Grande Alluvium will need to be drilled at approximately 150 feet below the surface. The four wells in the Hueco Bolsons Aquifer will be produced at a depth of 500 feet. These wells combined are anticipated to have an average capacity of 1,200 gpm. This strategy also includes expanding the desalination plant from the 6.0 MGD to 21.4 MGD.

**Quantity, Reliability, and Cost –** The nine proposed wells will have a total production capacity of 16,786 acre-feet per year. The groundwater source will continue to be brackish and will be converted to fresh quality through the desalination facility. The capital cost for this project is estimated at $71,809,000. There is a significant quantity of brackish quality water in the Rio Grande Alluvium Aquifer; therefore, the source is considered very reliable. Since this strategy relies on brackish supplies that are only occasionally used for agricultural irrigation users, competition for the water is expected to be minimal.

# 5A-7 WATER MANAGEMENT STRATEGIES FOR HACIENDAS DEL NORTE WID

## E-34 Water Loss Audit and Main-line Repair

According to the 2015 TWDB Public Water System Water Loss Survey, the Haciendas Del Norte Water Improvement District had real water losses (as opposed to apparent "paper" losses) of 27 acre-feet in 2015 (16.1 percent) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

**Quantity, Reliability and Cost -** The strategy assumes 3 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $764,000. The strategy is estimated to generate a potential savings of 12 acre-feet of water per year in 2020 and up to 19 acre-feet per year by 2070.

# 5A-8 WATER MANAGEMENT STRATEGY FOR EAST MONTANA WS

## E-35 Water Loss Audit and Leak Repair for East Montana Water System

According to the 2016 TWDB Public Water System Water Loss Survey, the East Montana Water System had real water losses (as opposed to apparent "paper" losses) of 155 acre-feet in 2016 (15.1 percent) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

**Quantity, Reliability and Cost -** The strategy assumes 4 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $1,018,000. The strategy is estimated to generate a potential savings of 41 acre-feet of water per year in 2020 and up to 63 acre-feet per year by 2070.

# 5A-9 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY TORNILLO WID

The township of Tornillo is an unincorporated community in El Paso County with a current population of 3,202 people and has been designated as a "Colonia". The El Paso County Tornillo Water Improvement District provides water services to approximately 985 connections, mostly residential, within the community. The District is self-supplied and relies on the Hueco Bolson Aquifer for municipal water supply needs. Although the supply-demand analysis does not project a future water supply deficit for El Paso County Tornillo WID, the following water management strategy is recommended to enhance the reliability of the District's future water supply availability:

## E-36 Additional Groundwater Well and Transmission Line

The District with support from El Paso County received funding to construct a new well in the Hueco Bolson Aquifer, which was completed and online by the end of 2010. The District is expecting to need an additional well in the future to meet local population growth. Water produced from these wells will be included in the arsenic treatment process upon completion of the treatment facility.

This strategy assumes the development of one new well at a depth of 400 feet. The well is assumed to be operating at a capacity of 310 gpm. In addition, this strategy includes 0.25 miles of 6-diameter transmission line. Minimal treatment, such as chlorine disinfection, will be required for municipal purposes.

**Quantity, Reliability, and Cost –** This strategy will yield an additional water supply of 333 acre-feet per year. The estimated total capital cost for this project is $2,060,000. Reliability of this source is high due to the Hueco Bolson Aquifer being a prolific aquifer. Modeling indicates that the Aquifer can be sustainably developed beyond previous estimates. However, development of Hueco Bolson groundwater may have a minor impact on other wells used for agricultural and rural purposes.

# 5A-10 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY-OTHER (VINTON HILLS)

El Paso County-Other Vinton Hills Estates and Vinton Hills Subdivision have a combined projected population of 1,231 in 2020; increasing to 3,277 by 2070. El Paso County Other Vinton Hills has a projected water supply deficit of 14 acre-feet in 2050; increasing to 138 acre-feet by 2070. The following water management strategy is recommended to enhance the reliability of the future water supply availability El Paso County Other – Vinton Hills:

- (E-37) Public Conservation Education
- (E-38) Purchase water from El Paso Water (EPW)
- (E-39) High Capacity Water Lines for Improved Distribution of Water from EPW

## E-37 Public Conservation Education

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short- and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling cause can be presented with sufficient frequency to be recognized and absorbed by the customers. There are many resources that can be consulted to provide insight into implanting effective information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned and implemented in a consistent and continual manner. A more detailed description of conservation BMPs that might be encouraged is available in *TWDB Report 362, Water Conservation Best Management Practices Guide.* These BMPs can also be found at: http://www.twdb.texas.gov/conservation/outreach/index.asp

County-Other entities are encouraged to emphasize conservation through public information programs. EPW will likely provide this service to many of the citizens in this category. A total of one percent reduction in demand is anticipated, which would result in a water savings of 2.8 acre-feet by year 2030. The 2030 annual cost for implementing a public information conservation program is estimated at $1,119. The total capital cost for this strategy is assumed to be $6,072.

## E-38 Purchase Water from El Paso Water

El Paso County-Other entities have historically purchased a portion of their water supply from EPW. This strategy provides for the purchase of additional supplies from EPW by Vinton Hills Estates and Vinton Hills Subdivision to meet their projected future supply needs.

**Quantity, Reliability and Cost -**This strategy assumes that Vinton Hills will purchase a combined amount of 14 acre-feet of water per year from EPW starting in 2050 and increasing to 137 acre-feet per year by 2070 at a cost of $1,041 per acre-foot. The total annual cost for the water purchase is approximately $15,000 in 2050 and $143,000 by 2070. The purchased supply is reliant on EPW maintaining its blended water supply and implementation of its Integrated Strategies (5A.4).

| El Paso County Other (Vinton Hills) | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Supply Amount (ac-ft/yr) | 0 | 0 | 0 | 14 | 77 | 137 |
| Total Annual Cost ($/year) | $0 | $0 | $0 | $15,000 | $80,000 | $143,000 |

The estimated quantity of supply for this strategy is dependent on EPW maintaining its blended water supply and implementing its Integrated Strategies. Supply amounts for individual WUGs range from 0 to 7,260 acre-feet. The reliability of this supply is high, assuming EPW successfully implements their Integrated Strategies. In contrast to many other water management strategies, there are no capital costs associated with the purchase EPW water strategies

## E-39 High Capacity Water Lines for Improved Distribution of Water from EPW

The City of Vinton has applied for financial assistance from the TWDB Drinking Water State Revolving Fund (DWSRF) program. The project is for the installation of new high capacity water lines, able to maintain a minimum pressure, to be tied into EPW's water system. A service fee will be needed to allow EPW to provide adequate water storage. This project will provide the City of Vinton with the community's first public water system.

**Quantity, Reliability, and Cost –** This strategy will yield an additional 400 acre-feet per year of water starting in 2050. Reliability of this source is high as it is part of the EPW Integrated Strategy. The estimated total capital cost for this project is approximately $17,075,000. This amount is derived from taking the total project cost reported in the 2018 TWDB Drinking Water State Revolving Fund Intended Use Plan ($12,782,746) and incorporating it into the TWDB Costing Tool to add contingencies and develop annual costs.

# 5A-11 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY IRRIGATION (EPCWID #1)

Irrigation shortages in El Paso County are the direct result of insufficient water in the Rio Grande during drought-of-record periods to meet anticipated needs. Thus, the quantity of water needed to meet the full demands cannot be realistically achieved during drought conditions and farmers in these areas have generally approached this situation by supplementing supplies with Rio Grande Alluvium Aquifer groundwater, reducing irrigated acreage, changing types of crops planted, or possibly not planting crops until water becomes available during the following season.

In some cases farmers may benefit from Best Management Practices (BMPs) for agricultural water users, which are a mixture of site-specific management, educational, and physical procedures that have proven to be effective and are cost-effective for conserving water. The Texas Water Development Board (TWDB), through the Water Conservation Implementation Task Force has published a report title *Water Conservation Best Management Practices* Guide (TWDB Report 362), which in part contains numerous BMPs for agricultural water users. These agricultural BMPs can also be found at: http://www.twdb.texas.gov/conservation/BMPs/Ag/index.asp

During previous planning periods, the FWTWPG sponsored and the TWDB funded an interim project to evaluate the effectiveness of previously recommended irrigation BMP strategies. The evaluation was conducted by the Texas AgriLife Research Center in El Paso. The entire report can be viewed at http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0704830690_RegionE/TxAgriLifeResearchIrrigationEfficiency-FinalReport.pdf.

The overall conclusion is that very limited opportunities exist for significant additional water conservation in Far West Texas irrigated agriculture. Those practices that suggest economic efficient additional water conservation include lining or pipelining district canals and the very small potential for additional irrigation scheduling and tail water recovery systems. In nearly all cases, these practices have been adopted to a large extent if applicable, further emphasizing the very limited opportunities for additional conservation. If all of these strategies were implemented, the water conserved would satisfy less than 25 percent of the projected unmet agricultural water demand in 2070 during drought-of-record conditions.

Based on this evaluation, the FWTWPG recommends the following conservation and reuse strategies: irrigation scheduling, tailwater reuse, and improvements to water district delivery systems. These strategies are intended for irrigation practices within the El Paso County Water Improvement District #1 (EPCWID#1). The potential water savings under both drought and full supply conditions is shown in the table below.

**Potential Water Savings for EPCWID #1**

| BMP Strategy | Drought | Full |
|---|---|---|
| Scheduling (subtotal) | 1,740 | 5,070 |
| Pivot Sprinkler | - | - |
| Surface Irrigation | - | - |
| Pipeline / Lining District Canals | 25,000 | 50,000 |
| Tailwater Reuse | 1,723 | 6,274 |
| **Total** | **28,463** | **61,344** |

El Paso County has approximately 16,570 acre-feet per year of an irrigation shortage in 2020, which decreases to 13,042 acre-feet per year by 2070. The following water management strategies are recommended to enhance the reliability of the future water supply availability for the irrigation needs within El Paso County:

- (E-40) Irrigation scheduling
- (E-41) Tailwater reuse
- (E-42) Improvements to water district delivery systems
- (E-43) Riverside Regulating Reservoir
- (E-44) New Rio Grande diversion point at La Union Canal

## E-40 Irrigation Scheduling

This strategy is intended for producers with an adequate supply of water throughout the growing season. It involves scheduling the time and amount of water that is applied to a crop based on the amount of water present in the crop root zone, the amount of water consumed by the crop since the last irrigation, and other considerations. Water savings are difficult to quantify and vary from year to year based on cropping practices, water quality, and quantity. It is estimated that 0.3 to 0.5 acre-feet of water per acre may be saved.

Due to recent droughts, EPCWID #1 has made several changes to aid the agricultural sector. Farmland is currently being irrigated with effluent (sewer treated) water. In 2015, 10,000 acres were irrigated in this manner. Also, modifications have been made to the local irrigation schedule. Farmers will now wet their lands for planting starting in February (irrigating as much as possible), up until the beginning of the irrigation season starting June 1st. This strategy assumes that upon the release of the Rio Grande project water, the project water will be mixed with well water and the effluent water in order to produce more supply to be allocated to other users including El Paso Water.

**Quantity, Reliability, and Cost -** Costs vary depending upon which scheduling method is used, number of fields scheduled, type of program and technical assistance. Based upon existing research conducted on surface water delivery through a series of canals, laterals, and on-farm distribution system, irrigation scheduling offers the potential to reduce water deliveries between 10 and 25 percent and more depending upon the capabilities of the individual district and producer. The project would have a benefit of 1,740 acre-feet per year. This strategy assumes an annual cost of approximately $102,595.

## E-41 Tailwater Reuse

This strategy is applicable to any irrigated system in which significant water quantity runs off the end of the irrigated field. This strategy consists of ditches or pipelines to collect tailwater and deliver it to a storage reservoir or small field pump. The water is then pumped to the upper end of the field and applied with the irrigation water. Water savings from the installation of tailwater reuse systems are highly dependent upon the local water supply (groundwater or surface water) and the current on-farm water management practices of the grower. Water savings will typically vary between 5 and 25 percent of the water applied to the head (upper) end of the field. This may range from a few to several inches (0.5 to 1.5 acre-foot per acre per year).

**Quantity, Reliability, and Cost –** Reservoirs or pumps costs range between $35 and $70 per acre per year for pump systems and between $60 and $120 per acre per year for reservoir systems. This project will deliver approximately 1,723 acre-feet of water per year and has an estimated annual cost of $973,368.

## E-42 Improvements to Water District Delivery Systems

EPCWID #1 continues to implement meaningful irrigation conservation measures. The District provides irrigation water for 69,010 acres, includes 350 miles of canals and 269 miles of drains, and supplies raw water to El Paso Water. Improvements to the water district delivery system include but are not limited to: lining of District irrigation canals, replacement of District canals and lateral canals with pipelines.

Lining of District irrigation canals involves the installation of a fixed lining impervious material in an existing or newly constructed canal. Concrete lining of canals and replacement of headgates has been a critical component of irrigation conservation for the District. EPCWID #1 has lined 15 miles of canals within the last seven years, and strives to continue lining approximately 5 miles each upcoming year. This allows for water to be delivered more efficiently to the farms. In addition, in 2015 a joint project between EPCWID #1 and EPWU for $120,000 was implemented to repair and upgrade the canal infrastructure at the headgates.

In 2002, EPCWID #1 received state funding from the TWDB to perform a water and energy conservation feasibility study on lining three canal segments to reduce seepage, construction of check structures and storage, and equalization structures to increase the efficiency and flexibility of water delivery. Funds were available through oil overcharge fees collected by the State Energy Conservation Office and deposited in the Water Bank Account. Water savings involve reduced seepage from the installation of a lining material. Concrete liners are estimated to salvage 80 percent of the original seepage. Costs vary by lining method.

This strategy assumes that replacement of District canals and lateral canals with pipelines involves replacing open canals with buried pipeline that is generally 72 inches in diameter or less. PVC Plastic Irrigation Pipe (PIP) and Reinforced Concrete Pipe (RCP) are the two most commonly used pipelines. Two primary limitations involve cost and water capacity. Water savings stem from reduced seepage. Costs vary and depend on pipe diameter, transportation of pipes, trenching, and other site-specific considerations. Federal funds, state funds and local funds have contributed to the success of this strategy. With the purchase of the proper equipment, the goal is to eventually control the headgates of the system through both the dispatch office and the telemetry system.

**Quantity, Reliability, and Cost –** The estimated total capital cost for this project is approximately $157,777,783 and will deliver approximately 25,000 acre-feet per year.

## E-43 Riverside Regulating Reservoir

To make more efficient use of surface water supplies, EPCWCID #1 has proposed purchasing the City of El Paso former Socorro Pond Sewage Treatment Facility located in the city limits of El Paso near the Bustamante Waste Water Facility.

The regulating reservoir will allow more efficient use of stored water releases from the Rio Grande Project storage reservoirs, as well as flows that originate as stormwater runoff below Caballo Reservoir. The primary source of water stored in the reservoir would be from excess flows diverted at American

Dam and conveyed to the heading of the Riverside Canal. These excess flows primarily consist of storm runoff and operation spills from upstream water users. The temporary stored water would be used either from downstream irrigators or be pumped to the nearby Jonathan Rogers Water Treatment Plant for municipal use. All of the water sources are already authorized through existing state and federal contracts, agreements and water rights.

The primary benefits of the project are: (1) Improved farm delivery scheduling and flows; (2) Conservation of water stored in upstream storage reservoir through using water captured in regulating reservoirs to meet downstream demands; and (3) A five-day supply of raw water for use by City of El Paso in case of an emergency such as failure or contamination of American Canal system.

Portions of the project have already been completed, including improvements to the Riverside Franklin Feeder Check Structure; a concreate bridge to the Jonathan Rogers WTP; - canal lining; and a flood waste-way to the river.

EPCWID #1 is collaborating with municipalities in El Paso County to make capacity upgrades to existing irrigation drain infrastructure to mitigate flooding while facilitating the capture and reuse of stormwater from local storm events. Stormwater capture and reuse would lead to the development of a new water source for EPCWID #1. Additional studies are needed to determine the quantity and quality of the stormwater that can be captured and the upgrades that are necessary for reuse. EPCWID #1 intends to pursue a mixture of funding options to develop stormwater capture and ruse infrastructure, such as any programs resulting from flood-related legislation passed by the 86th Texas Legislature, including Senate Bill (SB)7, SB 8, SB 500, and House Joint Resolution 4.

**Quantity, Reliability, and Cost** - The primary benefit of this strategy is allowing for more efficient use of existing supplies of water. Previous studies of this project have estimated that the project could provide 6,500 acre-feet of water per year. However, there may be some years where the strategy could provide more or less water, depending on available river supplies and the amount of excess water in the canal. The total capital cost of approximately $13.5 million and supply of 6,500 acre-feet per year developed from this project is equally split between EPW and the EPCWID#1 ($6,750,000 and 3,250 acre-feet per year each).

### E-44 New Wasteway 32 River Diversion Pumping Plan

EPCWID #1 is planning to develop a new diversion point at the Rio Grande at the El Paso Upper Valley. The new diversion pint will make irrigation water deliveries to agricultural water users via the La Union East Canal more efficient. In collaboration with EPW, the new diversion pint will allow the delivery of surface water to the Upper Valley Water Treatment Plant. The details for collaboration between EPCWID #1 and EPW for this option have yet to be determined and are outside the scope of regional water planning.

Diversions for irrigation water deliveries in the El Paso Upper Valley are currently made in collaboration with Elephant butte Irrigation District at the Mesilla Dam near Las Cruces, New Mexico. Water for EPCWID #1 is diverted at Mesilla Dam into the Westside Canal and conveyed approximately 20 miles to the heading of the La Union East and West canals and near the Rio Grande Project Wasteway 32. This Wasteway canal conveys bypass water from the La Union East Canal to the Rio Grande.

The proposed conversion of Wasteway 32 into a diversion point on the Rio Grande will reduce the amount of water lost to seepage in the Westside Canal and provide EPCWID #1 and EPW access to surface water during times when no water is or can be diverted at Mesilla Dam.

Portions of the project are already in progress, including concrete lining sections of the La Union East Canal and making sediment control upgrades at Wasteway 32. Additional costs for the Wasteway 32 La Union East River Pumping Plant are included as part of this water management strategy. Further agreements and possible re-routing may be required for surface water deliveries to the Upper Valley Water Treatment Plant.

**Quantity, Reliability, and Cost** – The primary benefit of this strategy is to increase the resiliency of existing supplies of water, reduction to seepage losses, and increased flexibility in operating the Rio Grande Project. The estimated total capital cost of this project is approximately $4,055,887 and will deliver approximately 5,000 acre-feet per year.

# 5A-12 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY MANUFACTURING

El Paso County Manufacturing entities have historically purchased a portion of their water supply from EPW. This strategy provides for the purchase of additional water supplies from EPWU to meet their projected future supply needs. Manufacturing shortages in El Paso County is projected at 8,841 acre-feet per year in 2020; increasing to 15,050 acre-feet per year by 2070. The following water management strategy is recommended to enhance the Manufacturing sector's future water supply availability:

- (E-45) Manufacturing Conservation
- (E-46) Purchase water from El Paso Water

## E-45 Manufacturing Conservation

Most groundwater used for manufacturing in El Paso County is for petroleum refining. Upgrading from a wet cooling tower to a hybrid water/air cooling tower minimizes loss by evaporation and required make-up water. The change of the cooling water system minimizes the lost by evaporation, entrainment and purge and as consequence to minimize the fresh water (make-up water) consumption. To minimize waste, cooling tower blowdown can be treated. Thus, depending on the treated effluent quality, it can be recycled to the cooling tower or to another purpose such as fired fighting or service water.

Maximizing cooling tower cycles offers many benefits in the way it reduces water consumption, minimizes waste generation, decreases chemical treatment requirements, and diminishes overall operating costs. Cooling tower cycles can be maximized in a variety of ways. These include pH adjustment, chemical scale inhibitors, and pretreatment of the tower make-up water. Potential cost savings vary from plant to plant, depending on the cost of fresh water, waste disposal costs, chemical treatment dosages, and energy. Nevertheless, in addition to the environmental, health, and safety improvements, some studies show that the return on investment for improving cooling tower efficiency is typically less than one year.

**Quantity, Reliability and Cost -** The estimated quantity of supply for these BMPs is uncertain due to variability of potential upgrades which can be costly, and lack of detailed data specific to the existing refineries and manufacturing plants. This strategy assumes a potential 50 percent savings if there is an industry switch to hybrid wet-dry cooling towers, which for the 2030 decade would be 430 acre-feet per year. The reliability of this supply is low due to uncertainty associated with estimated investments in BMPs. Studies show that the return on investment for improving cooling tower efficiency is typically less than one year; therefore, no capital cost is determined for this strategy.

## E-46 Purchase Water from El Paso Water (EPW)

This strategy assumes that El Paso County Manufacturing entities would purchase an additional 860 acre-feet of water per year from EPW starting in 2030 at a cost of approximately $1,220 per acre-foot.

**Quantity, Reliability and Cost -**The total annual cost for the water purchase is approximately $1,049,000. In contrast to many other water management strategies, there are no capital costs associated with the purchase EPW water strategies. The purchased supply is reliant on EPW maintaining its blended water supply and implementation of its Integrated Strategies (5A.4).

## 5A-13 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY MINING

El Paso County Mining entities purchase a portion of their water supply from EPWU; however, much of the water needs for mining operations are self-supplied from private/company water wells. Projected Mining water supply shortages in El Paso County begin in 2020 with a 1,926 acre-feet per year deficit; decreasing to 1,792 acre-feet per year by 2070. The following water management strategy is recommended to enhance the Mining industry's future water supply availability:

- (E-47) Mining Conservation
- (E-48) Additional groundwater wells in the Hueco-Mesilla Bolson Aquifer

### E-47 Mining Conservation

Mining groundwater use in Far West Texas is primarily associated with oil and gas production. Water is needed for well drilling activities, formation fracing, and sand (proppant) mining plants. The FWTWPG encourages the use of alternative water sources when and where it is economically feasible to do so. For conservation of freshwater resources associated with fracing, on-site treatment of produced and/or flowback water allows for reuse of the water stream. There are numerous third-party vendors who offer mobile produced water recycling systems.

**Quantity, Reliability and Cost** - In 2018, approximately ten percent of fracwater supply in the Permian Basin was recycled produced water. Conservation of 15 percent of El Paso County mining needs in 2020 would reduce mining needs by 278 acre-feet per year. This strategy will have immediate savings in water-handling (transportation and disposal) costs. It is assumed that the cost will reach zero within the first year due to offset by the money saved by phasing out traditional operation practices.

### E-48 Additional Groundwater Wells in the Hueco-Mesilla Bolson Aquifer

The Hueco-Mesilla Bolson Aquifer has been identified as a potential source of water to meet the mining shortages within El Paso County. This Aquifer, a major source of groundwater for cities in El Paso County, extends southeastward from the New Mexico state line in El Paso County to the southern end of the Quitman Mountains in Hudspeth County.

Water from this source is typically good. Fresh to slightly saline water exist in the upper portions of the bolson. Brackish water exists at greater depths and is recommended for mining purposes. This strategy assumes that five new wells will need to be drilled to an average depth of 585 feet below the surface.

**Quantity, Reliability, and Cost –** The quantity of water from five new wells in this source is expected to be approximately 600 gpm or 4,251 acre-feet per year. The reliability of this supply is medium to high, based on competing demands and water quality issues. Total cost of this project will be approximately $1,208,000.

# 5A-14 WATER MANAGEMENT STRATEGIES FOR EL PASO COUNTY STEAM ELECTRIC POWER

Steam Electric Power water supply shortages in El Paso County is projected at 7,260 acre-feet per year through 2070. Water supply needs are met partly by EPW's blended source along with obtaining self-supplied groundwater from the Hueco-Mesilla Bolson Aquifer. The following water management strategy is recommended to enhance the reliability of the future water supply availability for steam electric power.

- (E-49) Steam Electric Power Conservation
- (E-50) Purchase water from El Paso Water

## E-49 Steam Electric Power Conservation

Upgrading from a wet cooling tower to a hybrid water/air cooling tower minimizes loss by evaporation and required make-up water. The change of the cooling water system minimizes the lost by evaporation, entrainment and purge and as consequence to minimize the fresh water (make-up water) consumption. Dry cooling processes use very little water. However, compared to traditional wet cooling, dry cooling systems have higher upfront and higher operating costs, are less efficient and reliable at warmer temperatures, and demand a larger footprint. Hybrid systems combine wet cooling with dry cooling systems to solve some of these drawbacks, allowing them to function reliably in higher temperatures and a smaller footprint. To minimize waste, cooling tower blowdown can be treated. Thus, depending on the treated effluent quality it can be recycled to the cooling tower or to another purpose such as fired fighting or service water.

Maximizing cooling tower cycles offers many benefits in the way it reduces water consumption, minimizes waste generation, decreases chemical treatment requirements, and diminishes overall operating costs. Cooling tower cycles can be maximized in a variety of ways. These include pH adjustment, chemical scale inhibitors, and pretreatment of the tower make-up water. Potential cost savings vary from plant to plant, depending on the cost of fresh water, waste disposal costs, chemical treatment dosages, and energy. https://www.samcotech.com/how-can-you-reduce-water-used-in-electrical-generation/

**Quantity, Reliability and Cost -** The estimated quantity of supply for these BMPs is uncertain due to variability of potential upgrades which can be costly, and lack of detailed data specific to the existing power plants. This strategy assumes a potential 50 percent savings if there is an industry switch to hybrid wet-dry cooling towers, which for the 2020 decade would be 3,630 acre-feet per year. The reliability of this supply is low due to uncertainty associated with estimated investments in BMPs. Studies show that the return on investment for improving cooling tower efficiency is typically less than one year; therefore, no capital cost is determined for this strategy.

## E-50 Purchase Water from El Paso Water (EPW)

**Quantity, Reliability and Cost -** This strategy assumes that El Paso County Steam Electric Power would purchase 7,260 acre-feet of additional water per year from EPW starting in 2020 at a cost of $131 per acre-foot. The total annual cost for the water purchase is approximately $951,000. The purchased supply is reliant on EPW maintaining its blended water supply and implementation of its Integrated Strategies (5A.4).

# 5A-15 WATER MANAGEMENT STRATEGIES FOR HUDSPETH COUNTY

## 5A-15.1 WATER MANAGEMENT STRATEGIES FOR HUDSPETH COUNTY-OTHER (DELL CITY)

Dell City relies on the Bone Spring-Victorio Peak Aquifer for its municipal supply. While the supply availability is adequate, water from the aquifer must be desalinated to make it potable for public drinking water use. Although the supply-demand analysis does not project a future water supply deficit for Dell City, the maintenance and upgrade of the City's desalination facility is recommended to enhance the reliability of its future water supply availability.

### E-51 Brackish Groundwater Desalination Facility

Aided by financial assistance from the TWDB, Dell City has plans to replace the City's water treatment facility with a reverse osmosis system. The existing ionic filtration system is outdated and replacement parts are difficult to obtain. In addition, the City's groundwater source exceeds water quality standards for total dissolved solids and fluoride. This strategy incorporates Dell City's funding application from the TWDB Drinking Water State Revolving Fund (DWSRF) for an amount of $244,450. It is assumed that all other necessary infrastructure (e.g., piping, concentrate disposal) is currently in place for the existing facility and will not need to be updated.

**Quantity, Reliability, and Cost –** This strategy assumes an additional supply of 111 acre-feet of water per year. The reliability of this strategy is high due to the sufficient amounts of brackish groundwater. It is estimated that the total capital cost for this project is $1,636,000.

## 5A-15.2 WATER MANAGEMENT STRATEGIES FOR HUDSPETH COUNTY-OTHER (SIERRA BLANCA-HUDSPETH COUNTY WCID#1)

The Hudspeth County WCID#1 provides water to the Community of Sierra Blanca and the surrounding area. The Utility is under contract with the Town of Van Horn for delivery of water obtained from wells in the Wild Horse Flat Aquifer north of Van Horn near the airport. Since 1970, Sierra Blanca has drilled several wells near the town in unsuccessful attempts to develop local sources of groundwater. Although the supply-demand analysis does not project a future water supply deficit for the Utility, the following water management strategies are recommended to enhance the reliability of the Utility's future water supply availability:

- (E-52) Public Conservation Education
- (E-53) Replace Water-supply Line from Van Horn
- (E-54) Local Groundwater Well
- (E-55) Groundwater Well NE of Van Horn
- (E-56) Groundwater Well West of Van Horn

## E-52 Public Conservation Education

Public information programs, even though they may not be directly related to any equipment or operational change, can result in both short- and long-term water savings. Behavioral changes by customers will only occur if a reasonable yet compelling cause can be presented with sufficient frequency to be recognized and absorbed by the customers. There are many resources that can be consulted to provide insight into implanting effective information programs. Like any marketing or public information program, to be effective, water conservation public information should be planned out and implemented in a consistent and continual manner. A more detailed description of conservation BMPs that might be encouraged is available in TWDB Report 362, Water Conservation Best Management Practices Guide. These BMPs can also be found at: http://www.twdb.texas.gov/conservation/outreach/index.asp

The Hudspeth County WCID#1 (Sierra Blanca) is encouraged to emphasize conservation through public information programs. A total of one percent reduction in demand is anticipated, which would result in a water savings of 1.5 acre-feet by year 2030. The 2030 annual cost for implementing a public information conservation program is estimated at $621.54. It is estimated that the total capital cost for this project is $3,513.

## E-53 Replace Water-Supply Line from Van Horn

Water supply generated by the Town of Van Horn is delivered to the Hudspeth County WCID#1 (Sierra Blanca) through an old pipeline that needs major repair or replacement. The Utility estimates a substantial loss along the pipeline resulting in frequent repairs. In 2015, a loss of 7.4 acre-feet or 3.8 percent of the annual flow through the pipeline was recorded. This strategy describes the replacement of the old pipeline with 40 miles of eight-inch transmission line along an existing right of way. Also included is one pumping station and one booster station to overcome elevation gains.

**Quantity, Reliability, and Cost –** This strategy assumes an additional supply of 39 acre-feet of water per year. The supply from the Van Horn wellfield is very reliable. It is estimated that the total capital cost for this project is $18,432,000.

## E-54 Local Groundwater Well

A new groundwater well located within or adjacent to the Sierra Blanca may provide a local option for additional water supply. The source from which this well would produce is uncertain, but is likely from the Diablo Plateau Aquifer. Historically, wells in this area have produced small amounts of brackish groundwater. A well-site assessment is likely necessary for this project. For this strategy, a single well drilled to an estimated depth of 500 feet and completed to public-supply specifications might produce a desired yield of 20 GPM and be operated 12 hours a day. One half mile of 6-inch pipe will connect the supply to the nearest distribution line. As the anticipated supply will likely be brackish in quality, a small wellhead reverse osmosis desalination filtration system.

**Quantity, Reliability and Cost -** This strategy assumes an additional supply of 16 acre-feet of water per year. The supply from the Diablo Plateau Aquifer well is uncertain. It is estimated that the total capital cost for this project is $940,000.

### E-55 Groundwater Well NE of Van Horn

The Hudspeth County WCID#1 is under contract with the Town of Van Horn for delivery of water obtained from wells in the Wild Horse Flat Aquifer north of Van Horn near the airport. One well in this area is currently specifically designated for the District's supply, and there is substantial room for expansion if an additional well is needed to meet increased demand. This strategy describes the construction and completion of one additional well to supply the increased future need for the District. The well is proposed to be 1,500 feet deep with an average pumping capability of 400 GPM. One mile of pipeline is proposed to connect the new well to the main Utility transmission line.

**Quantity, Reliability, and Cost –** This strategy assumes an additional supply of 39 acre-feet of water per year. The supply from the Van Horn wellfield is very reliable. It is estimated that the total capital cost for this project is $2,132,000.

### E-56 Groundwater Well West of Van Horn

One new well is proposed for the Hudspeth County WCID #1 near the Allamoore industrial site along IH10 west of Van Horn. Groundwater availability at this location is uncertain; however, likely host aquifer formations include shallow Eagle Flat alluvium, Permian and Pre-Cambrian limestones and breccia, which for this strategy will be referred to as the Diablo Plateau Aquifer. This strategy describes the construction and completion of one well to supply the increased future need for the District. The well is proposed to be 500 feet deep with an average pumping capability of 100 GPM. A half-mile pipeline is proposed to connect the new well to the main Utility transmission line.

**Quantity, Reliability, and Cost –** This strategy assumes an additional supply of 39 acre-feet of water per year. The reliability of this strategy is uncertain as few wells have been drilled in this vicinity. It is estimated that the total capital cost for this project is $636,000.

## 5A-15.3 WATER MANAGEMENT STRATEGIES FOR HUDSPETH COUNTY MINING

Mining water supply shortages in Hudspeth County are projected at 219 acre-feet per year in 2070. Mining water supply needs within the county obtain supplies from both surface and groundwater sources. Surface water such as local supply is commonly used, but limited during drought conditions. Groundwater from the Rio Grande Alluvium Aquifer and West Texas Bolsons Aquifer are more reliable sources. The following water management strategy is recommended to enhance the reliability of the future water supply availability for the mining water-supply needs within Hudspeth County:

- (E-57) Mining Conservation
- (E-58) Additional groundwater well in the West Texas Bolsons (Eagle Flat) Aquifer

### E-57 Mining Conservation

Mining groundwater use in Far West Texas is primarily associated with oil and gas production. Water is needed for well drilling activities, formation fracing, and sand (proppant) mining plants. The FWTWPG encourages the use of alternative water sources when and where it is economically feasible to do so.

For conservation of freshwater resources associated with fracing, on-site treatment of produced and/or flowback water allows for reuse of the water stream. There are numerous third-party vendors who offer mobile produced water recycling systems.

**Quantity, Reliability and Cost** - In 2018, approximately 10 percent of fracwater supply in the Permian Basin was recycled produced water. Conservation of 15 percent of Hudspeth County mining needs in 2020 would reduce mining needs by 29 acre-feet per year. This strategy will have immediate savings in water-handling (transportation and disposal) costs. It is assumed that the cost will reach zero within the first year due to offset by the money saved by phasing out traditional operation practices.

### E-58 Additional Groundwater Well in the West Texas Bolsons (Eagle Flat) Aquifer

The West Texas Bolsons Aquifer has been identified as a potential source of water to meet the mining shortages within Hudspeth County. The Eagle Flat Bolson is situated between the Eagle Mountains along the south-southwest, the Diablo Plateau along the north, and the Carrizo and Van Horn Mountains along the east. Groundwater underlying the Eagle Flat area is not a source of supply for municipalities in Hudspeth County due to water quality and quantity limitations. However, the Eagle Flat is a sufficient source for mining purposes. This strategy assumes that one new well will be drilled to a depth of 375 feet.

**Quantity, Reliability, and Cost –** The one new well is assumed to produce at a rate of 240 GPM or 219 acre-feet per year. Historical industrial and agricultural use indicates that the West Texas Bolsons Aquifer may be a viable source, with a reliability range medium to high, based on competing demands and water quality issues. Total cost of this project will be approximately $306,000.

# 5A-16 WATER MANAGEMENT STRATEGIES FOR JEFF DAVIS COUNTY

## 5A-16.1 WATER MANAGEMENT STRATEGIES FOR FORT DAVIS WSC

Fort Davis Water Supply Corporation (FDWSC) provides water to the Community of Fort Davis and the surrounding area from three wells completed in the Davis Mountains Igneous Aquifer and continues to consider the feasibility of future water well development in surrounding areas. Although the supply-demand analysis does not project a future water supply deficit for the FDWSC, the following water management strategy is recommended to enhance the reliability of the future water supply availability.

- (E-59) Additional groundwater well in the Igneous Aquifer
- (E-60) Transmission line to connect Fort Davis WSC to Fort Davis Estates

### E-59 Additional Groundwater Well – Igneous Aquifer

This strategy assumes that one new well would need to be drilled into the Igneous Aquifer to provide approximately 274 acre-feet per year. The Aquifer is not a single homogeneous aquifer but rather a system of complex water-bearing formations that are in varying degrees of hydrologic communication. Most wells developed are less than 1,000 feet in depth.

This well would be located on the opposite end of the existing storage facility, and produce water from approximately 300 feet below the surface. In addition, 500 feet of eight-inch diameter connection pipeline will be necessary to connect to the storage facility. Minimal treatment will be required, such as chlorination disinfection for municipal use.

**Quantity, Reliability, and Cost** – The quantity and reliability of water from this source is expected to be approximately 274 gpm. Water quality of the aquifer is relatively good and generally meets safe drinking water standards. Minimal advanced treatment will be required for municipal purposes. The reliability of this supply is medium to high, based on competing demands. The total estimated project cost is approximately $584,000.

### E-60 Transmission Line to Connect Fort Davis WSC to Fort Davis Estates

FDWSC provides water to the Community of Fort Davis and the surrounding area which includes Fort Davis Estates. FDWSC has plans to construct an additional transmission line to connect FDWSC to the Fort Davis Estates subdivision, which has its own well. This strategy assumes the connection of 20 houses, with a 2-mile, 6-inch diameter transmission pipeline. Conveyance of water would flow both directions depending on peak demand. This pipeline would only be used for emergency purposes to meet the peak demand during summer months. The evaluation does not include additional storage. Funding is expected to be provided solely by Fort Davis WSC.

**Quantity, Reliability, and Cost** – This strategy would supply 114 acre-feet per year and is considered reliable. The total estimated capital cost for this project is $1,671,000.

# 5A-17 WATER MANAGEMENT STRATEGIES FOR JEFF DAVIS COUNTY-OTHER (TOWN OF VALENTINE)

The Town of Valentine, a small community in western Jeff Davis County, currently derives its entire water supply from one groundwater well completed in the Ryan Flat portion of the Salt Basin Aquifer, a subdivision of the West Texas Bolson Aquifers. A second well is needed as a supplemental and backup supply for the community. Although the supply-demand analysis does not project a future water-supply deficit for the Town of Valentine, the following water management strategy is recommended to enhance the reliability and security of the community's future water supply availability.

## E-61 Additional Groundwater Well in the Ryan Flat Aquifer

This strategy assumes that one new municipal well is needed to provide an additional water supply for the Town of Valentine. This new groundwater, well likewise completed in the Ryan Flat Aquifer would be located near the existing well and drilled to a depth of approximately 870 feet below the surface. In addition, 500 feet of six-inch diameter connection pipeline will be necessary. Minimal treatment will be required, such as chlorination disinfection for municipal use.

**Quantity, Reliability, and Cost** – The well is expected to reliably yield approximately 80 gpm and produce 129 acre-feet per year. Water quality of the Aquifer is relatively good and generally meets safe drinking water standards. Minimal advanced treatment will be required for municipal purposes. The total estimated project capital cost is approximately $783,000.

# 5A-18 WATER MANAGEMENT STRATEGIES FOR PRESIDIO COUNTY

## 5A-18.1 WATER MANAGEMENT STRATEGIES FOR THE CITY OF PRESIDIO

The City of Presidio is located on the Rio Grande adjacent from Ojinaga, Chihuahua on the U.S.-Mexico Border. The City and many other border residents of Presidio County rely on the West Texas Bolsons – Presidio-Redford Bolson Aquifer for municipal, domestic, livestock and irrigation water supply needs. Although the City's supply-demand analysis does not project a future water supply deficit for the City of Presidio, the following water management strategies are recommended to enhance the reliability of the City's future water supply availability:

- (E-62) Water loss audit and main-line repair
- (E-63) Additional groundwater well in the Presidio Bolson Aquifer

### E-62 Water Loss Audit and Main-line Repair

According to the 2015 TWDB Public Water System Water Loss Survey, the City of Presidio had real water losses (as opposed to apparent "paper" losses) of 98 acre-feet in 2015 (14.8%) due to leaking infrastructure. This amount of water loss is the sum of reported breaks and leaks, and unreported loss. The water supply system can reduce water losses and get a more accurate look at water consumption by taking the proper measures to identify and repair old infrastructure and inaccurate water meters. This strategy will provide a savings of only a portion of the total reported loss and assumes that a leak testing program would be implemented prior to possibly replacing portions of the existing leaking pipe.

**Quantity, Reliability, and Cost -** The strategy assumes 2 miles of 6-inch diameter pipe will be replaced, at a total estimated project capital cost of $509,000. The strategy is estimated to generate a potential savings of 35 acre-feet of water per year in 2020 and up to 45 acre-feet per year by 2070.

### E-63 Additional Groundwater Well in the Presidio Bolsons Aquifer

The City of Presidio has plans to develop new water supplies to meet growing water demands within the community. Currently, the Border Environment Cooperation Commission is working with the City of Presidio to develop several improvements to the City's existing water infrastructure. One such project is to extend water services along Highway 67 as far as the airport 5 miles north of town to provide services to Las Pampas Colonia. The new water line will benefit approximately 12 existing residences and an equal number of businesses. This strategy assumes that one new well will be drilled into the West Texas Bolsons Aquifer (Presidio-Redford Bolson) to a depth of 90 feet to generate approximately 150 gpm. The project includes 5 miles of 8-inch diameter transmission pipeline, one pump station, one 50,000-gallon storage tank and minimal treatment such as chlorine disinfection.

**Quantity, Reliability, and Cost** – The quantity and reliability of water from this source is expected to be approximately 120 acre-feet of water per year. The combined supplies from strategies using water from the Presidio Bolson Aquifer do not exceed the MAG value, indicating there are sufficient supplies for these strategies. Minimal advanced treatment will be required for municipal purposes. The reliability of this supply is low to medium based on finding a good location for a productive well. The total estimated project cost is approximately $5,509,000.

# 5A-19 WATER MANAGEMENT STRATEGIES FOR TERRELL COUNTY

## 5A-19.1 WATER MANAGEMENT STRATEGIES FOR TERRELL COUNTY MINING

Mining interests in Terrell County obtains their water from local surface water supplies and from the Edwards-Trinity (Plateau) Aquifer. Local surface water sources are commonly used, but limited during drought conditions. The Aquifer source is more reliable and is thus identified as a potential supply to meet the projected mining water supply deficits which are projected at 483 acre-feet per year in 2020; increasing to 586 acre-feet per year by 2030; and then decreasing to 195 acre-feet per year by 2070.

- (E-64) Mining Conservation
- (E-65) Additional wells in the Edwards-Trinity (Plateau) Aquifer - ALTERNATE

### E-64 Mining Conservation

Mining groundwater use in Far West Texas is primarily associated with oil and gas production. Water is needed for well drilling activities, formation fracing, and sand (proppant) mining plants. The FWTWPG encourages the use of alternative water sources when and where it is economically feasible to do so.

For conservation of freshwater resources associated with fracing, on-site treatment of produced and/or flowback water allows for reuse of the water stream. There are numerous third-party vendors who offer mobile produced water recycling systems. In 2018, approximately 10 percent of fracwater supply in the Permian Basin was recycled produced water.

**Quantity, Reliability, and Cost -** This strategy will have immediate savings in water-handling (transportation and disposal) costs. Conservation of 15 percent of Terrell County mining needs in 2020 would reduce its needs by 72 acre-feet per year. It is assumed that the cost will reach zero within the first year due to offset by the money saved by phasing out traditional operation practices.

### E-65 Additional Wells in the Edwards-Trinity (Plateau) Aquifer (ALTERNATE)

The following water management strategy exceeds the current MAG groundwater availability for the Edwards-Trinity (Plateau) Aquifer in Terrell County and therefore cannot be recommended. However, this strategy is included as an “Alternate” strategy designed to be recommended upon a change in DFC and MAG availabilities in future planning cycles, or by a rules modification by the Terrell County Groundwater Conservation District. Should the MAG change in future planning cycles, this strategy will become a recommended strategy. This strategy assumes that six new wells will be drilled to approximately 630 feet below the surface.

**Quantity, Reliability, and Cost –**Six new wells are assumed to supply an additional 470 acre-feet per year. Historical use indicates that the Edwards-Trinity (Plateau) Aquifer may be a viable source and the reliability of this supply is medium to high, based on competing demands and water quality issues. Total cost of this project will be approximately $921,000.

*This page intentionally left blank.*

# APPENDIX 5B
# STRATEGY EVALUATION QUANTIFICATION MATRIX

*This page intentionally left blank.*

# STRATEGY EVALUATION QUANTIFICATION MATRIX

The practicality of an implemented water management strategy may be measured in terms of quantity, quality and reliability of water produced and the varying degree of impact (positive or negative) on pre-existing local conditions. The Far West Texas Water Planning Group has adopted a standard procedure for ranking potential water management strategies. Quantitative and qualitative measurements are tabulated in Chapter 5 Tables 5-2 and 5-4. This procedure classifies the strategies using the TWDB's following standard categories developed for regional water planning:

**Table 5-2:**

- Quantity
- Quality
- Reliability
- Impact of Water, Agricultural, and Natural Resources
- Impact on Ecologically Unique Stream Segments

**Table 5-4:**

- Environmental Impact
    - Environmental water needs
    - Wildlife habitat
    - Cultural resources
    - Environmental water quality
    - Bays and estuaries

**<u>Quantity, Quality and Reliability</u>**

Quantity, quality and reliability are quantitatively assessed and assigned a ranking from 1 to 3 as listed in the Table 5B-1below, which shows the correlation between the category and the ranking.

**Table 5B-1. Quantity, Quality and Reliability Category Ranking Matrix**

| Rank | Quantity | Quality | Reliability |
|---|---|---|---|
| 1 | Meets 100% of shortage | Meets safe drinking water standards | Sustainable |
| 2 | Meets 50-99% of shortage | Must be treated or mixed to meet safe drinking water standards | Interruptible |
| 3 | Meets < 50% of shortage | Usable for intended non-drinking use only | Un-sustainable |

**Quantity** adequacy is measured as a percent of the volume of water needed to meet the specified water user group's (WUG's) shortage as calculated in Table 4-1 of Chapter 4 that is produced by the water management strategy. Percent volumes are only analyzed for WUGs with projected supply shortages.

**Quality** adequacy is measured in terms of meeting TCEQ Safe Drinking Water Standards. However, not all strategies are intended for use requiring SDWSs.

**Reliability** is evaluated based on the expected or potential for the water to be available during drought. Strategies that use water from a source that would not exceed permits or MAGs even during droughts are rated as sustainable. Strategies that use water from a source that is available during normal meteorological conditions, but may not be 100% available during drought are rated as interruptible. Strategies in which 100% of the supply cannot be maintained even during normal meteorological conditions are rated as un-sustainable.

## Impact on Water, Agricultural and Natural Resources, and Ecologically Unique Stream Segments

Impacts are quantitatively assessed and assigned a ranking from 1 to 5 as listed in Table 5B-2 below, which shows the correlation between the category and the ranking.

**Table 5B-2. Strategy Impact Category Ranking Matrix**

| Rank | Water Resources | Agricultural Resources | Natural Resources | Ecologically Unique Streams |
|---|---|---|---|---|
| 1 | Positive | Positive | Positive | Positive |
| 2 | None | None | None | None |
| 3 | Low | Low | Low | Low |
| 4 | Medium | Medium | Medium | Medium |
| 5 | High | High | High | High |

**Water Resources** impacts refer to the potential for the implemented strategy to compete for water sources shared with adjacent properties. The matrix ranking depicts the potential range of water-level drawdown induced across property boundaries during the life of the strategy project.

1 Positive - No aquifer drawdown; increased surface water flow

2 None – No new aquifer drawdown; no change to surface water flow

3 Low – <10 feet of aquifer drawdown; < 10% reduction in average surface flows

4 Medium – 10 to 50 feet of aquifer drawdown; 10 to 30% reduction in average surface flows

5 High - > 50 feet of aquifer drawdown; > 30% reduction in surface flows

**Agricultural Resources** impacts refer to the agricultural economic impact resulting from the loss or gain of water supplies currently in use by the agricultural user as the result of the implementation of a strategy. See Section 1.2.8 in Chapter 1 for a detailed discussion on the Agricultural Resources of Far West Texas.

1 Positive – provides water to agricultural users

2 None – does not impact agricultural supplies

3 Low – reduces agricultural activity by less than 10%

4 Medium – reduces agricultural activity by more than 10%

5 High – water rights use changes from agricultural to some other use thus elimination agricultural activity

**Natural Resources** impacts are those that impact the terrestrial and aquatic habitat of native plant and animal wildlife, as well as the scenic beauty of the Region that is critical to the tourism industry. See Section 1.2.9 in Chapter 1 for a detailed discussion on the Natural Resources of Far West Texas.

1 Positive – provides water to natural resources

2 None – does not impact natural resources

3 Low – reduces natural resources water supply by less than 10%

4 Medium – reduces natural resources water supply by more than 10%

5 High – reduces natural resources water supply by more than 50%

**Ecologically Unique Stream Segments** impacts are those that impact the natural habitat of portions of streams that have been identified by the Far West Texas Water Planning Group as "ecologically unique stream segments". See Chapter 8 of both the 2011 and 2016 Far West Texas Water Plan for a location and description of designated stream segments.

1 Positive – provides water to designated stream segments

2 None – does not impact designated stream segments

3 Low – reduces designated stream segment water supply by less than 10%

4 Medium – reduces designated stream segment water supply by more than 10%

5 High – reduces designated stream segment water supply by more than 50%

**Environmental Impacts**

Environmental impacts are quantitatively assessed and assigned a ranking from 1 to 5 as listed in the Table 5B-3 below, which shows the correlation between the category and the ranking. The Environmental Matrix takes into consideration the following categories;

- Environmental Water Needs
- Wildlife Habitat
- Cultural Resources

- Environmental Water Quality
- Bays and Estuaries

**Table 5B-3. Environmental Impact Category Ranting Matrix**

| Rank | Environmental Water Needs | Wildlife Habitat | Cultural Resources | Environmental Water Quality | Bays and Estuaries |
|---|---|---|---|---|---|
| 1 | Positive | Positive | Positive | Positive | Not applicable |
| 2 | No new | No new | No new | No new | |
| 3 | Minimal negative | Minimal negative | Minimal negative | Minimal negative | |
| 4 | Moderate negative | Moderate negative | Moderate negative | Moderate negative | |
| 5 | Significant negative | Significant negative | Significant negative | Significant negative | |

**Environmental Water Needs** impacts refer to how the strategy will impact the area's overall environmental water needs. Water is vital to the environmental health of a region, and so it is important to take into account how strategies will impact the amount of water that will be available to the environment.

1 Positive – additional water will be introduced for environmental use

2 No new – no additional water will be introduced for environmental use

3 Minimal negative – environmental water needs will be reduced by <10%

4 Moderate negative – environmental water needs will be reduced by 10 to 30%

5 Significant negative - environmental water needs will be reduced by >30%

**Wildlife Habitat** impacts refer to how the strategy will impact the wildlife habitat of the local area. The more area that is impacted due to the implementation of the strategy, the more the area's habitat will be disrupted.

1 Positive – additional habitat area for wildlife use will be created

2 No new – no additional habitat area for wildlife use will be created or destroyed

3 Minimal negative – wildlife habit will be reduced by < 100 acres

4 Moderate negative – wildlife habit will be reduced by 100 to 1,000 acres

5 Significant negative - wildlife habit will be reduced by > 1,000 acres

**Cultural Resources** impacts refer to how the strategy will impact cultural resources located within the area. Cultural resources are defined as the collective evidence of the past activities and accomplishments

of people. Locations, buildings and features with scientific, cultural or historic value are considered to be cultural resources.

1 Positive – cultural resources will be identified and protected

2 No new – no impact will occur to local cultural resources

3 Minimal negative – disturbance to cultural resources will be < 10%

4 Moderate negative – disturbance to cultural resources will be 10 to 20%

5 Significant negative - disturbance to cultural resources will be > 20%

**Environmental Water Quality** impacts refer to the impact that the implementation of the strategy will have on the local area's natural water quality. Negative impacts could include the introduction of poorer quality water, the reduction of the natural flow of water of native quality source water, or the introduction of detrimental chemical elements into the natural water ways.

1 Positive – water quality of area streams will be enhanced for existing environmental use

2 No new – water quality characteristics of existing environmental habitat will not be changed

3 Minimal negative – water quality characteristics of existing environmental habitat will be negatively altered by < 10%

4 Moderate negative – water quality characteristics of existing environmental habitat will be negatively altered by < 10 to 30%

5 Significant negative - water quality characteristics of existing environmental habitat will be negatively altered by > 30%

**Bays and Estuaries -** Far West Texas is located too far away from any bays and estuaries of the Texas coastline to have a quantifiable impact. Therefore, this category was assumed to be non-applicable for every strategy.

*This page intentionally left blank.*

# CHAPTER 6

# REGIONAL WATER PLAN IMPACTS AND CONSISTENCY WITH PROTECTION OF WATER, AGRICULTURAL AND NATURAL RESOURCES

*This page intentionally left blank.*

# 6 REGIONAL WATER PLAN IMPACTS AND CONSISTENCY WITH PROTECTION OF WATER AGRICULTURAL AND NATURAL RESOURCES

Chapter 6 describes how this *2021 Far West Texas Plan* is consistent with the long-term protection of water resources, agricultural resources, and natural resources that are important to Far West Texas. All planning analyses applied and recommendations made in the development of this *Plan* honor all existing water rights, contracts, and option agreements; and have no impact on navigation on any of the Region's surface water streams and rivers.

The socioeconomic impact of not meeting water supply needs within the Region is discussed in an analysis report prepared by the Texas Water Development Board and presented in Appendix 6A at the end of this chapter. Based on projected water demands and existing water supplies, the Region identified water needs (potential shortages) that could occur under a repeat of the drought of record for six water use categories (municipal, irrigation, livestock, manufacturing, mining, and steam-electric power). The TWDB then estimated the annual socioeconomic impacts of those needs—if they are not met—for each water use category and as an aggregate for the region.

The report describes that Far West Texas generated more than $35 billion in gross domestic product (2018 dollars) and supported roughly 435,000 jobs in 2016. It is estimated that not meeting the identified water needs in Far West Texas would result in an annually combined lost income impact of approximately $883 million in 2020, increasing to $1.75 billion in 2070. In 2020, the Region would lose approximately 3,600 jobs, and by 2070 job losses would increase to approximately 12,000 if anticipated needs are not mitigated.

## 6.1 PROTECTION OF WATER RESOURCES

Water resources in Far West Texas as described in Chapter 3 include groundwater in numerous aquifers and surface water occurring in the Rio Grande and Pecos River basins. The numerous springs, which represent a transition point between groundwater and surface water, are also recognized in Chapter 1, Section 1.6 for their major importance.

The first step in achieving long-term water resources protection was in the process of estimating each source's availability. Surface water estimates were developed through a water availability model process (WAM) and are based on the quantity of surface water available to meet existing water rights during a drought-of-record.

Groundwater availability estimates are based on the Modeled Available Groundwater (MAG) volumes that may be produced on an average annual basis to achieve a Desire Future Condition (DFC) as adopted by Groundwater Management Areas (GMAs). Establishing conservative levels of water source availability thus results in less potential of over exploiting the supply.

The next step in establishing the long-term protection of water resources occurs in the water management strategies developed in Chapter 5 to meet potential water supply shortages. Each strategy was evaluated for potential threats to water resources in terms of source depletion (reliability), quality degradation, and impact to environmental habitat.

Water conservation strategies are also recommended for each entity with a supply deficit. Conservation reduces the impact on water supplies by reducing the actual water demand for the supply. Chapter 5 provides an overview of these impact evaluations.

Chapters 5 and 7 contain information and recommendations pertaining to water conservation and drought management practices. When enacted, the conservation practices will diminish water demand, the drought management practices will extend supplies over the stress period, and the land management practices will potentially increase aquifer recharge.

## 6.2 PROTECTION OF AGRICULTURAL RESOURCES

Agriculture in Far West Texas, as described in Chapter 1, Sections 1.2.8 and 1.3.2, includes the raising of crops and livestock, as well as a multitude of businesses that support this industry. Water is an absolute necessity to maintaining the agricultural industry and its use represents approximately 65 percent of all the water used in the Region. Many of the communities in the Region depend on various forms of the agricultural industry for a significant portion of their economy. It is thus important to the economic health and way of life in these communities to protect water resources that have historically been used in the support of agricultural activities.

TWDB's socio-economic analysis (Appendix 6A) reports that a projected water shortages in the irrigated agriculture water use category for one or more decades within the water planning horizon (Chapter 4, Table 4-1) only occurs in Culberson and El Paso Counties. No water shortages are projected for Livestock use. Per the TWDB's socio-economic analysis, a negative tax impact was surmised, primarily due to past subsidies from the federal government. Income and job losses are shown in the Table below:

**Impacts of Water Shortages on Irrigation**

| WUG | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| Income Losses ($ millions) * | $2 | $1 | $1 | $1 | $1 | $1 |
| Job Losses | 26 | 18 | 18 | 18 | 18 | 18 |

* Year 2018 dollars rounded.

The *2021 Far West Texas Water Plan* provides irrigation strategy recommendations in Chapter 5 that address water conservation management practices. If implemented, these practices will result in reduced water application per acre irrigated. Also, non-agricultural strategies provided in Chapter 5 include an analysis of potential impact to agricultural interests.

An interim project was performed in 2009 to evaluate the effectiveness of previously recommended irrigation practices. A summary of this report titled " Evaluation of Irrigation Efficiency Strategies for Far West Texas: Feasibility, Water Savings and Cost Considerations" is available on the Rio Grande COG web site at http://www.riocog.org.

## 6.3 PROTECTION OF NATURAL RESOURCES

The Far West Texas Water Planning Group has adopted a stance toward the protection of natural resources. Natural resources are defined in Chapter 1, Section 1.2.9 as including terrestrial and aquatic habitats that support a diverse environmental community as well as provide recreational and economic opportunities. Environmental and recreational water needs are discussed in Chapter 2, Section 2.3. Chapter 8 describes recommended ecologically unique river and stream segments.

The protection of natural resources is closely linked with the protection of water resources as discussed in Section 6.1 above. Where possible, the methodology used to assess groundwater source availability is based on not significantly lowering water levels to a point where spring flows might be impacted. Thus, the intention to protect surface flows is directly related to those natural resources that are dependent on surface water sources or spring flows for their existence.

Environmental impacts were evaluated in the consideration of strategies to meet water-supply deficits. Chapter 5 provides a comparative analysis of all selected strategies. Of prime consideration was whether a strategy potentially could diminish the quantity of water currently existing in the natural environment and if a strategy could impact water quality to a level that would be detrimental to animals and plants that naturally inhabit the area under consideration.

The Far West Texas Water Planning Group continues to recommend as "Ecologically Unique River and Stream Segments" three streams that lie within the boundaries of State-managed properties, four within National Park boundaries, and specified streams managed by the Texas Nature Conservancy. A quantitative analysis conducted to assess potential impacts of the *Plan* on these segments found that all recommended strategies listed in Chapter 5 have no influence on water resources in the vicinity of these segments. Although the Planning Group chooses to respect the privacy of private lands by not recommending stream segments on these properties, the Group recognizes and applauds the conservation work that is undertaken on a daily basis by the majority of these private landowners.

# APPENDIX 6A
# SOCIOECONOMIC IMPACT OF UNMET WATER NEEDS

*This page intentionally left blank.*

# Socioeconomic Impacts of Projected Water Shortages for the Far West Texas (Region E) Regional Water Planning Area

**Prepared in Support of the 2021 Region E Regional Water Plan**

Dr. John R. Ellis
Water Use, Projections, & Planning Division
Texas Water Development Board

November 2019

# Table of Contents

Executive Summary ..... 1
1 Introduction ..... 3
1.1 Regional Economic Summary ..... 3
1.2 Identified Regional Water Needs (Potential Shortages) ..... 5
2 Impact Assessment Measures ..... 7
2.1 Regional Economic Impacts ..... 8
2.2 Financial Transfer Impacts ..... 8
2.3 Social Impacts ..... 9
3 Socioeconomic Impact Assessment Methodology ..... 11
3.1 Analysis Context ..... 11
3.2 IMPLAN Model and Data ..... 11
3.3 Elasticity of Economic Impacts ..... 12
3.4 Analysis Assumptions and Limitations ..... 13
4 Analysis Results ..... 17
4.1 Impacts for Irrigation Water Shortages ..... 17
4.2 Impacts for Livestock Water Shortages ..... 17
4.3 Impacts of Manufacturing Water Shortages ..... 18
4.4 Impacts of Mining Water Shortages ..... 18
4.5 Impacts for Municipal Water Shortages ..... 19
4.6 Impacts of Steam-Electric Water Shortages ..... 20
4.7 Regional Social Impacts ..... 21
Appendix A - County Level Summary of Estimated Economic Impacts for Region E ..... 22

# Executive Summary

Evaluating the social and economic impacts of not meeting identified water needs is a required analysis in the regional water planning process. The Texas Water Development Board (TWDB) estimates these impacts for regional water planning groups (RWPGs) and summarizes the impacts in the state water plan. The analysis presented is for the Far West Texas Regional Water Planning Group (Region E).

Based on projected water demands and existing water supplies, Region E identified water needs (potential shortages) that could occur within its region under a repeat of the drought of record for six water use categories (irrigation, livestock, manufacturing, mining, municipal and steam-electric power). The TWDB then estimated the annual socioeconomic impacts of those needs—if they are not met—for each water use category and as an aggregate for the region.

This analysis was performed using an economic impact modeling software package, IMPLAN (Impact for Planning Analysis), as well as other economic analysis techniques, and represents a snapshot of socioeconomic impacts that may occur during a single year repeat of the drought of record with the further caveat that no mitigation strategies are implemented. Decade specific impact estimates assume that growth occurs, and future shocks are imposed on an economy at 10-year intervals. The estimates presented are not cumulative (i.e., summing up expected impacts from today up to the decade noted), but are simply snapshots of the estimated annual socioeconomic impacts should a drought of record occur in each particular decade based on anticipated water supplies and demands for that same decade.

For regional economic impacts, income losses and job losses are estimated within each planning decade (2020 through 2070). The income losses represent an approximation of gross domestic product (GDP) that would be foregone if water needs are not met.

The analysis also provides estimates of financial transfer impacts, which include tax losses (state, local, and utility tax collections); water trucking costs; and utility revenue losses. In addition, social impacts are estimated, encompassing lost consumer surplus (a welfare economics measure of consumer wellbeing); as well as population and school enrollment losses.

IMPLAN data reported that Region E generated close to $35 billion in GDP (2018 dollars) and supported roughly 435,000 jobs in 2016. Region E estimated total population was approximately 863,000 in 2016.

It is estimated that not meeting the identified water needs in Region E would result in an annually combined lost income impact of approximately $883 million in 2020, increasing to $1.75 billion in 2070 (Table ES-1). In 2020, the region would lose approximately 3,600 jobs, and by 2070 job losses would increase to approximately 12,000 if anticipated needs are not mitigated.

All impact estimates are in year 2018 dollars and were calculated using a variety of data sources and tools including the use of a region-specific IMPLAN model, data from TWDB annual water use

estimates, the U.S. Census Bureau, Texas Agricultural Statistics Service, and the Texas Municipal League.

**Table ES-1 Region E socioeconomic impact summary**

| Regional Economic Impacts | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Income losses ($ millions)*** | $883 | $1,143 | $1,287 | $1,386 | $1,538 | $1,753 |
| **Job losses** | 3,635 | 5,443 | 6,606 | 7,592 | 9,422 | 11,989 |
| **Financial Transfer Impacts** | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| **Tax losses on production and imports ($ millions)*** | $58 | $80 | $93 | $103 | $118 | $139 |
| **Water trucking costs ($ millions)*** | $- | $- | $- | $- | $- | $- |
| **Utility revenue losses ($ millions)*** | $11 | $21 | $31 | $60 | $93 | $123 |
| **Utility tax revenue losses ($ millions)*** | $0 | $0 | $1 | $1 | $2 | $2 |
| **Social Impacts** | **2020** | **2030** | **2040** | **2050** | **2060** | **2070** |
| **Consumer surplus losses ($ millions)*** | $3 | $15 | $40 | $79 | $133 | $201 |
| **Population losses** | 667 | 999 | 1,213 | 1,394 | 1,730 | 2,201 |
| **School enrollment losses** | 128 | 191 | 232 | 267 | 331 | 421 |

* Year 2018 dollars, rounded**.** Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

# 1 Introduction

Water shortages during a repeat of the drought of record would likely curtail or eliminate certain economic activity in businesses and industries that rely heavily on water. Insufficient water supplies could not only have an immediate and real impact on the regional economy in the short term, but they could also adversely and chronically affect economic development in Texas. From a social perspective, water supply reliability is critical as well. Shortages could disrupt activity in homes, schools and government, and could adversely affect public health and safety. For these reasons, it is important to evaluate and understand how water supply shortages during drought could impact communities throughout the state.

As part of the regional water planning process, RWPGs must evaluate the social and economic impacts of not meeting water needs (31 Texas Administrative Code §357.33 (c)). Due to the complexity of the analysis and limited resources of the planning groups, the TWDB has historically performed this analysis for the RWPGs upon their request. Staff of the TWDB's Water Use, Projections, & Planning Division designed and conducted this analysis in support of Region E, and those efforts for this region as well as the other 15 regions allow consistency and a degree of comparability in the approach.

This document summarizes the results of the analysis and discusses the methodology used to generate the results. Section 1 provides a snapshot of the region's economy and summarizes the identified water needs in each water use category, which were calculated based on the RWPG's water supply and demand established during the regional water planning process. Section 2 defines each of ten impact assessment measures used in this analysis. Section 3 describes the methodology for the impact assessment and the approaches and assumptions specific to each water use category (i.e., irrigation, livestock, manufacturing, mining, municipal, and steam-electric power). Section 4 presents the impact estimates for each water use category with results summarized for the region as a whole. Appendix A presents a further breakdown of the socioeconomic impacts by county.

## 1.1 Regional Economic Summary

The Region E Regional Water Planning Area generated close to $35 billion in gross domestic product (2018 dollars) and supported roughly 435,000 jobs in 2016, according to the IMPLAN dataset utilized in this socioeconomic analysis. This activity accounted for approximately 2 percent of the state's total gross domestic product of 1.73 trillion dollars for the year based on IMPLAN. Table 1-1 lists all economic sectors ranked by the total value-added to the economy in Region E. The real estate, manufacturing, and retail trade sectors generated close to 25 percent of the region's total value-added and were also significant sources of tax revenue. The top employers in the region were in the public administration, retail trade, and health care sectors. Region E's estimated total population was approximately 863,000 in 2016, comprising 3 percent of the state's total.

This represents a snapshot of the regional economy as a whole, and it is important to note that not all economic sectors were included in the TWDB socioeconomic impact analysis. Data considerations prompted use of only the more water-intensive sectors within the economy because

damage estimates could only be calculated for those economic sectors which had both reliable income and water use estimates.

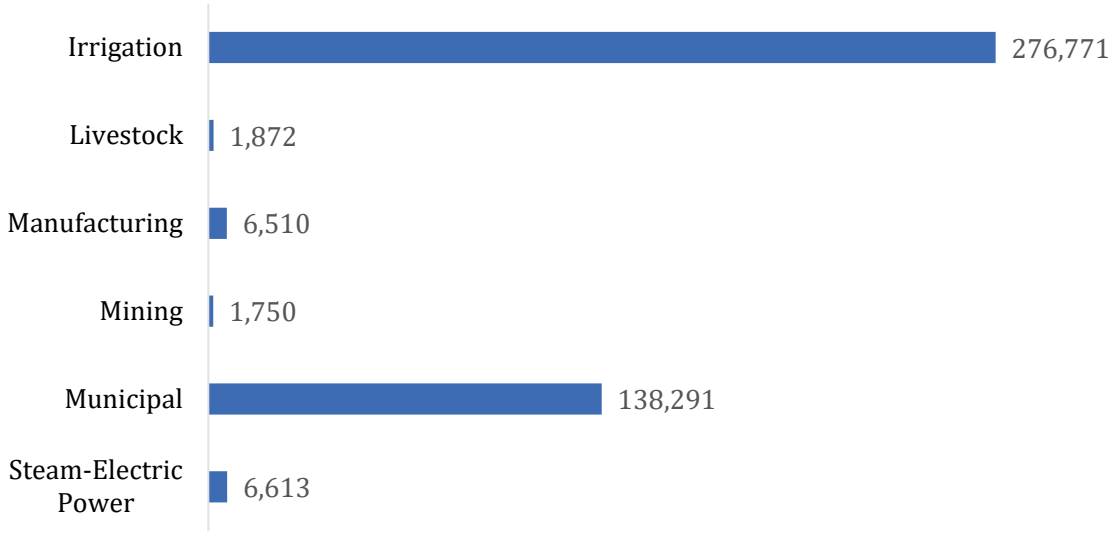
**Table 1-1 Region E regional economy by economic sector***

| Economic sector | Value-added ($ millions) | Tax ($ millions) | Jobs |
|---|---|---|---|
| **Public Administration** | $10,871.7 | $(105.1) | 101,104 |
| **Real Estate and Rental and Leasing** | $3,358.3 | $514.2 | 15,728 |
| **Manufacturing** | $2,628.6 | $88.5 | 18,922 |
| **Retail Trade** | $2,518.5 | $648.9 | 46,183 |
| **Health Care and Social Assistance** | $2,245.4 | $29.6 | 45,413 |
| **Wholesale Trade** | $1,907.6 | $420.0 | 14,273 |
| **Transportation and Warehousing** | $1,708.2 | $53.0 | 21,793 |
| **Information** | $1,398.5 | $479.4 | 5,131 |
| **Professional, Scientific, and Technical Services** | $1,285.7 | $43.3 | 17,931 |
| **Accommodation and Food Services** | $1,257.6 | $220.7 | 37,186 |
| **Administrative and Support and Waste Management and Remediation Services** | $1,196.6 | $35.8 | 31,879 |
| **Construction** | $1,182.7 | $29.1 | 26,328 |
| **Finance and Insurance** | $936.0 | $74.6 | 15,900 |
| **Other Services (except Public Administration)** | $870.7 | $106.9 | 20,143 |
| **Utilities** | $806.7 | $160.1 | 1,572 |
| **Arts, Entertainment, and Recreation** | $128.0 | $34.8 | 5,220 |
| **Management of Companies and Enterprises** | $113.4 | $5.4 | 1,914 |
| **Agriculture, Forestry, Fishing and Hunting** | $105.8 | $4.0 | 2,929 |
| **Educational Services** | $104.1 | $5.2 | 3,959 |
| **Mining, Quarrying, and Oil and Gas Extraction** | $64.7 | $39.3 | 1,171 |
| **Grand Total** | $34,688.8 | $2,887.5 | 434,680 |

*Source: 2016 IMPLAN for 536 sectors aggregated by 2-digit NAICS (North American Industry Classification System)

While municipal and manufacturing sectors led the region in economic output, the majority (64 percent) of water use in 2016 occurred in irrigated agriculture. In fact, more than 3 percent of the state's irrigation water use occurred within Region E. Figure 1-1 illustrates Region E's breakdown of the 2016 water use estimates by TWDB water use category.

**Figure 1-1 Region E 2016 water use estimates by water use category (in acre-feet)**




Source: TWDB Annual Water Use Estimates (all values in acre-feet)

## 1.2 Identified Regional Water Needs (Potential Shortages)

As part of the regional water planning process, the TWDB adopted water demand projections for water user groups (WUG) in Region E with input from the planning group. WUG-level demand projections were established for utilities that provide more than 100 acre-feet of annual water supply, combined rural areas (designated as county-other), and county-wide water demand projections for five non-municipal categories (irrigation, livestock, manufacturing, mining and steam-electric power). The RWPG then compared demands to the existing water supplies of each WUG to determine potential shortages, or needs, by decade.

Table 1-2 summarizes the region's identified water needs in the event of a repeat of the drought of record. Demand management, such as conservation, or the development of new infrastructure to increase supplies, are water management strategies that may be recommended by the planning group to address those needs. This analysis assumes that no strategies are implemented, and that the identified needs correspond to future water shortages. Note that projected water needs generally increase over time, primarily due to anticipated population growth, economic growth, or declining supplies. To provide a general sense of proportion, total projected needs as an overall percentage of total demand by water use category are also presented in aggregate in Table 1-2. Projected needs for individual water user groups within the aggregate can vary greatly and may reach 100% for a given WUG and water use category. A detailed summary of water needs by WUG and county appears in Chapter 4 of the 2021 Region E Regional Water Plan.

**Table 1-2 Regional water needs summary by water use category ***

| Water Use Category | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|---|
| **Irrigation** | water needs (acre-feet per year) | 16,903 | 13,375 | 13,375 | 13,375 | 13,375 | 13,375 |
| | % of the category's total water demand | 5% | 4% | 4% | 4% | 4% | 4% |
| **Livestock** | water needs (acre-feet per year) | - | - | - | - | - | - |
| | % of the category's total water demand | 0% | 0% | 0% | 0% | 0% | 0% |
| **Manufacturing** | water needs (acre-feet per year) | - | 860 | 860 | 860 | 860 | 860 |
| | % of the category's total water demand | 0% | 11% | 11% | 11% | 11% | 11% |
| **Mining** | water needs (acre-feet per year) | 2,530 | 3,223 | 3,840 | 4,407 | 5,038 | 5,796 |
| | % of the category's total water demand | 32% | 36% | 40% | 44% | 49% | 54% |
| **Municipal**** | water needs (acre-feet per year) | 4,102 | 8,061 | 11,815 | 24,605 | 38,953 | 52,666 |
| | % of the category's total water demand | 3% | 5% | 7% | 13% | 19% | 24% |
| **Steam-electric power** | water needs (acre-feet per year) | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 |
| | % of the category's total water demand | 69% | 69% | 69% | 69% | 69% | 69% |
| **Total water needs (acre-feet per year)** | | **30,795** | **32,779** | **37,150** | **50,507** | **65,486** | **79,957** |

*Entries denoted by a dash (-) indicate no identified water need for a given water use category.
** Municipal category consists of residential and non-residential (commercial and institutional) subcategories.

# 2 Impact Assessment Measures

A required component of the regional and state water plans is to estimate the potential economic and social impacts of potential water shortages during a repeat of the drought of record. Consistent with previous water plans, ten impact measures were estimated and are described in Table 2-1.

**Table 2-1 Socioeconomic impact analysis measures**

| Regional economic impacts | Description |
|---|---|
| **Income losses - value-added** | The value of output less the value of intermediate consumption; it is a measure of the contribution to gross domestic product (GDP) made by an individual producer, industry, sector, or group of sectors within a year. Value-added measures used in this report have been adjusted to include the direct, indirect, and induced monetary impacts on the region. |
| **Income losses - electrical power purchase costs** | Proxy for income loss in the form of additional costs of power as a result of impacts of water shortages. |
| **Job losses** | Number of part-time and full-time jobs lost due to the shortage. These values have been adjusted to include the direct, indirect, and induced employment impacts on the region. |
| **Financial transfer impacts** | **Description** |
| **Tax losses on production and imports** | Sales and excise taxes not collected due to the shortage, in addition to customs duties, property taxes, motor vehicle licenses, severance taxes, other taxes, and special assessments less subsidies. These values have been adjusted to include the direct, indirect and induced tax impacts on the region. |
| **Water trucking costs** | Estimated cost of shipping potable water. |
| **Utility revenue losses** | Foregone utility income due to not selling as much water. |
| **Utility tax revenue losses** | Foregone miscellaneous gross receipts tax collections. |
| **Social impacts** | **Description** |
| **Consumer surplus losses** | A welfare measure of the lost value to consumers accompanying restricted water use. |
| **Population losses** | Population losses accompanying job losses. |
| **School enrollment losses** | School enrollment losses (K-12) accompanying job losses. |

## 2.1 Regional Economic Impacts

The two key measures used to assess regional economic impacts are income losses and job losses. The income losses presented consist of the sum of value-added losses and the additional purchase costs of electrical power.

### *Income Losses - Value-added Losses*

Value-added is the value of total output less the value of the intermediate inputs also used in the production of the final product. Value-added is similar to GDP, a familiar measure of the productivity of an economy. The loss of value-added due to water shortages is estimated by input-output analysis using the IMPLAN software package, and includes the direct, indirect, and induced monetary impacts on the region. The indirect and induced effects are measures of reduced income as well as reduced employee spending for those input sectors which provide resources to the water shortage impacted production sectors.

### *Income Losses - Electric Power Purchase Costs*

The electrical power grid and market within the state is a complex interconnected system. The industry response to water shortages, and the resulting impact on the region, are not easily modeled using traditional input/output impact analysis and the IMPLAN model. Adverse impacts on the region will occur and are represented in this analysis by estimated additional costs associated with power purchases from other generating plants within the region or state. Consequently, the analysis employs additional power purchase costs as a proxy for the value-added impacts for the steam-electric power water use category, and these are included as a portion of the overall income impact for completeness.

For the purpose of this analysis, it is assumed that power companies with insufficient water will be forced to purchase power on the electrical market at a projected higher rate of 5.60 cents per kilowatt hour. This rate is based upon the average day-ahead market purchase price of electricity in Texas that occurred during the recent drought period in 2011. This price is assumed to be comparable to those prices which would prevail in the event of another drought of record.

### *Job Losses*

The number of jobs lost due to the economic impact is estimated using IMPLAN output associated with each TWDB water use category. Because of the difficulty in predicting outcomes and a lack of relevant data, job loss estimates are not calculated for the steam-electric power category.

## 2.2 Financial Transfer Impacts

Several impact measures evaluated in this analysis are presented to provide additional detail concerning potential impacts on a portion of the economy or government. These financial transfer impact measures include lost tax collections (on production and imports), trucking costs for imported water, declines in utility revenues, and declines in utility tax revenue collected by the

state. These measures are not solely adverse, with some having both positive and negative impacts. For example, cities and residents would suffer if forced to pay large costs for trucking in potable water. Trucking firms, conversely, would benefit from the transaction. Additional detail for each of these measures follows.

#### *Tax Losses on Production and Imports*

Reduced production of goods and services accompanying water shortages adversely impacts the collection of taxes by state and local government. The regional IMPLAN model is used to estimate reduced tax collections associated with the reduced output in the economy. Impact estimates for this measure include the direct, indirect, and induced impacts for the affected sectors.

#### *Water Trucking Costs*

In instances where water shortages for a municipal water user group are estimated by RWPGs to exceed 80 percent of water demands, it is assumed that water would need to be trucked in to support basic consumption and sanitation needs. For water shortages of 80 percent or greater, a fixed, maximum of $35,000[1] per acre-foot of water applied as an economic cost. This water trucking cost was utilized for both the residential and non-residential portions of municipal water needs.

#### *Utility Revenue Losses*

Lost utility income is calculated as the price of water service multiplied by the quantity of water not sold during a drought shortage. Such estimates are obtained from utility-specific pricing data provided by the Texas Municipal League, where available, for both water and wastewater. These water rates are applied to the potential water shortage to estimate forgone utility revenue as water providers sold less water during the drought due to restricted supplies.

#### *Utility Tax Losses*

Foregone utility tax losses include estimates of forgone miscellaneous gross receipts taxes. Reduced water sales reduce the amount of utility tax that would be collected by the State of Texas for water and wastewater service sales.

## 2.3 Social Impacts

#### *Consumer Surplus Losses for Municipal Water Users*

Consumer surplus loss is a measure of impact to the wellbeing of municipal water users when their water use is restricted. Consumer surplus is the difference between how much a consumer is

[1] Based on staff survey of water hauling firms and historical data concerning transport costs for potable water in the recent drought in California for this estimate. There are many factors and variables that would determine actual water trucking costs including distance to, cost of water, and length of that drought.

willing and able to pay for a commodity (i.e., water) and how much they actually have to pay. The difference is a benefit to the consumer's wellbeing since they do not have to pay as much for the commodity as they would be willing to pay. Consumer surplus may also be viewed as an estimate of how much consumers would be willing to pay to keep the original quantity of water which they used prior to the drought. Lost consumer surplus estimates within this analysis only apply to the residential portion of municipal demand, with estimates being made for reduced outdoor and indoor residential use. Lost consumer surplus estimates varied widely by location and degree of water shortage.

### *Population and School Enrollment Losses*

Population loss due to water shortages, as well as the associated decline in school enrollment, are based upon the job loss estimates discussed in Section 2.1. A simplified ratio of job and net population losses are calculated for the state as a whole based on a recent study of how job layoffs impact the labor market population.[2] For every 100 jobs lost, 18 people were assumed to move out of the area. School enrollment losses are estimated as a proportion of the population lost based upon public school enrollment data from the Texas Education Agency concerning the age K-12 population within the state (approximately 19%).

[2] Foote, Andrew, Grosz, Michel, Stevens, Ann. "Locate Your Nearest Exit: Mass Layoffs and Local Labor Market Response." University of California, Davis. April 2015, http://paa2015.princeton.edu/papers/150194. The study utilized Bureau of Labor Statistics data regarding layoffs between 1996 and 2013, as well as Internal Revenue Service data regarding migration, to model the change in the population as the result of a job layoff event. The study found that layoffs impact both out-migration and in-migration into a region, and that a majority of those who did move following a layoff moved to another labor market rather than an adjacent county.

# 3 Socioeconomic Impact Assessment Methodology

This portion of the report provides a summary of the methodology used to estimate the potential economic impacts of future water shortages. The general approach employed in the analysis was to obtain estimates for income and job losses on the smallest geographic level that the available data would support, tie those values to their accompanying historic water use estimate, and thereby determine a maximum impact per acre-foot of shortage for each of the socioeconomic measures. The calculations of economic impacts are based on the overall composition of the economy divided into many underlying economic sectors. Sectors in this analysis refer to one or more of the 536 specific production sectors of the economy designated within IMPLAN, the economic impact modeling software used for this assessment. Economic impacts within this report are estimated for approximately 330 of these sectors, with the focus on the more water-intensive production sectors. The economic impacts for a single water use category consist of an aggregation of impacts to multiple, related IMPLAN economic sectors.

## 3.1 Analysis Context

The context of this socioeconomic impact analysis involves situations where there are physical shortages of groundwater or surface water due to a recurrence of drought of record conditions. Anticipated shortages for specific water users may be nonexistent in earlier decades of the planning horizon, yet population growth or greater industrial, agricultural or other sector demands in later decades may result in greater overall demand, exceeding the existing supplies. Estimated socioeconomic impacts measure what would happen if water user groups experience water shortages for a period of one year. Actual socioeconomic impacts would likely become larger as drought of record conditions persist for periods greater than a single year.

## 3.2 IMPLAN Model and Data

Input-Output analysis using the IMPLAN software package was the primary means of estimating the value-added, jobs, and tax related impact measures. This analysis employed regional level models to determine key economic impacts. IMPLAN is an economic impact model, originally developed by the U.S. Forestry Service in the 1970's to model economic activity at varying geographic levels. The model is currently maintained by the Minnesota IMPLAN Group (MIG Inc.) which collects and sells county and state specific data and software. The year 2016 version of IMPLAN, employing data for all 254 Texas counties, was used to provide estimates of value-added, jobs, and taxes on production for the economic sectors associated with the water user groups examined in the study. IMPLAN uses 536 sector-specific Industry Codes, and those that rely on water as a primary input were assigned to their appropriate planning water user categories (irrigation, livestock, manufacturing, mining, and municipal). Estimates of value-added for a water use category were obtained by summing value-added estimates across the relevant IMPLAN sectors associated with that water use category. These calculations were also performed for job losses as well as tax losses on production and imports.

The adjusted value-added estimates used as an income measure in this analysis, as well as the job and tax estimates from IMPLAN, include three components:

- ***Direct effects*** representing the initial change in the industry analyzed;
- ***Indirect effects*** that are changes in inter-industry transactions as supplying industries respond to reduced demands from the directly affected industries; and,
- ***Induced effects*** that reflect changes in local spending that result from reduced household income among employees in the directly and indirectly affected industry sectors.

Input-output models such as IMPLAN only capture backward linkages and do not include forward linkages in the economy.

## 3.3 Elasticity of Economic Impacts

The economic impact of a water need is based on the size of the water need relative to the total water demand for each water user group. Smaller water shortages, for example, less than 5 percent, are generally anticipated to result in no initial negative economic impact because water users are assumed to have a certain amount of flexibility in dealing with small shortages. As a water shortage intensifies, however, such flexibility lessens and results in actual and increasing economic losses, eventually reaching a representative maximum impact estimate per unit volume of water. To account for these characteristics, an elasticity adjustment function is used to estimate impacts for the income, tax and job loss measures. Figure 3-1 illustrates this general relationship for the adjustment functions. Negative impacts are assumed to begin accruing when the shortage reaches the lower bound 'b1' (5 percent in Figure 3-1), with impacts then increasing linearly up to the 100 percent impact level (per unit volume) once the upper bound reaches the 'b2' level shortage (40 percent in Figure 3-1).

To illustrate this, if the total annual value-added for manufacturing in the region was $2 million and the reported annual volume of water used in that industry is 10,000 acre-feet, the estimated economic measure of the water shortage would be $200 per acre-foot. The economic impact of the shortage would then be estimated using this value-added amount as the maximum impact estimate ($200 per acre-foot) applied to the anticipated shortage volume and then adjusted by the elasticity function. Using the sample elasticity function shown in Figure 3-1, an approximately 22 percent shortage in the livestock category would indicate an economic impact estimate of 50% of the original $200 per acre-foot impact value (i.e., $100 per acre-foot).

Such adjustments are not required in estimating consumer surplus, utility revenue losses, or utility tax losses. Estimates of lost consumer surplus rely on utility-specific demand curves with the lost consumer surplus estimate calculated based on the relative percentage of the utility's water shortage. Estimated changes in population and school enrollment are indirectly related to the elasticity of job losses.

Assumed values for the lower and upper bounds 'b1' and 'b2' vary by water use category and are presented in Table 3-1.

**Figure 3-1 Example economic impact elasticity function (as applied to a single water user's shortage)**

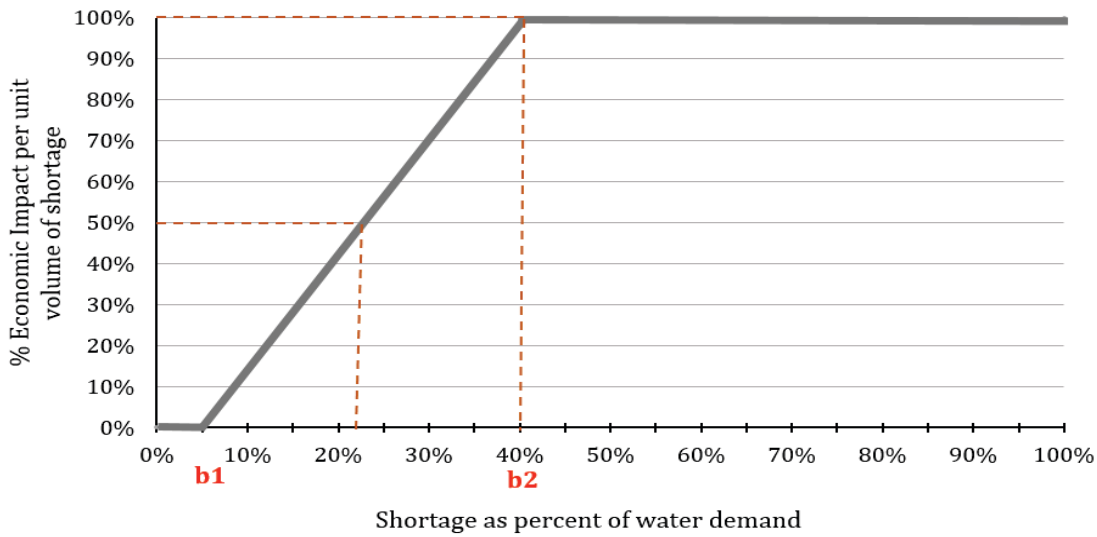



**Table 3-1 Economic impact elasticity function lower and upper bounds**

| Water use category | Lower bound (b1) | Upper bound (b2) |
|---|---|---|
| **Irrigation** | **5%** | **40%** |
| **Livestock** | **5%** | **10%** |
| **Manufacturing** | **5%** | **40%** |
| **Mining** | **5%** | **40%** |
| **Municipal (non-residential water intensive subcategory)** | **5%** | **40%** |
| **Steam-electric power** | **N/A** | **N/A** |

## 3.4 Analysis Assumptions and Limitations

The modeling of complex systems requires making many assumptions and acknowledging the model's uncertainty and limitations. This is particularly true when attempting to estimate a wide range of socioeconomic impacts over a large geographic area and into future decades. Some of the key assumptions and limitations of this methodology include:

1. The foundation for estimating the socioeconomic impacts of water shortages resulting from a drought are the water needs (potential shortages) that were identified by RWPGs as part of the

regional water planning process. These needs have some uncertainty associated with them but serve as a reasonable basis for evaluating the potential impacts of a drought of record event.

2. All estimated socioeconomic impacts are snapshots for years in which water needs were identified (i.e., 2020, 2030, 2040, 2050, 2060, and 2070). The estimates are independent and distinct "what if" scenarios for each particular year, and water shortages are assumed to be temporary events resulting from a single year recurrence of drought of record conditions. The evaluation assumed that no recommended water management strategies are implemented. In other words, growth occurs and future shocks are imposed on an economy at 10-year intervals, and the resulting impacts are estimated. Note that the estimates presented are not cumulative (i.e., summing up expected impacts from today up to the decade noted), but are simply snapshots of the estimated annual socioeconomic impacts should a drought of record occur in each particular decade based on anticipated water supplies and demands for that same decade.

3. Input-output models such as IMPLAN rely on a static profile of the structure of the economy as it appears today. This presumes that the relative contributions of all sectors of the economy would remain the same, regardless of changes in technology, availability of limited resources, and other structural changes to the economy that may occur in the future. Changes in water use efficiency will undoubtedly take place in the future as supplies become more stressed. Use of the static IMPLAN structure was a significant assumption and simplification considering the 50-year time period examined in this analysis. To presume an alternative future economic makeup, however, would entail positing many other major assumptions that would very likely generate as much or more error.

4. This is not a form of cost-benefit analysis. That approach to evaluating the economic feasibility of a specific policy or project employs discounting future benefits and costs to their present value dollars using some assumed discount rate. The methodology employed in this effort to estimate the economic impacts of future water shortages did not use any discounting methods to weigh future costs differently through time.

5. All monetary values originally based upon year 2016 IMPLAN and other sources are reported in constant year 2018 dollars to be consistent with the water management strategy requirements in the State Water Plan.

6. IMPLAN based loss estimates (income-value-added, jobs, and taxes on production and imports) are calculated only for those IMPLAN sectors for which the TWDB's Water Use Survey (WUS) data was available and deemed reliable. Every effort is made in the annual WUS effort to capture all relevant firms who are significant water users. Lack of response to the WUS, or omission of relevant firms, impacts the loss estimates.

7. Impacts are annual estimates. The socioeconomic analysis does not reflect the full extent of impacts that might occur as a result of persistent water shortages occurring over an extended duration. The drought of record in most regions of Texas lasted several years.

8. Value-added estimates are the primary estimate of the economic impacts within this report. One may be tempted to add consumer surplus impacts to obtain an estimate of total adverse economic impacts to the region, but the consumer surplus measure represents the change to the wellbeing of households (and other water users), not an actual change in the flow of dollars through the economy. The two measures (value-added and consumer surplus) are both valid impacts but ideally should not be summed.

9. The value-added, jobs, and taxes on production and import impacts include the direct, indirect and induced effects to capture backward linkages in the economy described in Section 2.1. Population and school enrollment losses also indirectly include such effects as they are based on the associated losses in employment. The remaining measures (consumer surplus, utility revenue, utility taxes, additional electrical power purchase costs, and potable water trucking costs), however, do not include any induced or indirect effects.

10. The majority of impacts estimated in this analysis may be more conservative (i.e., smaller) than those that might actually occur under drought of record conditions due to not including impacts in the forward linkages in the economy. Input-output models such as IMPLAN only capture backward linkages on suppliers (including households that supply labor to directly affected industries). While this is a common limitation in this type of economic modeling effort, it is important to note that forward linkages on the industries that use the outputs of the directly affected industries can also be very important. A good example is impacts on livestock operators. Livestock producers tend to suffer substantially during droughts, not because there is not enough water for their stock, but because reductions in available pasture and higher prices for purchased hay have significant economic effects on their operations. Food processors could be in a similar situation if they cannot get the grains or other inputs that they need. These effects are not captured in IMPLAN, resulting in conservative impact estimates.

11. The model does not reflect dynamic economic responses to water shortages as they might occur, nor does the model reflect economic impacts associated with a recovery from a drought of record including:
    a. The likely significant economic rebound to some industries immediately following a drought, such as landscaping;
    b. The cost and time to rebuild liquidated livestock herds (a major capital investment in that industry);
    c. Direct impacts on recreational sectors (i.e., stranded docks and reduced tourism); or,
    d. Impacts of negative publicity on Texas' ability to attract population and business in the event that it was not able to provide adequate water supplies for the existing economy.

12. Estimates for job losses and the associated population and school enrollment changes may exceed what would actually occur. In practice, firms may be hesitant to lay off employees, even in difficult economic times. Estimates of population and school enrollment changes are based on regional evaluations and therefore do not necessarily reflect what might occur on a statewide basis.

13. **The results must be interpreted carefully. It is the general and relative magnitudes of impacts as well as the changes of these impacts over time that should be the focus rather than the absolute numbers.** Analyses of this type are much better at predicting relative percent differences brought about by a shock to a complex system (i.e., a water shortage) than the precise size of an impact. To illustrate, assuming that the estimated economic impacts of a drought of record on the manufacturing and mining water user categories are $2 and $1 million, respectively, one should be more confident that the economic impacts on manufacturing are twice as large as those on mining and that these impacts will likely be in the millions of dollars. But one should have less confidence that the actual total economic impact experienced would be $3 million.

14. The methodology does not capture "spillover" effects between regions – or the secondary impacts that occur outside of the region where the water shortage is projected to occur.

15. The methodology that the TWDB has developed for estimating the economic impacts of unmet water needs, and the assumptions and models used in the analysis, are specifically designed to estimate potential economic effects at the regional and county levels. Although it may be tempting to add the regional impacts together in an effort to produce a statewide result, the TWDB cautions against that approach for a number of reasons. The IMPLAN modeling (and corresponding economic multipliers) are all derived from regional models – a statewide model of Texas would produce somewhat different multipliers. As noted in point 14 within this section, the regional modeling used by TWDB does not capture spillover losses that could result in other regions from unmet needs in the region analyzed, or potential spillover gains if decreased production in one region leads to increases in production elsewhere. The assumed drought of record may also not occur in every region of Texas at the same time, or to the same degree.

# 4 Analysis Results

This section presents estimates of potential economic impacts that could reasonably be expected in the event of water shortages associated with a drought of record and if no recommended water management strategies were implemented. Projected economic impacts for the six water use categories (irrigation, livestock, manufacturing, mining, municipal, and steam-electric power) are reported by decade.

## 4.1 Impacts for Irrigation Water Shortages

Two of the seven counties in the region are projected to experience water shortages in the irrigated agriculture water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 4-1. Note that tax collection impacts were not estimated for this water use category. IMPLAN data indicates a negative tax impact (i.e., increased tax collections) for the associated production sectors, primarily due to past subsidies from the federal government. However, it was not considered realistic to report increasing tax revenues during a drought of record.

**Table 4-1 Impacts of water shortages on irrigation in Region E**

| Impact measure | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Income losses ($ millions)*** | $2 | $1 | $1 | $1 | $1 | $1 |
| **Job losses** | 36 | 18 | 18 | 18 | 18 | 18 |

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

## 4.2 Impacts for Livestock Water Shortages

None of the seven counties in the region are projected to experience water shortages in the livestock water use category. Estimated impacts to this water use category appear in Table 4-2.

**Table 4-2 Impacts of water shortages on livestock in Region E**

| Impact measure | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Income losses ($ millions)*** | $- | $- | $- | $- | $- | $- |
| **Jobs losses** | - | - | - | - | - | - |
| **Tax losses on production and imports ($ millions)*** | $- | $- | $- | $- | $- | $- |

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

## 4.3 Impacts of Manufacturing Water Shortages

Manufacturing water shortages in the region are projected to occur in one of the seven counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 4-3.

**Table 4-3 Impacts of water shortages on manufacturing in Region E**

| Impacts measure | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Income losses ($ millions)*** | $- | $41 | $41 | $41 | $41 | $41 |
| **Job losses** | - | 270 | 270 | 270 | 270 | 270 |
| **Tax losses on production and Imports ($ millions)*** | $- | $3 | $3 | $3 | $3 | $3 |

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

## 4.4 Impacts of Mining Water Shortages

Mining water shortages in the region are projected to occur in three of the seven counties in the region for one or more decades within the planning horizon. Estimated impacts to this water use type appear in Table 4-4.

**Table 4-4 Impacts of water shortages on mining in Region E**

| Impacts measure | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Income losses ($ millions)*** | $680 | $866 | $980 | $1,047 | $1,133 | $1,254 |
| **Job losses** | 3,135 | 3,970 | 4,502 | 4,821 | 5,221 | 5,783 |
| **Tax losses on production and Imports ($ millions)*** | $56 | $72 | $81 | $87 | $95 | $105 |

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

## 4.5 Impacts for Municipal Water Shortages

Two of the seven counties in the region are projected to experience water shortages in the municipal water use category for one or more decades within the planning horizon.

Impact estimates were made for two sub-categories within municipal water use: residential and non-residential. Non-residential municipal water use includes commercial and institutional users, which are further divided into non-water-intensive and water-intensive subsectors including car wash, laundry, hospitality, health care, recreation, and education. Lost consumer surplus estimates were made only for needs in the residential portion of municipal water use. Available IMPLAN and TWDB Water Use Survey data for the non-residential, water-intensive portion of municipal demand allowed these sectors to be included in income, jobs, and tax loss impact estimate.

Trucking cost estimates, calculated for shortages exceeding 80 percent, assumed a fixed, maximum cost of $35,000 per acre-foot to transport water for municipal use. The estimated impacts to this water use category appear in Table 4-5.

**Table 4-5 Impacts of water shortages on municipal water users in Region E**

| Impacts measure | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Income losses[1] ($ millions)*** | $22 | $56 | $85 | $116 | $183 | $278 |
| **Job losses[1]** | 464 | 1,186 | 1,817 | 2,483 | 3,913 | 5,919 |
| **Tax losses on production and imports[1] ($ millions)*** | $2 | $6 | $9 | $13 | $20 | $30 |
| **Trucking costs ($ millions)*** | $- | $- | $- | $- | $- | $- |
| **Utility revenue losses ($ millions)*** | $11 | $21 | $31 | $60 | $93 | $123 |
| **Utility tax revenue losses ($ millions)*** | $0 | $0 | $1 | $1 | $2 | $2 |

[1] Estimates apply to the water-intensive portion of non-residential municipal water use.
* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

## 4.6 Impacts of Steam-Electric Water Shortages

Steam-electric water shortages in the region are projected to occur in one of the seven counties in the region for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 4-6.

Note that estimated economic impacts to steam-electric water users:

- Are reflected as an income loss proxy in the form of estimated additional purchasing costs for power from the electrical grid to replace power that could not be generated due to a shortage;
- Do not include estimates of impacts on jobs. Because of the unique conditions of power generators during drought conditions and lack of relevant data, it was assumed that the industry would retain, perhaps relocating or repurposing, their existing staff in order to manage their ongoing operations through a severe drought.
- Do not presume a decline in tax collections. Associated tax collections, in fact, would likely increase under drought conditions since, historically, the demand for electricity increases during times of drought, thereby increasing taxes collected on the additional sales of power.

**Table 4-6 Impacts of water shortages on steam-electric power in Region E**

| Impacts measure | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Income Losses ($ millions)*** | $180 | $180 | $180 | $180 | $180 | $180 |

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

## 4.7 Regional Social Impacts

Projected changes in population, based upon several factors (household size, population, and job loss estimates), as well as the accompanying change in school enrollment, were also estimated and are summarized in Table 4-7.

**Table 4-7 Region-wide social impacts of water shortages in Region E**

| Impacts measure | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Consumer surplus losses ($ millions)*** | $3 | $15 | $40 | $79 | $133 | $201 |
| **Population losses** | 667 | 999 | 1,213 | 1,394 | 1,730 | 2,201 |
| **School enrollment losses** | 128 | 191 | 232 | 267 | 331 | 421 |

* Year 2018 dollars, rounded. Entries denoted by a dash (-) indicate no estimated economic impact. Entries denoted by a zero ($0) indicate estimated income losses less than $500,000.

# Appendix A - County Level Summary of Estimated Economic Impacts for Region E

County level summary of estimated economic impacts of not meeting identified water needs by water use category and decade (in 2018 dollars, rounded). Values are presented only for counties with projected economic impacts for at least one decade.
**(* Entries denoted by a dash (-) indicate no estimated economic impact)**

| | | Income losses (Million $)* | | | | | | Job losses | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| County | Water Use Category | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| **EL PASO** | IRRIGATION | $1.69 | $0.82 | $0.82 | $0.82 | $0.82 | $0.82 | 36 | 18 | 18 | 18 | 18 | 18 |
| **EL PASO** | MANUFACTURING | - | $41.35 | $41.35 | $41.35 | $41.35 | $41.35 | - | 270 | 270 | 270 | 270 | 270 |
| **EL PASO** | MINING | $386.81 | $515.95 | $648.86 | $792.22 | $947.90 | $1,124.69 | 1,773 | 2,365 | 2,974 | 3,631 | 4,344 | 5,155 |
| **EL PASO** | MUNICIPAL | $21.67 | $55.51 | $85.12 | $116.36 | $183.41 | $277.45 | 462 | 1,184 | 1,815 | 2,482 | 3,912 | 5,917 |
| **EL PASO** | STEAM ELECTRIC POWER | $179.59 | $179.59 | $179.59 | $179.59 | $179.59 | $179.59 | - | - | - | - | - | - |
| **EL PASO Total** | | **$589.77** | **$793.23** | **$955.75** | **$1,130.34** | **$1,353.08** | **$1,623.90** | **2,271** | **3,836** | **5,076** | **6,400** | **8,543** | **11,359** |
| **HUDSPETH** | MINING | $14.88 | $11.75 | $13.85 | $15.18 | $15.86 | $16.62 | 110 | 87 | 102 | 112 | 117 | 123 |
| **HUDSPETH** | MUNICIPAL | $0.07 | $0.08 | $0.08 | $0.08 | $0.08 | $0.08 | 1 | 2 | 2 | 2 | 2 | 2 |
| **HUDSPETH Total** | | **$14.95** | **$11.83** | **$13.93** | **$15.26** | **$15.94** | **$16.71** | **111** | **89** | **104** | **114** | **119** | **125** |
| **TERRELL** | MINING | $278.59 | $337.99 | $317.23 | $239.94 | $169.00 | $112.47 | 1,252 | 1,519 | 1,426 | 1,078 | 759 | 505 |
| **TERRELL Total** | | **$278.59** | **$337.99** | **$317.23** | **$239.94** | **$169.00** | **$112.47** | **1,252** | **1,519** | **1,426** | **1,078** | **759** | **505** |
| **REGION E Total** | | **$883.30** | **$1,143.05** | **$1,286.91** | **$1,385.54** | **$1,538.02** | **$1,753.08** | **3,635** | **5,443** | **6,606** | **7,592** | **9,422** | **11,989** |

# CHAPTER 7

# DROUGHT RESPONSE INFORMATION, ACTIVITIES, AND RECOMMENDATIONS

*This page intentionally left blank.*

# 7 REGIONAL DROUGHT RESPONSE, INFORMATION, ACTIVITES, AND RECOMMENDATIONS

Drought is a frequent and inevitable factor in the climate of Texas. Therefore, it is vital to plan for the effect that droughts will have on the use, allocation and conservation of water in the State. Through the regional water planning process, requirements for drought management planning are found in Title 31 of the Texas Administrative Code (TAC), Part 10, Chapter 357, Subchapter D. Texas Statute reference §357.42 includes requirements regarding drought response information, activities, and recommendations. This chapter examines these specific requirements and identifies drought impacts within the Region.

## 7.1 DROUGHTS OF RECORD IN FAR WEST TEXAS

The severity of the recent drought significantly impacted the lives of water users, providers and water managers who were hard-pressed to find solutions to critical supply and demand issues. The severity of the impacts varied, but the overriding sense of urgency to create workable strategies and solutions was acknowledged and acted upon Statewide. Therefore, it is critical in this planning cycle to continue to address the impact that drought has had and will have on the future use, allocation and conservation of water in Far West Texas.

There are different types of drought that have been defined in various ways; however, these definitions fall into four primary categories: meteorological, agricultural, hydrological and socioeconomic drought. In the most general sense, drought is a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group or environmental purpose. The State Drought Preparedness Plan provides more specific and detailed definitions. and is located at the following link:

http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/droughtPrepPlan.pdf.

Meteorological drought is quantified by how dry it is (for example, a rain deficit) compared to normal conditions as well as the duration of the dry period. This is typically a region-specific metric, since factors affecting meteorological drought can vary so much in different regions.

Agricultural drought looks at the effects of meteorological drought in terms of agricultural impacts. For example, evapotranspiration, soil moisture and plant stress are measures of agricultural drought, which account for vulnerability of crops through the various growth stages.

Hydrological drought is measured in terms of effects on surface and subsurface waters, such as reservoir stage and capacity, stream flow or groundwater levels in wells. Hydrological drought is usually defined on a river-basin or watershed scale. Hydrological droughts typically lag behind meteorological and agricultural droughts because it takes more time for the evidence of basin-wide impacts to manifest.

Socioeconomic drought occurs when the demand for an economic product (such as hydroelectric power) exceeds supply due to a weather-related deficit. Typically, demand for a product increases with population growth and per capita consumptions. Supply increases due to efficiency technology and the construction of new water projects. If both are increasing, the rate of change between supply and demand is the key. However, when demand exceeds supply, vulnerability is magnified by water shortages during drought.

Several climatological drought indicators have been formulated to quantify drought. The Palmer Drought Severity Index (PDSI) was developed in 1965 and is currently used by many federal and state agencies. The PDSI is a soil moisture index that works best in relatively large regions with uniform topography that don't experience extreme climate shifts. PDSI values can lag oncoming drought by several months. The TWDB uses the PDSI to monitor State drought conditions, which has values ranging between -6.0 (driest) to 6.0 (wettest). "Extreme drought" conditions have a PDSI between -6.0 and -4.0, and "severe drought" conditions have a PDSI between -3.99 and -3.0. An accumulated area graph of the weekly PDSI categories for the Trans-Pecos region is included as Figure 7-1.

Since 2000, the Trans-Pecos region experienced recurring extreme drought conditions in 2000 through 2004, 2006 through 2008, in 2013 and in 2018. The Trans-Pecos region experienced the longest sustained periods of extreme drought between January 2011 and September 2012.

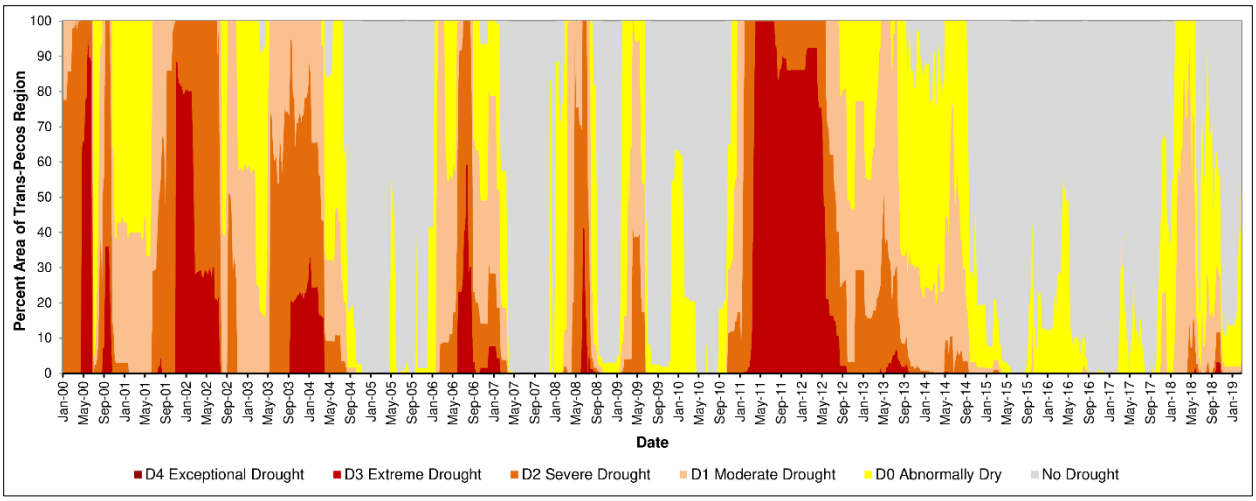



**Figure 7-1. Drought in the Texas Trans-Pecos Region, 2000-2018**

Source: U.S. Drought Monitor

Far West Texas, including the Trans-Pecos Regions is perennially under drought or near drought conditions compared with more humid areas of the State. Citizens of the Region experience a wide range of weather conditions due to the Region being in the middle latitudes and northwest of the Gulf of Mexico. Although residents of the Region are generally accustomed to these conditions, the low rainfall and the accompanying high levels of evaporation underscore the necessity of developing plans that respond to potential disruptions in the supply of groundwater and surface water caused by drought conditions.

### 7.1.1 Precipitation Indicator

Average annual precipitation varies from about 8 inches a year in El Paso County to nearly 15 inches in Jeff Davis County, based on NWS cooperator weather station data (Figure 7-2).

Comparing the 1950s DOR and the current drought can be accomplished using historic precipitation, stream flow records, spring discharge, and water level measurements in wells for locations that have accumulated data measurements since the 1940s.

The greatest precipitation impact to the Region comes further north in New Mexico and southern Colorado. Along the Rio Grande lies New Mexico's largest reservoir, Elephant Butte Reservoir. In terms of Far West Texas' surface water availability, it is the annual volume of water released from the Elephant Butte that must try to meet a portion of the growing water demands of the Region. However, severe drought had driven the storage levels of the Elephant Butte Reservoir to record lows of less than ten percent full, or 97 feet into the reservoirs "dead pool during the recent drought. This is one of the many problems in a series of drought-related challenges facing the Region. Currently, Elephant Butte Reservoir is 22 percent full, so it has recovered somewhat from the previous drought.

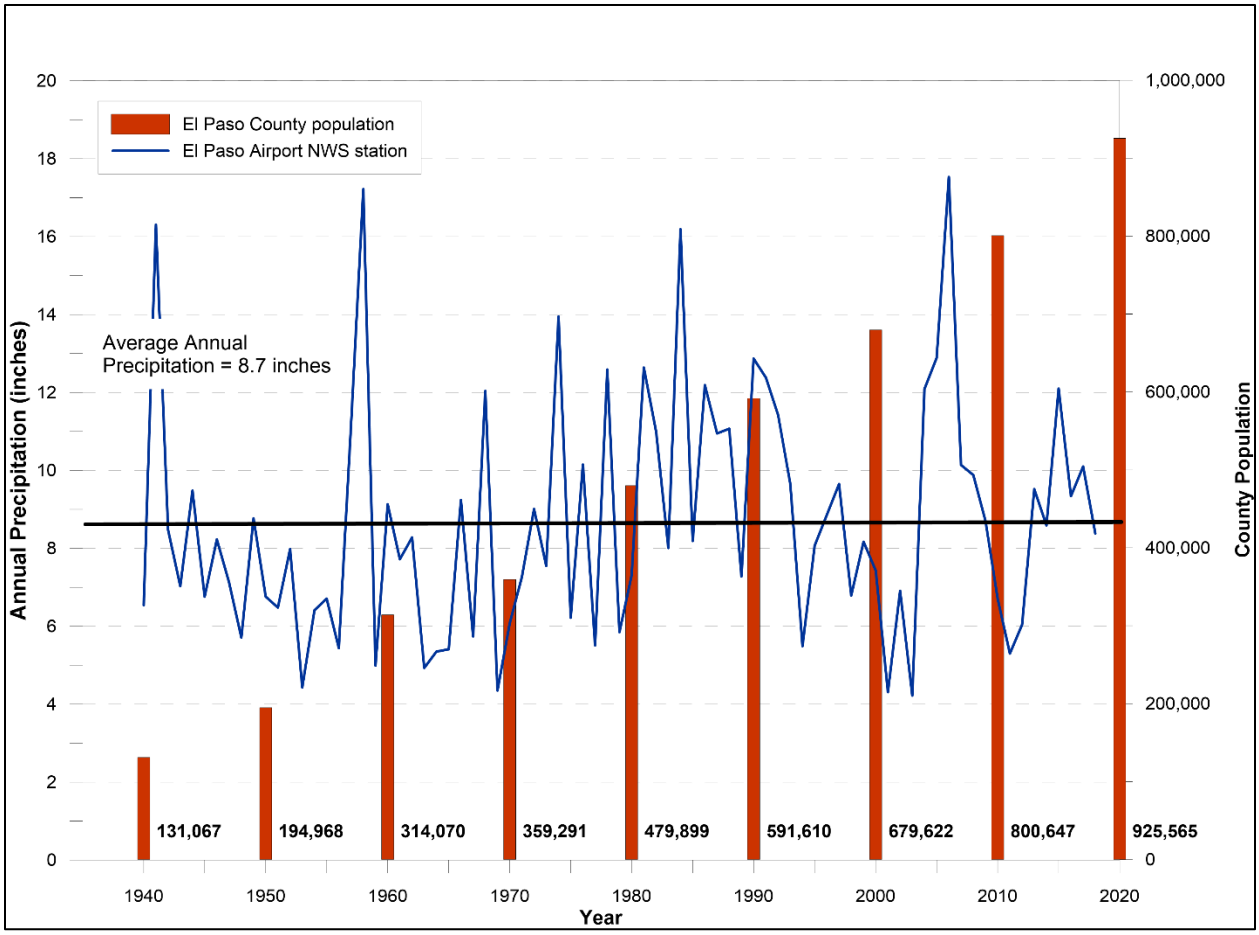



**Figure 7-2. Annual Rainfall vs Population, El Paso County, 1940-2012**

Source: NOAA NCDC; Texas Almanac

Figure 7-3 presents the storage capacity of Elephant Butte Reservoir from 1915 through 2019. The graph illustrates that the most significant declines in capacity due to drought impacting the reservoir occurred between 1951 and 1957. Recurring cycles of low capacity are evident between 1963 and 1965, 1971 and 1973, 1977 and 1979, 2003 and 2005and since 2012. The longest sustained period of very low capacity occurred between 1953 and 1957.

Although water users located near the Rio Grande are more significantly impacted by precipitation that falls within the upper reaches of the Rio Grande Basin in New Mexico and southern Colorado, this is not the case for water users who are located further from the river. Precipitation in these areas provides important recharge to aquifers that are annually diminished by pumping withdrawals.

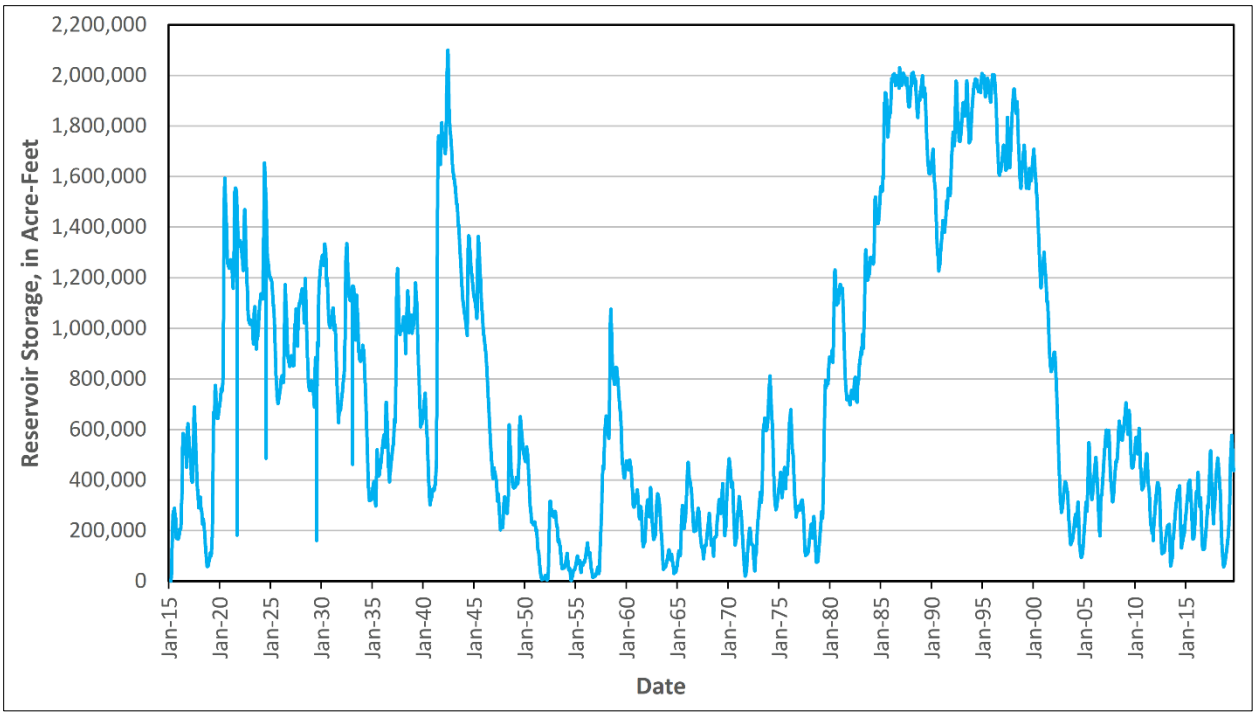



**Figure 7-3. Storage Levels for Elephant Butte Reservoir 1915-2019**

Source: Water Data for Texas

### 7.1.2 Stream Flow Indicator

The monitoring of streamflow of a river can generally provide a reliable indication of drought conditions throughout much of the State. However, gaging streamflow of the Rio Grande must be performed with knowledge of other factors that impact the supply of water in the river. Depending on the location of the stream gage, releases from Elephant Butte Reservoir and reservoirs on the Rio Conchos in Mexico have a large influence on streamflow at any given time.

A graph of streamflow at IBWC gaging station 08-374200.00 located on the Rio Grande just below the confluence with the Rio Conchos is included as Figure 7-4. The top graph illustrates peak events; the bottom graph focuses on low flow/no flow events. The construction and filling of Elephant Butte Reservoir accounts for the data gap between 1914 and 1930. The Luis L. Leon Reservoir (on the Rio Conchos) was completed in 1968.

Peak flows since 1900 have decreased after the construction of Elephant Butte Reservoir. The most current extreme peak occurred in 2008. The late spring and summer of 2008 was an abnormally wet season from the monsoonal rainfall over Mexico and southwest Texas (Hurricane Dolly in July, followed by tropical storm Julio in late August followed by tropical storm Lowell in September). The peak flow of 51,206 cfs occurred on September 19, 2008. Levees failed at Presidio, Texas and Ojinaga, Mexico causing extensive, devastating flooding in the area. The levees were designed for 42,000 cfs. Low-flow events appear to have occurred with relatively high frequency between 1900 and 1904, between 1952 and 1958, between 1996 and 2006. No flow was recorded between December 2011 and October 2014.

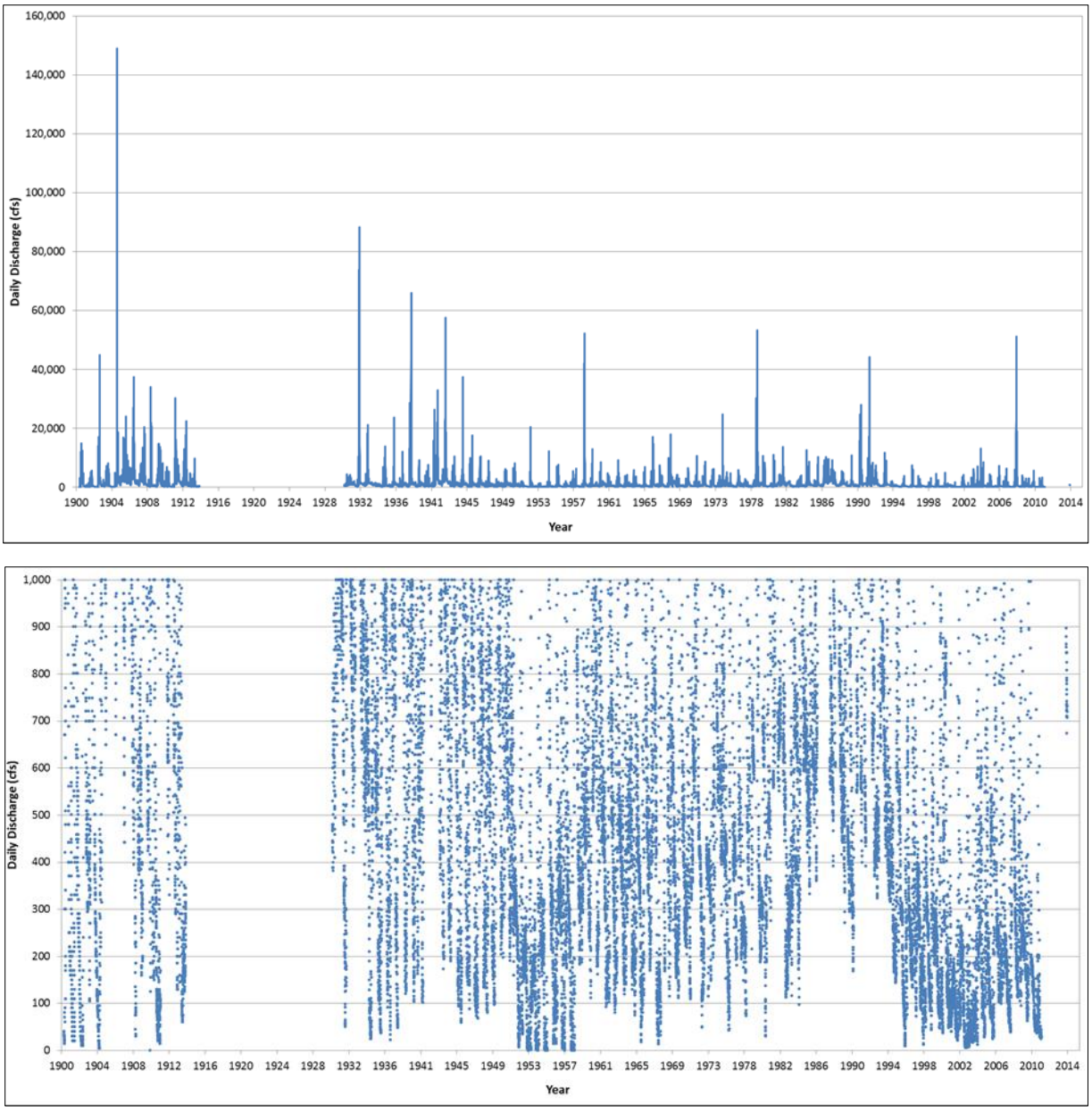



**Figure 7-4. Streamflow below Rio Conchos Confluence 1900-2014**

Source: IBWC (Filed a FOLA request on 3.7.19.

### 7.1.3 Spring Discharge Indicator

The San Solomon Spring System includes several springs that discharge to the Toyahville Basin near Toyahville, Texas. This group of springs includes: Phantom Lake, San Solomon, Giffin, Saragosa, West and East Sandia springs.

The only spring in this system that has a gaging station with a continuous period of record from the 1940s through today is Giffin Springs (Figure 7-5). The period of record extends back to 1930; however, measurements were sporadic prior to 1941. The average discharge for all measurements between 1941 and March 2019 is 4.2 cfs. The graph indicates that the longest period of below average flow within this

period of record occurred between 1964 and 1981. Note that most of these years had between two and four discharge measurements recorded. Additionally, springflow has generally remained below average since May 2015.

Some of the springs within this system have ceased to flow. For example, Phantom Lake Springs in Jeff Davis County are the highest in elevation of all the springs in the San Solomon Spring System. This spring stopped flowing naturally in 2001. This is partially attributed to irrigation pumping in the local area.

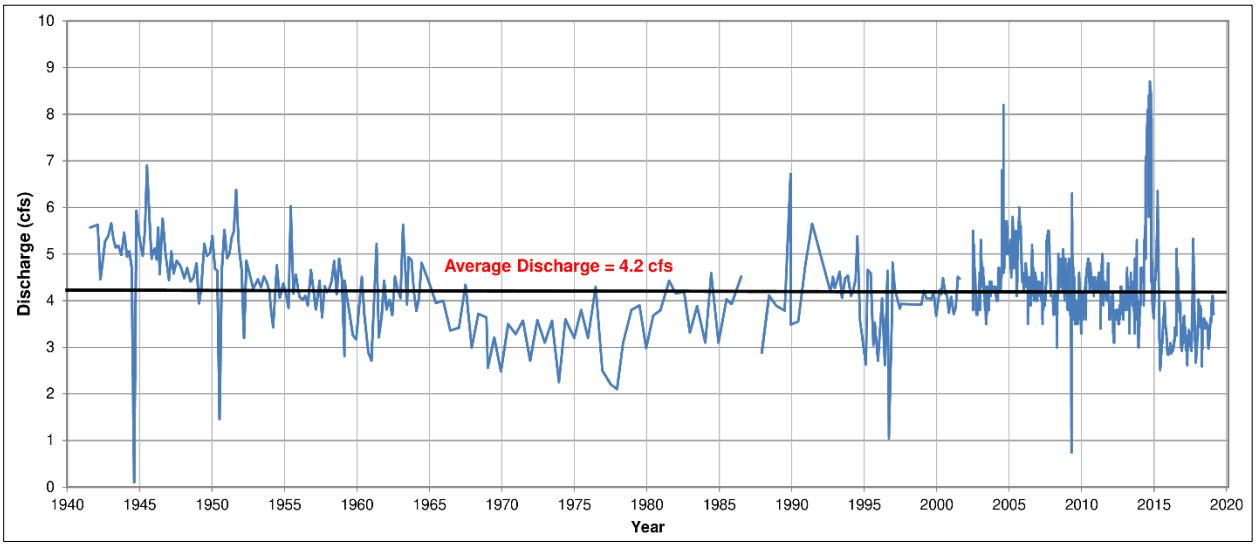



**Figure 7-5. Giffin Springs Discharge 1941-March 2019**

Source: Water Data for Texas

### 7.1.4 Groundwater Level Indicator

Figure 7-6 compares daily water level data from an existing real-time monitoring well with daily precipitation data from the nearby NWS Cooperative Weather Station at Panther Junction to illustrate aquifer response to precipitation events. This graph represents state well 73-47-404 which is completed within the Davis Mountains Igneous Aquifer in Brewster County. The data suggests that response time in the aquifer is quite rapid and occurs within a few days. Not all wells can be so readily correlated to rainfall events. Out of the nine pairs of wells and weather stations that were investigated within the Region, only this well showed an obvious response to rainfall occurring near the well.

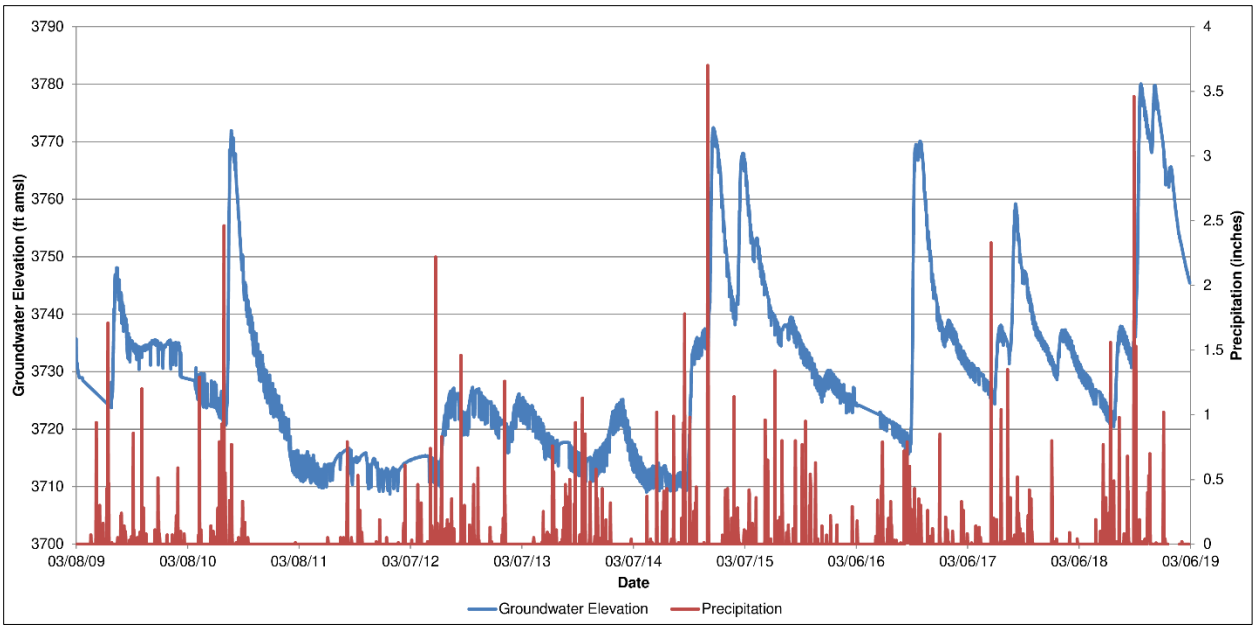



**Figure 7-6. Daily Groundwater Elevation and Daily Precipitation, Igneous Aquifer, Brewster County**

Source: Water Data for Texas

### 7.1.5 Far West Texas Drought of Record

The South-Central Climate Science Center prepared a report on the drought history for the Trans-Pecos of Texas in May of 2013. In this report, they determined that the period from February 1943 to November 1967 is the Drought of Record (DOR) for the Texas Trans-Pecos. The study points out that they consider the drought with the worst environmental conditions to outweigh the drought with the worst recorded impacts. They stated that a shorter less severe drought with high monetary losses (such as in 2011) does not outweigh a long and severe drought that occurred earlier in history. The study looked at data between 1895 and 2013. For this planning cycle, the drought of the 1950s is declared the DOR.

The catalyst for the recent drought can be attributed primarily to rainfall deficit (meteorological drought). The hydrological drought that has occurred because of rainfall deficit is evident in the decreased storage water levels of the Elephant Butte Reservoir, along with the decrease in the stream flow and spring discharge data that has been presented. However, the greatest unknown factor that these data collectively point to is the impact that can be attributed to anthropological factors.

The hydrological drought (impact on surface waters and groundwater) is a result of both meteorological and socioeconomic drought. To reiterate, socioeconomic drought occurs when demand exceeds supply due to a weather-related deficit. Typically, demand for a product increases with population growth and per capita consumptions. Supply increases due to efficiency technology and the construction of new water projects. If both are increasing, the rate of change between supply and demand is the key. However, when demand exceeds supply, vulnerability is magnified by water shortages during drought.

## 7.2 CURRENT DROUGHT PREPARATIONS AND RESPONSE

As mandated by 31 TAC 357.42(a)&(b), this section of the Plan summarizes and assesses all preparations and drought contingency plans that have been adopted by utilities and Groundwater Conservation Districts within the Far West Texas Region. The summary includes what specific triggers are used to determine the onset of each defined drought stage and the associated response actions that have been developed by local entities to decrease water demand during the drought stage.

Because of the range of conditions that affected the more than 4,000 water utilities throughout the State in 1997, the Texas Legislature directed the TCEQ to adopt rules establishing common drought plan requirements for water suppliers. Thus, TCEQ requires all wholesale public water providers, retail public water suppliers serving 3,300 connections or more, and irrigation districts to submit drought contingency plans (DCPs). In addition, many Groundwater Conservation Districts also have DCPs that provide education and voluntary action recommendations.

Plans are required to be made available for inspection upon request. Guidelines as to what should be included in each drought contingency plan can be found on TCEQ's website. at the following link: http://www.tceq.texas.gov/permitting/water_rights/contingency.html/#contents

DCPs are intended to establish criteria to identify when water supplies may be threatened and the actions that should be taken to ensure these potential threats are minimized. A common feature of drought contingency plans is a structure that allows increasingly stringent drought response measures to be implemented in successive stages as water supply decreases and water demand increases. This measured or gradual approach allows for timely and appropriate action as a water shortage develops. The onset and termination of each implementation stage should be defined by specific "triggering" criteria. Triggering criteria are intended to ensure that: 1) timely action is taken in response to a developing situation, and 2) the response is appropriate to the level of severity of the situation. Each water-supply entity is responsible for establishing its own DCP that includes appropriate triggering criteria and responses.

### 7.2.1 Drought Response Triggers

Drought response triggers should be specific to each water supplier and should be based on an assessment of the water user's vulnerability. In some cases, it may be more appropriate to establish triggers based on a supply source volumetric indicator such as a lake surface elevation or an aquifer static water level. Similarly, triggers might be based on supply levels remaining in an elevated or ground storage tank within the water distribution system; this is not a recommended approach, as the warning of supply depletion would be only three to four days. Triggers based on demand levels can also be effective, if the demands are very closely and frequently monitored. Whichever method is employed, trigger criteria should be defined on well-established relationships between the benchmark and historical experience. If historical observations have not been made, then common sense must prevail until such time that more specific data can be presented.

### 7.2.2 Surface Water Triggers

Surface water sources are among the first reliable indicators of the onset of hydrologic drought. The annual allotment of Rio Grande Project water is determined by the U.S. Bureau of Reclamation (USBR) based on the amount of usable water in storage in Elephant Butte and Caballo Reservoirs. Based on the amount of storage remaining in Elephant Butte and Caballo Reservoirs at the end of the primary irrigation

season (early- to mid-October), the USBR determines the amount of water that will be delivered the following year. In general, a one-year drought in the Upper Rio Grande drainage basin will have little effect on overall storage in the reservoirs. However, a long-term drought would have a significant effect on water releases downstream. Downstream users, both irrigation and municipal, are thus aware in advance of coming surface water supply shortages and can react accordingly.

The City of El Paso's Drought and Emergency Management Plan (2012) is administered through EPW and is based on three Drought or Water Emergency Stages: (1) At Stage I El Paso County Water Improvement District No. 1 (EPCWID#1) declares surface water allotment is less than 0.5 acre-feet per acre on or before April 1st; or when water demand is projected to exceed available capacity as determined by El Paso Water; (2) A Stage II water emergency is triggered when the EPCWID#1 declares surface water allotment of less than 1.0 acre-feet per acre after April 1 but before May 1st or there is not enough continuous release of surface water; or water demand is projected by EPW to exceed available capacity; (3) A Stage III water emergency is triggered when the EPCWID#1 declares surface water allotment of less than 1.5 acre-feet per acre after May 1 but before May 15th or there is not enough continuous release of surface water; or water demand is projected by EPW to exceed available capacity. A water emergency may also be declared based on a water system failure due to weather, electrical or mechanical failure or contamination of source. Once any stage is declared, the General Manager of EPW can implement a variety of response measures designed to conserve water. These range from use restrictions to citations for noncompliance.

Most of the other communities in El Paso County receive their water supplies from EPW or from other water-supply entities including the Horizon Regional MUD, El Paso County WCID No.4, and the Lower Valley Water District. Because of their reliance on supply provided by EPW, the Lower Valley Water District drought contingency triggers and responses are similar to the triggers and responses developed by EPW. The other wholesale water providers rely on groundwater, which is discussed under the following Groundwater Triggers section.

Irrigation districts depend on runoff from watersheds in the Upper Rio Grande drainage basins of New Mexico and southern Colorado to provide surface water to support irrigation in El Paso and Hudspeth Counties. Hence, drought triggers for the EPCWID #1 and the Hudspeth County Conservation and Reclamation District No.1 (HCCRD #1) are established based on storage levels in Elephant Butte and Caballo Reservoirs, which are in turn dependent on meteorological and hydrological conditions in these watersheds.

Drought conditions, which impact the EPCWID #1, are those that affect the headwaters of the Rio Grande and its tributaries, such that Rio Grande Compact water deliveries into Elephant Butte Reservoir are reduced. The district's board of directors determines when a drought exists and establishes the yearly delivery allotment to its water users based on its diversion allocation from the USBR. Generally, when water storage in Elephant Butte Reservoir is less than 0.9 million acre-feet during the irrigation season (March through September), the USBR declares drought conditions and sets its diversion allocations (using the D1 and D2 curves) to the irrigation districts based on a delivery allotment of less than its normal (non-drought) three acre-feet per acre. During times of drought, the district will lower its delivery allotment based on the amount of its reduced diversion allocation from the USBR and its delivery commitments to its users. The extent of the reductions in the water allotments will be dependent on the severity of the drought conditions and will remain in effect until the conditions that triggered the drought contingency no longer exist.

The HCCRD #1 bases drought contingency planning on evaluation of the water supply projected and received by the EPCWID #1, since all waters received by HCCRD #1 are return flows and operational spills for El Paso County. Since conditions, to a degree, can be predicted prior to a crop season, the drought mitigation plan largely affects agricultural producers cropping plan. When a mild or moderate predicted shortage occurs, the HCCRD #1 will notify its clientele of the amount of the expected shortage. For a severe shortage, where the water supply will provide less than 50 percent of the expected demand, agricultural producers will be asked to prioritize their water requests based upon crop needs.

Water in the Lower Rio Grande segment is used principally for irrigation, recreation, and environmental needs. A drought trigger for this segment of the river is based on flows of less than 35,438 acre-feet. The TCEQ Rio Grande Watermaster administers the allocation of Texas' share of the international water and is responsible for informing water-rights users of expected diversions during drought years.

### 7.2.3 Groundwater Triggers

Groundwater triggers that indicate the onset of drought in Far West Texas are not as easily identifiable as relative to surface-water triggers. This is attributable to (1) the rapid response of stream discharge and reservoir storage to short-term changes in climatic conditions within a region and within adjoining areas where surface drainage originates, and (2) the typically slower response of groundwater systems to recharge processes. Although climatic conditions over a period of one or two years might have a significant impact on the availability of surface water, aquifers of the same area might not show comparable levels of response for much longer periods of time, depending on the location and size of recharge areas in a basin, the distribution of precipitation over recharge areas, the amount of recharge, and the extent to which aquifers are developed and exploited by major users of groundwater.

Several groundwater basins are identified in Chapter 3 as aquifers that will likely not experience consistent water-level decline, or mining, based on comparisons between projected demand, recharge and storage. In these areas, water levels might be expected to remain constant or relatively constant over the 2020 to 2070 planning period. Because of minimal water-level changes in these aquifers, water levels are not recommended as a drought-condition trigger. Atmospheric conditions are a better indicator for these areas.

Basins that do not receive sufficient recharge to offset natural discharge and pumpage may be depleted of groundwater (e.g., mined). The rate and extent of groundwater mining are related to the timeframe and the extent to which withdrawals exceed recharge. In such basins, water levels may fall over long periods of time, eventually reaching a point at which the cost of lifting water to the surface becomes uneconomic. Thus, water levels in such areas may not be a satisfactory drought trigger. Instead, communities might consider the rate at which water levels decline in response to increased demand during drought as a sufficient indicator.

Water levels in observation wells in and adjacent to municipal wellfields, especially where wells are completed in aquifers that respond relatively quickly to recharge events, may be established as drought triggers for municipal utilities in the future providing a sufficient number of measurements are made annually to establish a historical record. Water levels below specified elevations for a pre-determined period of time might be interpreted to be reasonable groundwater indicators of drought conditions. Until such historical water-level trends are established, municipal utilities will likely continue to depend on demand as a percentage of production capacity as their primary drought trigger. Twelve water-supply

entities were listed in Table 6-1 in the 2011 Plan. Drought triggers of all entities are structured around system production capacity and daily demand, except for El Paso, which is structured upon surface-water allotment stages. None of the entities used groundwater triggers. However, while most of the entities rely on a system capacity trigger of some kind, they also have groundwater wells that they pump from and monitor.

### 7.2.4 System Capacity Triggers

Because of the above described problems with using water levels as drought-condition indicators, several municipal water-supply entities in the Far West Texas Region that rely on groundwater generally establish drought-condition triggers based on levels of demand that exceed a percentage of the systems production capacity. Alpine, Van Horn (and Sierra Blanca) Anthony, Vinton, Horizon Regional MUD (Horizon City), Dell City, Fort Davis WSC (Fort Davis), Marfa, Presidio and Terrell County WCID #1 (Sanderson) have adopted system capacity triggers. Several entities have drought responses triggered when daily water demand exceeds 75 percent of production capacity.

El Paso (EPW) receives surface water allocations from the local irrigation district, El Paso County Water Improvement District No.1 (EPCWID#1) via the Rio Grande Project. Currently, El Paso has water rights to about 65,000 ac-ft/yr. EPW initiates the various drought triggers based on the amount of surface water being provided by the EPCWID #1 as described in Section 7.3.2 above.

### 7.2.5 Municipal and Wholesale Water Provider Drought Contingency Plans

The TCEQ requires all retail public water suppliers serving 3,300 connections or more and wholesale public water providers to submit a drought contingency plan as a way to prepare and respond to water shortages. The amended Title 30, Texas Administrative Code, Chapter 288 became effective on December 6, 2012 addressing TCEQ's guidelines and plan requirements. The forms for wholesale public water providers, retail public water suppliers and irrigation districts are available at:

https://www.tceq.texas.gov/permitting/water_rights/wr_technical-resources/contingency.html#whattoinclude Drought contingency plans for municipal uses by public water suppliers must document coordination with the regional water planning groups to ensure consistency with the regional water plans. The following entities have prepared drought contingency plans which are accessible at the specified websites:

- City of Alpine (http://cityofalpine.com/)
- City of Van Horn (http://vanhornutilities.com)
- Town of Anthony (http://townofanthony.org/index.php)
- City of El Paso (https://www.epwater.org/)
- El Paso County Tornillo WID
- El Paso County WCID #4 (Fabens)
- Fort Bliss
- Horizon Regional MUD (http://horizonregional.com/)
- Lower Valley Water District (http://www.lvwd.org/)

- City of Clint (drought plan same as LVWD)
- City of San Elizario (drought plan same as LVWD)
- City of Socorro (drought plan same as LVWD)
- City of Vinton (drought plan same as EPW)
- Fort Davis WSC
- City of Marfa
- City of Presidio (http://presidiotx.us/)
- Terrell County WCID #1

A list of entities, their supply source, specific triggers and actions, for each drought stage is provided in Table 7-1.

**Table 7-1. Municipal Mandated Drought Triggers and Actions**

| Water Supply Entity | Water Supply Source | Drought Trigger | Drought Stage and Response | | | | |
|---|---|---|---|---|---|---|---|
| | | | Mild | Moderate | Severe | Critical | Emergency |
| City of Alpine | Igneous (Meriwether #1 & #2 wells) | Demand-based triggers include the following components: 1) percent of water treatment capacity, 2) total daily demand as percent of pumping capacity, 3) storage capacity and 4) well pump run time. | Demand reaches 90% of production capacity; system failure that would limit the capacity of the system below 85% during peak demand periods. | Demand reaches 95% of production capacity; system failure that would limit the capacity of the system below 75% during peak demand periods. | Demand reaches 100% of production capacity; system failure that would limit the capacity of the system below 70% during peak demand periods. | Extended period of severe condition or any natural catastrophic situation. | N/A |
| | | | Voluntary- reduce water demand. | Mandatory- lawn watering schedule. | Set limits on water consumption; prohibit use of specific outdoor watering activities. | N/A | N/A |
| City of El Paso (EPWU) | Hueco-Mesilla Bolson, Rio Grande River | Surface water allotment from El Paso Co. WID #1; system capacity limits. | EPCWID decreases allotment less than 0.5 acre foot per acre on or before April 1; water demand is projected to exceed EPWU system capacity. | EPCWID decreases allotment less than 1.0 acre foot per acre on or after April 1 but before May 1 or there is not a continuous release of surface water; water demand is projected to exceed EPWU system capacity. | EPCWID decreases allotment less than 1.5 acre foot per acre after May 1 but before May 15 or there is not a continuous release of surface water; water demand is projected to exceed EPWU system capacity. | N/A | N/A |
| | | | Voluntary- reduce water demand by 25%. | Mandatory- lawn watering schedule. | Set limits on water consumption; prohibit use of specific outdoor watering activities. | N/A | N/A |
| City of Marfa | Igneous | Base on water supply and/or demand conditions. | Demand exceeds 90% of production capacity for 3 consecutive days; system disruption occurs that limits the capacity of the system below 85% during peak demand periods. | Demand exceeds 95% of production capacity for 3 consecutive days; system disruption occurs that limits the capacity of the system below 75% during peak demand periods. | Demand exceeds 98% of production capacity for 3 consecutive days; system disruption occurs that limits the capacity of the system below 70% during peak demand periods. | Extended period of severe condition or any natural catastrophic situation. | N/A |
| | | | Voluntary- reduce water demand by 1-5%. | Reduce water demand by 5-10%. | Reduce water demand by10-15%. | Reduce water demand by15-20%. | Reduce water usage as deemed necessary. |

**Table 7-1. (Continued) Municipal Mandated Drought Triggers and Actions**

| Water Supply Entity | Water Supply Source | Drought Trigger | Drought Stage and Response | | | | |
|---|---|---|---|---|---|---|---|
| | | | Mild | Moderate | Severe | Critical | Emergency |
| City of Presidio | West Texas Bolson | Base on system capacity limits. | Total daily water demand equals or exceeds 2 million gallons on a single day. | Total daily water demand equals or exceeds 2 million gallons for 3 consecutive days. | Total daily water demand equals or exceeds 2 million gallons for 7 consecutive days. | Total daily water demand equals or exceeds 2 million gallons for 14 consecutive days. | Major system failures or supply contamination. |
| | | | Voluntary- reduce water use below 2 million gallons per day. | Mandatory- reduce water use below 2 million gallons per day. | Mandatory- reduce water use below 2 million gallons per day by restricting non-essential water use. | Mandatory- reduce water use below 2 million gallons per day by restricting irrigation of landscaped areas. | Mandatory- reduce water use below 2 million gallons per day by allocating water according to the water allocation plan. |
| City of Van Horn | West Texas Bolson | Demand exceeds production or storage capability measured over a 24-hr. period, and refilling the storage facilities is rendered impossible. | Triggers were not provided in the DCP | Triggers were not provided in the DCP | Triggers were not provided in the DCP | Demand exceeds 80% of production capacity. | Demand exceeds 90% of production capacity. |
| | | | Voluntary- reduce water use. | Limit water usage determined by the plant's capability to provide continuous service in direct proportion to the loss of production/refill capability of the storage facility. | All outdoor water usage is prohibited. | Allocate water. | All uses of public water supply will be banned except in cases of emergency. |
| El Paso County Tornillo WID | Hueco-Mesilla Bolson | Base on system capacity limits and known water levels in the groundwater well(s). | N/A | Treated water reservoir levels do not fill above 70% overnight. | Treated water reservoir levels do not fill above 50% overnight and/or static water level in the EPCTWID well is less than previous month. | EPCTWID well capacity is equal to or less than 80% of the well's original specific capacity. | Major system failures or supply contamination. |
| | | | Voluntary- reduce water demand by 3%. | Reduce water demand by 10%. | Reduce water demand by 30%. | Reduce water demand by 40%. | Reduce water demand by 50%. |

**Table 7-1. (Continued) Municipal Mandated Drought Triggers and Actions**

| Water Supply Entity | Water Supply Source | Drought Trigger | Drought Stage and Response | | | | |
|---|---|---|---|---|---|---|---|
| | | | Mild | Moderate | Severe | Critical | Emergency |
| El Paso County WCID #4 | Hueco-Mesilla Bolson | Base on system capacity limits. | Average daily water use reaches 80% for 3 consecutive days. | Average daily water use reaches 90% for 3 consecutive days. | Average daily water use reaches 100% for 3 consecutive days. | Failure of system components is reduced to only one well. | Major system failures or supply contamination. |
| | | | Voluntary-reduce water demand by 15%. | Reduce water demand by 25%. | Reduce water demand by 50%. | Reduce water demand by 75%. | Reduce water demand by 75%. |
| Fort Bliss | Hueco-Mesilla Bolson | Base on system capacity limits. | N/A | Demand exceeds 90% of production capacity for 2 consecutive days. | Demand exceeds 95% of production capacity for 2 consecutive days. | Demand exceeds 100% of production capacity for 2 consecutive days. | Major system failures or supply contamination. |
| | | | N/A | Reduce water demand by 20%. | Reduce water demand by 30%. | Reduce water demand by 40%. | Reduce water demand by 50%. |
| Fort Davis WSC | Igneous | Base on system capacity limits. | N/A | Total daily water demand ranges from 60-70% of production capacity. | Total daily water demand exceeds 75% of production capacity. | Total daily water demand exceeds 75% of production capacity for more than 5 consecutive days. | Major system failures or supply contamination. |
| | | | Voluntary-reduce water demand by 10%. | Mandatory-reduce water demand by 10%. | Reduce water usage to a point the District can revert to the previous stage and continue to reduce usage until 10% reduction is secured. | Discontinue all non-essential and landscape irrigation water use. | Water rationing may be put into effect. |
| Horizon Regional MUD | Hueco-Mesilla Bolson | Base on system capacity limits and water levels in District's well(s). | Total daily water demands reach 80% of the District's capacity for 5 consecutive days. | Total daily water demands reach 90% of the District's capacity for 5 consecutive days. | Demand equals or exceeds 95% of the District's capacity for 3 consecutive days. | Demand meets 100% of capacity for 3 consecutive days. | Major system failures or supply contamination. |
| | | | Voluntary-reduce water demand by 10%. | Mandatory-reduce water demand by 10%. | Reduce water usage to a point the District can revert to the previous stage and continue to reduce usage until 10% reduction is secured. | Discontinue all non-essential and landscape irrigation water use. | Water rationing may be put into effect. |

**Table 7-1. (Continued) Municipal Mandated Drought Triggers and Actions**

| Water Supply Entity | Water Supply Source | Drought Trigger | Drought Stage and Response | | | | |
|---|---|---|---|---|---|---|---|
| | | | Mild | Moderate | Severe | Critical | Emergency |
| Lower Valley Water District | Hueco-Mesilla Bolson | Water levels in Elephant Butte Reservoir are less than a designated depth; decrease in surface water allotment; and increase in demand. | Water stored in Elephant Butte Reservoir is less than 50,000 acre-feet; surface water allotment is less than or equal to 3.0 acre-ft./acre; or demand exceeds 90% system capacity. | Surface water allotment less than or equal to 2.5 acre-ft./acre; or demand exceeds 95% system capacity. | Surface water allotment less than or equal to 2.0 acre-ft./acre; or demand exceeds 100% system capacity. | N/A | Major system failures or supply contamination. |
| | | | Voluntary-reduce landscape irrigation water use by 50%. | Voluntary-reduce industry water consumption by 25% | All non-essential water use is prohibited. | N/A | Water rationing may be put into effect. |
| Terrell County WCID #1 (Sanderson) | Edwards-Trinity (Plateau) | Base on system capacity limits. | Daily water demand reaches or exceeds 80% of the system's capacity for 5 consecutive days. | Daily water demand reaches or exceeds 90% of the system's capacity for 5 consecutive days. | Daily water demand reaches or exceeds 100% of the system's capacity for 2 consecutive days. | N/A | N/A |
| | | | Inform the public. | All non-essential water use is prohibited. | Prohibit outside water use. | N/A | N/A |
| Town of Anthony | Hueco-Mesilla Bolson | Base on system capacity limits. | Daily water demand exceeds 90% of the system's capacity for 3 consecutive days; equipment or system failure occurs that limits the capacity of the system below 85% during high demand periods. | Daily water demand exceeds 90% of the system's capacity for 3 consecutive days; equipment or system failure occurs that limits the capacity of the system below 75% during high demand periods. | Daily water demand exceeds 98% of the system's capacity for 3 consecutive days; equipment or system failure occurs that limits the capacity of the system below 70% during high demand periods. | N/A | Major system failures or supply contamination. |
| | | | Voluntary-reduce water demand by 1-5% | Reduce water demand by 5-10% | Reduce water demand by 10-15% | N/A | Water rationing may be put into effect. |

### 7.2.6 Groundwater Conservation District Drought Management

A discussion of the creation and the goals of the six Groundwater Conservation Districts (GCDs) formed in Far West Texas are discussed in more detail in Chapter 5 - Section 5.3. This section will focus on summarizing drought management by the Districts.

Six districts are currently in operation within the planning region:

- Brewster County GCD (http://westtexasgroundwater.com)
- Culberson County GCD (http://www.co.culberson.tx.us/page/culberson.GroundWaterConservationDistrict)
- Hudspeth County UWCD #1
- Jeff Davis County UWCD
- Presidio County UWCD
- Terrell County GCD

Groundwater Conservation Districts are required to define management goals that specifically address drought conditions within their groundwater management plans. These are delineated via management objectives and performance standards.

#### 7.2.6.1 Brewster County Groundwater Conservation District

**Management Objective –** file and discuss at each meeting of the Board, drought emergency contingency plans received since the previous meeting.

The District, in partnership with the landowners of the District, hopes to monitor changing storage conditions of groundwater due to drought conditions.

#### 7.2.6.2 Culberson County Groundwater Conservation District

**Management Objective** – The District will monitor the PDSI and the TWDB drought page and report findings and actions to the District Board on a quarterly basis. If PDSI indicates that the District will experience severe drought conditions, the District will notify all public water suppliers within the District.

#### 7.2.6.3 Hudspeth County Underground Water Conservation District No. 1

**Management Objective –** the annual amount of groundwater permitted by the District for withdrawal from the portion of the Bone Spring-Victorio Peak aquifer located within the District may be curtailed during periods of extreme drought in the recharge zone of the aquifer or because of other conditions that cause significant declines in groundwater levels. Such curtailment may be triggered by the District's Board based on the groundwater levels measured in the District's monitoring well(s).

#### 7.2.6.4 Jeff Davis County Underground Water Conservation District

**Management Objective –** the District will monitor the PDSI and report to the Board, the number of times the District experiences PDSI of less than one (mild drought). If PDSI indicates that the District will experience severe drought conditions, the District will notify all public water suppliers within the District.

#### 7.2.6.5 Presidio County Underground Water District

**Management Objective –** the District will monitor the PDSI at least once quarterly. If PDSI indicates that the District will experience severe drought conditions, the District will notify all public water suppliers within the District.

#### 7.2.6.6 Terrell County Groundwater Conservation District

**Management Objective –** the District will access the PDSI map and will check for updates to the Drought Preparedness Council Situation Report and discuss current drought conditions during at least one Board meeting a year.

## 7.3 EXISTING AND POTENTIAL EMERGENCY INTERCONNECTS

According to Texas Statute §357.42(d)(e) regional water planning groups are to collect information on existing major water infrastructure facilities that may be used in the event of an emergency shortage of water. Pertinent information includes identifying the potential user(s) of an interconnected facility, the potential supplier(s), the estimated potential volume of supply that could be provided, and a general description of the facility. Texas Water Code §16.053(c) requires more specific information regarding facility locations to remain confidential. This section provides general information regarding existing and potential emergency interconnects among water user groups within Far West Texas.

Major water infrastructure facilities with the potential to interconnect with other utilities were identified through a survey process to better evaluate existing and potentially feasible emergency interconnects. Six potential interconnects are identified as shown in Table 7-2. Additional water supply is also available to EPW during an emergency shortage of water, via the Desalination Plant.

**Table 7-2. Potential Emergency Interconnects to Major Water Facilities**

| Entity Providing Supply | Entity Receiving Supply |
|---|---|
| Lower Valley Water District | El Paso WCID #4 Fabens |
| | El Paso Co. Tornillo WID |
| | Horizon Regional MUD |
| | Clint |
| EPW | Town of Anthony |
| El Paso County WID #4 | Gilroy Station, Fabens |
| Fort Davis Estates | Fort Davis |

## 7.4 EMERGENCY RESPONSES TO LOCAL DROUGHT CONDITIONS OR LOSS OF MUNICIPAL SUPPLY

Texas Statute §357.42(g) requires regional water planning groups to evaluate potential temporary emergency water supplies for all County-Other WUGs and municipalities with 2010 populations less than 7,500 that rely on a sole source of water. The purpose of this evaluation is to identify potential alternative water sources that may be considered for temporary emergency use if the existing water supply sources become temporarily unavailable due to extreme hydrologic conditions such as emergency water right curtailment, unanticipated loss of reservoir conservation storage, or other localized drought impacts.

This section provides potential solutions that should act as a guide for municipal water users that are most vulnerable in the event of a loss of supply. This review was limited and did not require technical analyses or evaluations following in accordance with 31 TAC §357.34.

There are 12 municipal and County-Other entities in the Region that have a 2010 Census population of less than 7,500 and rely upon a sole source of water. Eleven entities rely on groundwater and one (City of Clint) relies on water purchased from another entity. Potential emergency water supply sources that might be used by these small sole-source municipal or County-Other entities include the following:

- New local groundwater well
- Emergency interconnect
- Use of other named local supply
- Trucked-in water delivery
- Brackish groundwater limited treatment
- Brackish groundwater desalination
- Release from upstream reservoir
- Curtailment of upstream and/or downstream water rights

Based upon personal communication with the entities, the addition of a new local groundwater well along with trucking in water was identified by all entities as a potential emergency water supply source. The City of Clint and the City of Presidio would also consider the curtailment of proximal water rights as a feasible option under emergency conditions. The entities along with feasible potential emergency water supply options have been included in Table 7-3.

**Table 7-3. Emergency Responses to Local Drought Conditions**

| Entity | | | | Implementation Requirements | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water User Group Name** | **County** | **2020 Population** | **2020 Demand** | **Curtailment of upstream/downstream** | **Additional groundwater well** | **Brackish groundwater limited treatment** | **Brackish groundwater desalination** | **Emergency interconnect** | **Trucked - in water** | **Type of infrastructure required** | **Entity providing supply** | **Other local entities required to participate** | **Emergency agreements already in place** |
| Alpine | Brewster | 6,066 | 1,934 | | ▪ | | | | ▪ | | | | |
| Anthony | Brewster | 4,206 | 770 | | ▪ | | | ▪ | ▪ | Pipeline; Truck | EPW | | General |
| Clint | El Paso | 1,131 (2017) | 92 (2016) | ▪ | ▪ | | | ▪ | ▪ | Pipeline; Truck | LVWD; EPW | LVWD | |
| East Montana Water System | El Paso | 6,599 | 806 | | ▪ | | | | ▪ | | | | |
| El Paso Co. Tornillo WID | El Paso | 3,202 | 320 | | ▪ | | | | ▪ | | | | |
| El Paso WCID 4 Fabens | El Paso | 8,858 | 810 | | ▪ | | | | ▪ | | | | |
| Esperanza Water Service | Hudspeth | 905 | 142 | | ▪ | | | | ▪ | | | | |
| Federal Correctional Institution - La Tuna | El Paso | 1,668 | 352 | | ▪ | | | | ▪ | | | | |
| Fort Davis WSC | Jeff Davis | 1,361 | 319 | | ▪ | | | ▪ | ▪ | Pipeline; Truck | Fort Davis Estates | | |
| Haciendas Del Norte WID | El Paso | 1,218 | 196 | | ▪ | | | | ▪ | | | | |
| Hudspeth County WCID 1 | Hudspeth | 952 | 142 | | ▪ | | | | ▪ | | | | |
| Lajitas Municipal Services | Brewster | 542 | 103 | | ▪ | | | | ▪ | | | | |
| Marathon WSSS | Brewster | 444 | 124 | | ▪ | | | | ▪ | | | | |
| Marfa | Presidio | 2,583 | 690 | | ▪ | | | | ▪ | | | | |
| Paseo Del Este MUD 1 | El Paso | 8,116 | 1,054 | | ▪ | | | | ▪ | | | | |
| Presidio | Presidio | 5,458 | 738 | ▪ | ▪ | | | | ▪ | Trucks | | | |

**Table 7-3. (Continued) Emergency Responses to Local Drought Conditions**

| Entity | | | | Implementation Requirements | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water User Group Name** | **County** | **2020 Population** | **2020 Demand** | **Curtailment of upstream/downstream** | **Additional groundwater well** | **Brackish groundwater limited treatment** | **Brackish groundwater desalination** | **Emergency interconnect** | **Trucked - in water** | **Type of infrastructure required** | **Entity providing supply** | **Other local entities required to participate** | **Emergency agreements already in place** |
| Terrell County WCID 1 (Sanderson ) | Terrell | 870 | 178 | | ▪ | | | | ▪ | Trucks | | | |
| Sierra Blanca (County-Other) | Hudspeth | 553 | 58 | | ▪ | | ▪ | ▪ | ▪ | Trucks | | Hudspeth Co. WCID 1 | General |
| Van Horn | Culberson | 2,319 | 662 | | ▪ | | | | ▪ | Trucks | | | |
| Valentine (County-Other) | Jeff Davis | 198 | 168 | | ▪ | | | | ▪ | | | | |

In order to qualify for emergency funds that are earmarked for emergency groundwater supply wells, entities must have a drought plan in place and be currently listed as an entity that is limiting water use to avoid shortages. This list is updated weekly by the TCEQ's Drinking Water Technical Review and Oversight Team and can be found at: https://www.tceq.texas.gov/drinkingwater/trot/droughtw.html.

There is some assistance available through the Texas Department of Agriculture and the Texas Water Development Board. There are requirements, deadlines, and a specific application process. Contact the TWDB by e-mail, <Financial_Assistance@twdb.texas.gov>, or call 512-463-0991. Contact the Texas Department of Agriculture, Community Development Block Grants, or call 512-463-7476. Funding is limited.

Other TCEQ Guidance resources:

- Emergency and Temporary Use of Wells for Public Water Supplies (RG-485)
- https://www.tceq.texas.gov/assets/public/comm_exec/pubs/rg/rg-485.pdf Video: Workshop on Drought Emergency Planning for Public Water Systems in Texas http://www.youtube.com/watch?v=BdlF9CEcGPI&feature=plcp&context=C34378a7UDOEgsToPDskJNYWXf5I3pKq8tW9pkVqQU

# 7.5 REGION-SPECIFIC MODEL DROUGHT RESPONSE RECOMMENDATIONS AND MODEL CONTINGENCY PLANS

As mandated by TAC 357.42(c)&(i), the RWPGs shall develop drought response recommendations regarding the management of existing groundwater and surface water sources in the RWPA designated in accordance with §357.32. The RWPGs shall make drought preparation and response recommendations regarding the development of, content contained within, and implementation of local drought contingency plans. The RWPGs shall develop region-specific model drought contingency plans that shall be presented in the RWP which shall be consistent with 30 TAC Chapter 288 requirements.

A new component of the planning process introduced in this planning cycle is Regional Drought Planning, which essentially expands the conceptualization and application of drought planning by specific entities to encompass the entire Far West Texas Region. The approach utilized in developing a region-specific drought plan considers the following: 1) all regional groundwater and surface water sources, 2) current drought plans that are being utilized by user entities within the region, and 3) current monitoring stations within the region that have evolved since the previous planning cycle.

The goals of this approach are: 1) to gain a comprehensive view of what particular resources are being monitored by entities within the region, 2) determine which resources are not being monitored, 3) determine which users do not fall under the umbrella of existing DCPs, 3) identify potential monitoring stations with publicly accessible real-time data that currently exist, 4) determine how these data can be utilized for the water user groups that do are not subject to existing DCPs, and ultimately 5) development of a regional model drought contingency plan.

As discussed in Section 7.2, numerous groundwater conservation districts, irrigation districts, municipalities, and various public supply systems have written drought management plans or drought contingency plans and have provided them for inclusion in the Regional Plan.

### 7.5.1 Regional Groundwater Resources and Monitoring

Nine groundwater sources identified within Far West Texas and their contribution to total regional groundwater supply, based upon historical pumping averages for years 2012 through 2016, are:

- Bone Spring-Victorio (15%)
- Capitan Reef Complex (3%)
- Edwards-Trinity (Plateau) (less than 1%)
- Hueco-Mesilla (39%)
- Igneous (2%)
- Marathon (less than 1%)
- Rustler (less than 1%)
- West Texas Bolson (11%)
- Other (29%)

Current drought contingency plans are detailed in Section 7.3.5 and Table 7-1. State well numbers of the monitoring wells used by municipal entities that utilize groundwater triggers are shown in Table 7-4. A map of these locations is included as Figure 7-7.

**Table 7-4. Current Municipal Trigger Monitoring Wells**

| Water Supply Entity | County | Water Supply Source | Well ID |
|---|---|---|---|
| City of Marfa | Presidio | Igneous | 51-48-603 |
| City of Marfa | Presidio | Igneous | 51-48-602 |
| Terrell County WCID #1 | Terrell | Edwards-Trinity (Plateau) | 53-53-804 |
| Terrell County WCID #1 | Terrell | Edwards-Trinity (Plateau) | 53-53-806 |
| Terrell County WCID #1 | Terrell | Edwards-Trinity (Plateau) | 53-53-809 |
| Terrell County WCID #1 | Terrell | Edwards-Trinity (Plateau) | 53-53-903 |

The previous Far West Texas Water Plans identified wells that could potentially be used for drought monitoring. Table 7-5 provides a selection of groundwater trigger wells included in the 2016 Plan, with an updated status and history of measurements.

**Table 7-5. 2016 RWP Groundwater Trigger Monitoring Wells**

| Aquifer | County | Well ID | Monitoring Agency | Period of Record & Measurement Count | Current Status |
|---|---|---|---|---|---|
| Igneous | Brewster | 52-35-709 (Cartwright Well) | TWDB | 1958-2019 (100 measurements) | Active |
| Marathon | Brewster | 52-55-106 | Registered Driller | 2008 (1 measurement) | Inactive |
| Lobo | Culberson | 51-02-903 | TWDB | 1950-2019 (66 measurements) | Active |
| Wild Horse | Culberson | 47-59-106 | TWDB | 1953-2019 (64 measurements) | Active |
| Hueco Bolson | El Paso | 49-13-710 (EPWU #67) | City | 1968-2009 (50 measurements) | Inactive (plugged in 2009) |
| Mesilla Bolson | El Paso | 49-04-138 (JL-EPWU #117) | USGS | 1952-2010 (46 measurements) | Monitoring discontinued in 2010 |
| Rio Grande Alluvium | El Paso | 49-04-701 | U.S. Bureau of Reclamation | 1946-1990 (532 measurements) | Unknown |
| Bone Spring-Victorio | Hudspeth | 48-07-516 | TWDB | 1966-2019 Recorder well | Active |
| Ryan Flat | Jeff Davis | 51-19-902 (2 Section Well) | TWDB | 1955-2019 (61 measurements) | Active |
| Edwards-Trinity (Plateau) | Terrell | 53-53-601 | Terrell County WCID #1 | 1986 (no measurements) | Unknown |

The TWDB maintains a component of their website called Water Data for Texas that is a collective of real-time monitoring data from both groundwater wells and reservoir stage-capacity gages. Table 7-6 is a summary of the 7 groundwater wells located within Far West Texas, with their locations included on Figure 7-7.

**Table 7-6. Currently Active (Real-Time) Monitoring Wells**
Source: Water Data for Texas

| County | State Well Number | Aquifer | Aquifer Type | Entity/Cooperator | Data Transmission | Start Date - Period of Record |
|---|---|---|---|---|---|---|
| Brewster | 7347404 | Other | Unconfined | Texas Water Development Board | Satellite | 5/9/2007 |
| Culberson | 4759123 | Salt Bolson and Cretaceous | Unconfined | Texas Water Development Board | Satellite | 6/10/1996 |
| El Paso | 4904476 | Hueco-Mesilla Bolson | Unconfined | U.S. Geological Survey | Satellite | 10/15/2013 |
| El Paso | 4913301 | Hueco-Mesilla Bolson | Unconfined | Texas Water Development Board | Satellite | 12/5/2002 |
| Hudspeth | 4807516 | Bone Spring-Victorio Peak | Unconfined | Texas Water Development Board | Satellite | 3/10/1966 |
| Jeff Davis | 5225209 | Igneous | Unconfined | Texas Water Development Board | Satellite | 9/5/2001 |
| Presidio | 5129805 | West Texas Bolson | Unconfined | Texas Water Development Board | Satellite | 9/15/1993 |

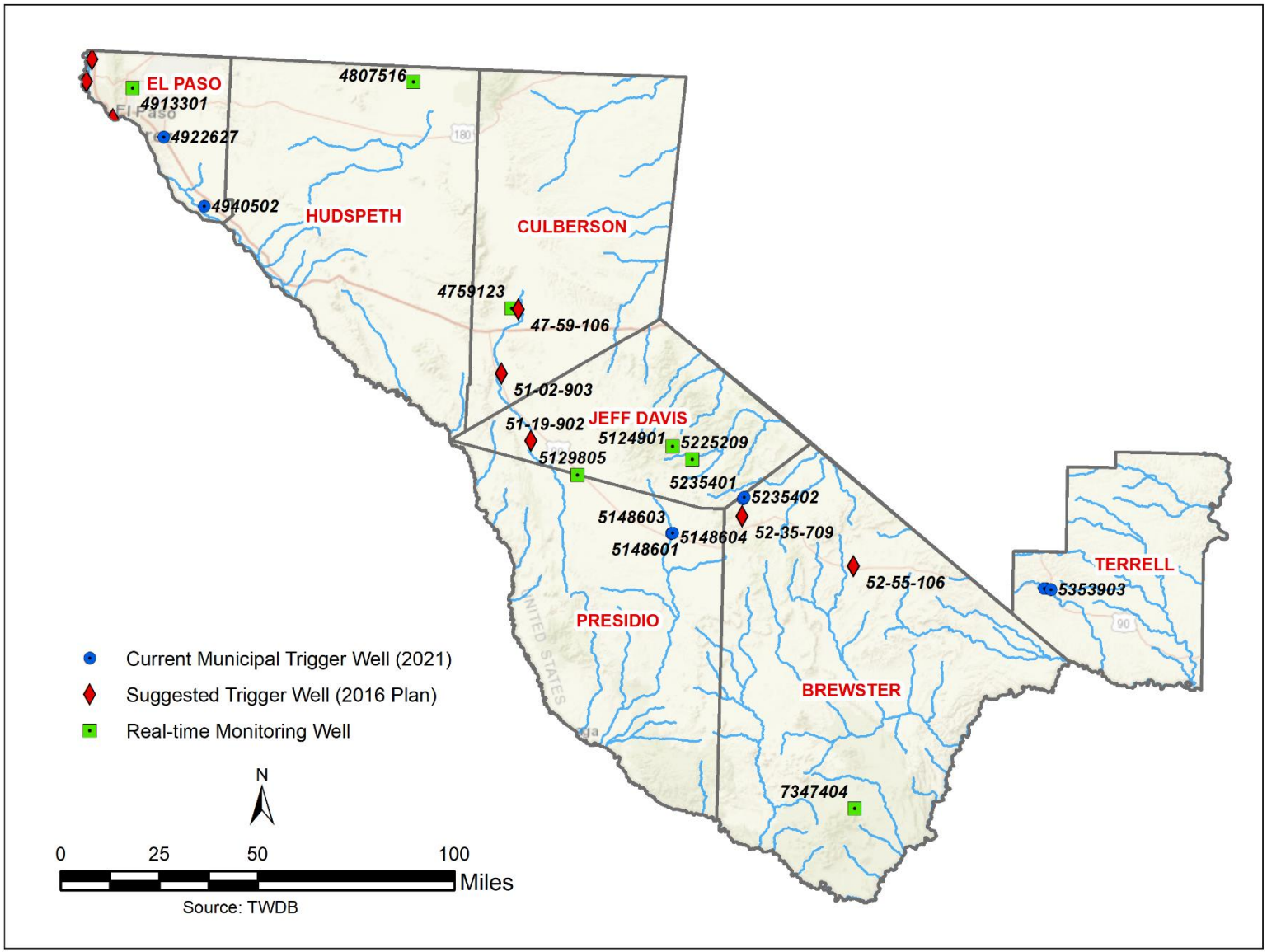



**Figure 7-7. Regional Monitoring and Trigger Wells**

### 7.5.2 Regional Surface Water Resources

Surface water sources identified within Far West Texas and their contribution to total regional surface water supply are:

- Rio Grande (65%)
- Rio Grande Return Flows (34%)
- Pecos River (<1%)

The basin contribution to the regional supply calculation is based upon the WAM Run 3 (Full Authorization) availability numbers.

A list of selected currently active stream flow and spring flow and gauging stations are listed in Table 7-7 International Boundary Water Commission (IBWC) and U.S. Geological Survey (USGS) gauging stations located along the Rio Grande between the Rio Conchos and the Pecos River are presented on Figure 7-8. There are five stations that are currently operating in this reach of the Rio Grande. The IBWC and USGS stations have real-time data that is publicly accessible online.

**Table 7-7. Currently Active Surface Water Gauging Locations, USGS, IBWC**

| County | Station ID | Station Name | Agency | Period of Record | Measurement Frequency |
|---|---|---|---|---|---|
| Presidio | 08-3650.00 | Rio Grande below American Dam at El Paso, Texas | IBWC | 1938-2019 | 15 minutes |
| Presidio | 08-3705.00 | Rio Grande at Old Fort Quitman, Texas | IBWC | 1923-2019 | 15 minutes |
| Presidio | 08-3712.00 | Rio Grande near Candelaria, Texas | IBWC | 1976-2019 | 15 minutes |
| Presidio | 08-3715.00 | Rio Grande above Rio Conchos near Presidio, Texas | IBWC | 1900-2019 | 15 minutes |
| Presidio | 08-3742.00 | Rio Grande below Rio Conchos near Presidio, Texas | IBWC | 1900-2019 | 15 minutes |
| Presidio | 08-3743.00 | Rio Grande below Mulato Dam near Redford, Texas | IBWC | 2014-2019 | 15 minutes |
| Val Verde | 08-4474.10 | Pecos River near Langtry, Texas | IBWC | 1967-2019 | 15 minutes |
| Brewster | 08-3745.00 | Terlingua Creek near Terlingua, Texas | IBWC | 1932-2019 | 15 minutes |
| Brewster | 08-3750.00 | Rio Grande at Johnson Ranch near Castolon, Texas | IBWC | 1936-2019 | 15 minutes |
| Brewster | 08374550 | Rio Grande near Castolon, Texas | USGS | 2007-2019 | Daily |
| Brewster | 08375300 | Rio Grande at Rio Grande Village, BBNP, Texas | USGS | 2007-2019 | Daily |
| Terrell | 08447020 | Independence Creek near Sheffield, Texas | USGS | 1974-2019 | Daily |

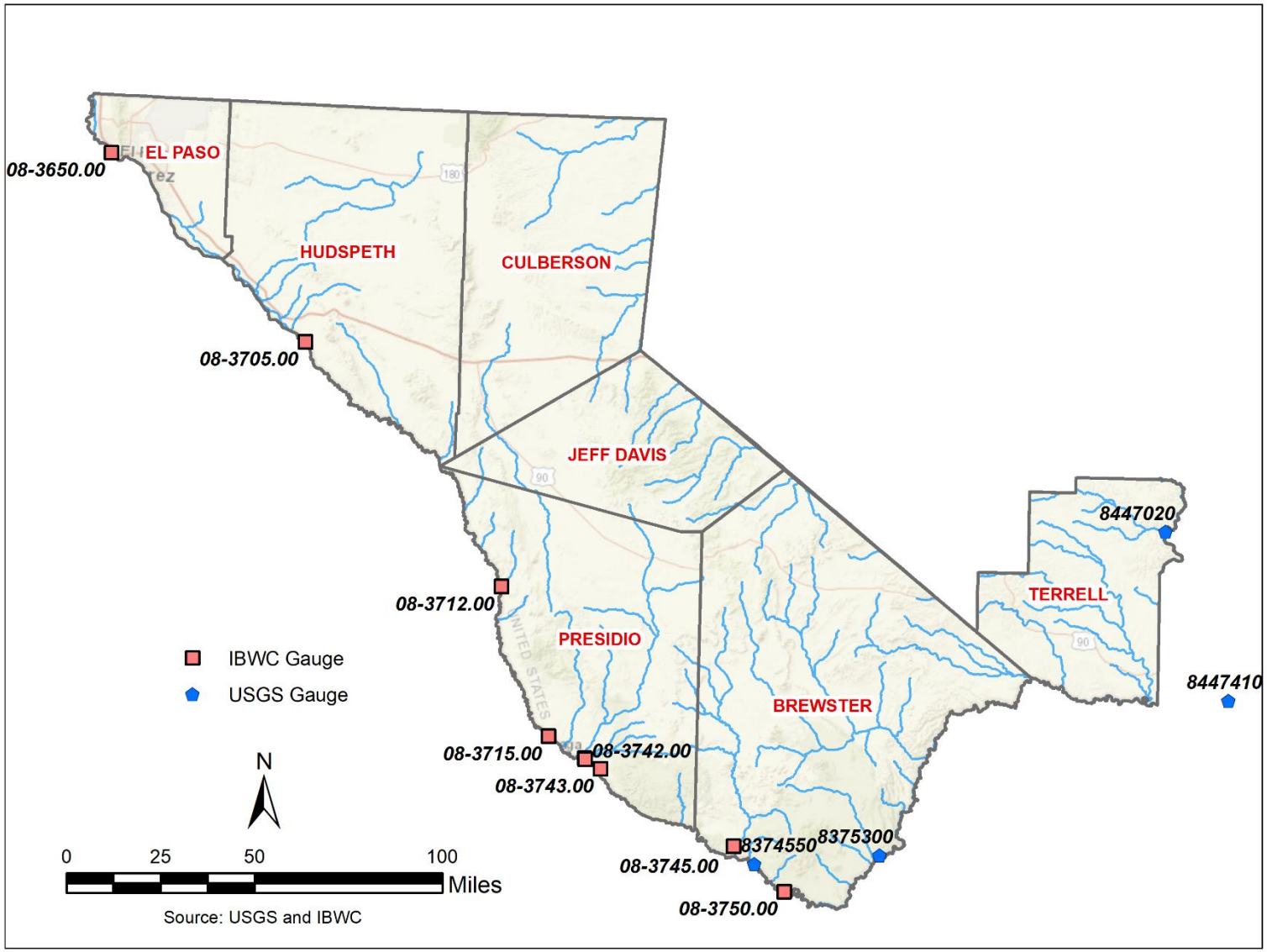



**Figure 7-8. Selected Active Surface Water Gaging Locations**

### 7.5.3 Regional Model Drought Contingency Plan

The Regional Model DCP summary Table 7-8 provides an overview of all existing regional water sources, WUGs, monitoring wells, gaging stations as well as recommended drought triggers and actions. The intent of including the monitoring wells and stations is to provide a comprehensive region-wide assessment of what current tools are available to WUGs and districts to monitor resources within the Region.

The Regional Model DCP will undoubtedly change over time to address particular needs and issues of the Region's users. Therefore, this initial version of the model plan will primarily focus on identifying all sources, users and monitoring tools to find the specific components within the Region that are not currently incorporated into any existing drought plan but could potentially utilize existing data resources. Another focus of this first model plan will consider consistency of existing plans within the Region. Entities that have adopted drought plans will only be assessed to this end, therefore fine tuning existing triggers of existing municipal drought plans is not a goal of the model plan beyond an effort toward achieving consistent responses/actions to drought across the Region. No triggers have been recommended for modification; however, an effort has been made to make the percent reduction of demand/use a little more aggressive and more equitable across the board. Additionally, 'voluntary conservation' has been removed as a stage 1 action. Conservation is a BMP that ideally will ultimately be practiced on a daily basis, and not merely as a reaction to drought conditions, therefore it has been removed as an action in the Regional Model DCP.

Smaller PWS entities (county-other), manufacturing, power, and irrigation water wells that exceed GCD exempt well-production thresholds are subject to drought actions imposed by the conservation districts. Exempt well users are requested to voluntarily follow the actions specified by the Districts for non-exempt users. Generally, the water user groups within the Region that are *not* included in these plans (or included on a voluntary basis) are: 1) exempt water wells in counties with established GCDs, 2) users in Culberson and Hudspeth County outside of GCD boundaries, 3) and El Paso County users outside of EPW distribution system.

*This page intentionally left blank.*

**Table 7-8. Recommended Regional Drought Plan Triggers and Actions**

| Source Name | Source Type | Source User Entity | Current WUG Monitoring | Real-time Source Monitoring | Factors to be Considered | Recommendations | Specific Actions (Percent Reduction Demand/ Use) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Source Manager | | | | Users | | | |
| | | | | | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | | | | | | | Mild | Mod | Severe | Critical | Mild | Mod | Severe | Critical |
| ***Bone Spring - Victorio Peak*** | GW | *County Other* | TWDB | 48-07-516 (TWDB) | District trigger and monitoring wells mentioned in GMP | Create a formal DCP with wells, triggers and responses | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *Irrigation* | | | | | | | | | | | | |
| | | *Livestock* | | | | | | | | | | | | |
| ***Capitan Reef Complex*** | GW | *Irrigation* | N/A | N/A | Non-potable supply. | N/A | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *Mining* | | | | | | | | | | | | |
| | | *Livestock* | | | | | | | | | | | | |
| ***Edwards-Trinity (Plateau)*** | GW | Terrell County WCID #1 (Sanderson) | TWDB 53-53-804, 53-53-806, 53-53-809, 53-53-903 | N/A | District trigger and monitoring wells in place. | Create a formal DCP with wells, triggers and responses. Make stage 1 a mandatory 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | County Other - (Brewster, Culberson, Jeff Davis, Terrell) | N/A | N/A | Subject to GCD management plans. | N/A | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *Irrigation* | | | | | | | | | | | | |
| | | *Livestock* | | | | | | | | | | | | |
| | | *Mining* | | | | | | | | | | | | |
| ***Hueco-Mesilla Bolson*** | GW | City of El Paso | N/A | 49-04-476 (USGS), or 49-13-301 (TWDB) | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a mandatory 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | City of Vinton | | | Purchases supply from El Paso. | Follow El Paso triggers and actions. | | | | | | | | |
| | | Lower Valley Water District | | | Multiple triggers in place. | Remove voluntary conservation as a stage. Make stage 1 a mandatory 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | Town of Clint | | | Purchase supply from LVWD. | Follow LVWD triggers and actions. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | City of San Elizario | | | | | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | City of Socorro | | | | | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | El Paso County Tornillo WID | | | N/A | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | El Paso County WCID #4 | | | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| ***Hueco-Mesilla Bolson*** | GW | Fort Bliss | N/A | 49-04-476 (USGS), or 49-13-301 (TWDB) | Plan in place. | Add triggers and actions for Stage 1 to achieve 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | Horizon Regional MUD | | | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | Town of Anthony | | | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *County Other* | | | No GCD. | N/A | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *Manufacturing* | | | | | | | | | | | | |
| | | *Mining* | | | | | | | | | | | | |
| | | *Power* | | | | | | | | | | | | |
| | | *Livestock* | | | | | | | | | | | | |

**Table 7-8. (Continued) Recommended Regional Drought Plan Triggers and Actions**

| Source Name | Source Type | Source User Entity | Current WUG Monitoring | Real-time Source Monitoring | Factors to be Considered | Recommendations | Specific Actions (Percent Reduction Demand/ Use) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Source Manager | | | | Users | | | |
| | | | | | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | | | | | | | Mild | Mod | Severe | Critical | Mild | Mod | Severe | Critical |
| ***Igneous*** | GW | City of Alpine | N/A | not needed | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | City of Marfa | 51-48-602, 51-48-603 | not needed | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | Fort Davis WSC | N/A | 52-25-209 (TWDB) | Plan in place. | Add triggers and actions for Stage 1 to achieve 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *County Other* | | | Subject to GCD management plans. | N/A | Follow GCD recommendations. | | | | | | | |
| | | *Irrigation* | | | | | | | | | | | | |
| | | *Mining* | | | | | | | | | | | | |
| | | *Livestock* | | | | | | | | | | | | |
| ***Marathon*** | GW | Marathon WSSS | N/A | N/A | Subject to GCD management plans. | N/A | Follow GCD recommendations. | | | | | | | |
| | | *County Other* | | | | | | | | | | | | |
| | | *Livestock* | | | | | | | | | | | | |
| ***West Texas Bolsons*** | GW | City of Presidio | N/A | 47-59-123 (TWDB) | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | City of Van Horn | | | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. Add triggers to DCP. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | Hudspeth County WCID #1 (Sierra Blanca) | | | No DCP submitted. | N/A | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *County Other* | N/A | 51-29-805 (TWDB) | GCDs except in Hudspeth County. | N/A | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *Irrigation* | | | | | | | | | | | | |
| | | *Mining* | | | | | | | | | | | | |
| | | *Livestock* | | | | | | | | | | | | |
| ***Other - Rio Grande Alluvium (El Paso, Hudspeth)*** | GW | Horizon Regional MUD | N/A | N/A | Plan in place. | Remove voluntary conservation as a stage. Make stage 1 a 20% demand reduction. | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *Mining* | N/A | N/A | NO GCD. | N/A | 20 | 30 | 40 | 50 | 20 | 30 | 40 | 50 |
| | | *Irrigation* | | | | | | | | | | | | |
| ***Other - Volcanics (Brewster)*** | GW | *Mining* | N/A | 73-47-404 | Subject to GCD management plans. | N/A | Follow GCD recommendations. | | | | | | | |
| | | *Irrigation* | | | | | | | | | | | | |
| | | *Livestock* | | | | | | | | | | | | |

**Table 7-8. (Continued) Recommended Regional Drought Plan Triggers and Actions**

| Source Name | Source Type | Source User Entity | Current WUG Monitoring | Real-time Source Monitoring | Factors to be Considered | Recommendations | Specific Actions (Percent Reduction Demand/ Use) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Source Manager | | | | Users | | | |
| | | | | | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | | | | | | | Mild | Mod | Severe | Critical | Mild | Mod | Severe | Critical |
| Upper Rio Grande | SW | City of El Paso | EPCWID#1 | USBR Elephant Butte Reservoir Dam | Rio Grande Project | No recommendations. | No recommendations. | | | | | | | |
| Lower Rio Grande | SW | Hudspeth County Irrigation | | 08-3705.00 Rio Grande at Old Fort Quitman, Texas | | No recommendations. | No recommendations | | | | | | | |
| | | Presidio County Irrigation | | IBWC 08-3742.00 Rio Grande below Rio Conchos near Presidio, TX<br><br>USGS 08375300 Rio Grande at Rio Grande Village, BBNP, Texas | | No recommendations. | | | | | | | | |
| Terlingua Creek | SW | | | IBWC 08-3745.00 Terlingua Creek near Terlingua, TX | | No recommendations. | | | | | | | | |
| Pecos River | SW | | | IBWC 08-4474.10 Pecos River near Langtry, TX | | No recommendations. | | | | | | | | |
| Independence Creek | SW | | | USGS 08447020 Independence Creek near Sheffield, TX | | No recommendations. | | | | | | | | |
| Toyahville Springs | SW | | | USGS 08427000 Giffin Springs at Toyahville, TX | | No recommendations. | | | | | | | | |

### 7.5.4 Model Drought Contingency Plans

Model drought contingency plans were developed for the Far West Texas region and can be accessed online at http://riocog.org/ENVSVCS/FWTWPG/docs.htm and are included in Attachment 7-1. Each plan identifies four drought stages: mild, moderate, severe and emergency. The recommended responses range from notification of drought conditions and voluntary reductions in the "mild" stage to mandatory restrictions during an "emergency" stage. Entities using the model plan can select the trigger conditions for the different stages and appropriate responses for each stage.

In 2019, the Drought Preparedness Council recommended that a model DCP be in place for any water user group that exceeds ten percent of the Region's water demands. For Region E, these user groups include irrigation and municipal. Based on this recommendation, model DCPs for municipal and irrigation users have been added.

#### Public Water Supplier

Drought contingency plans have previously been adopted by the majority public suppliers and municipalities in the Plateau Region, although some suppliers did not provide any adopted plans. Current triggers and response actions for participating entities are summarized in Table 7-1. Recommended changes to existing response actions are detailed in Table 7-8.

#### Irrigation

Irrigation wells located within a municipality are subject to the triggers and response actions designated by the city's drought plan. Non-exempt irrigation wells located outside of a municipality but within a GCD are subject to the triggers and response actions of the GCD. Exempt irrigation wells located within a GCD are requested to comply voluntarily with response actions that have been mandated for non-exempt well owners. No response actions have been designated for irrigators located in El Paso County except for those located within the City of El Paso's jurisdictional boundary.

#### Wholesale Water Provider

There are three wholesale water providers in the Far West Region:

- El Paso Water
- Lower Valley Water District.
- El Paso County WID #1

Currently adopted triggers and response actions for these providers are summarized in Table 7-9.

**Table 7-9. Wholesale Water Provider Drought Triggers and Response Actions**

| | | Stage & Description | | | | |
|---|---|---|---|---|---|---|
| **WWP** | | **1 - Mild** | **2 - Moderate** | **3 - Severe** | **4 - Extreme** | **5 - Emergency** |
| El Paso Water | Trigger | EPCWID decreases allotment less than 0.5-acre foot per acre on or before April 1; water demand is projected to exceed EPWU system capacity. | EPCWID decreases allotment less than 1.0-acre foot per acre on or after April 1 but before May 1 or there is not a continuous release of surface water; water demand is projected to exceed EPWU system capacity. | EPCWID decreases allotment less than 1.5-acre foot per acre after May 1 but before May 15 or there is not a continuous release of surface water; water demand is projected to exceed EPWU system capacity. | N/A | N/A |
| El Paso Water | Conservation Goal (percent reduction in pumpage) | Voluntary-reduce water demand by 25%, public education and outreach. | Mandatory-lawn watering schedule and permitting. | Set limits on water consumption; prohibit use of specific outdoor watering activities. | N/A | N/A |
| Lower Valley Water District | Trigger | Water stored in Elephant Butte Reservoir is less than 50,000 acre-feet; surface water allotment is less than or equal to 3.0 acre-ft./acre; or demand exceeds 90% system capacity. | Surface water allotment less than or equal to 2.5 acre-ft./acre; or demand exceeds 95% system capacity. | Surface water allotment less than or equal to 2.0 acre-ft./acre; or demand exceeds 100% system capacity. | N/A | Major system failures or supply contamination. |
| Lower Valley Water District | Conservation Goal (percent reduction in pumpage) | Voluntary- reduce landscape irrigation water use by 50%. No: aesthetic use (fountains), car washes, filling of pools, or pavement washing. | Voluntary- reduce industry water consumption by 25% No: planting except xeriscape, street-sweeping, City or County irrigation, plus all stage 1 restrictions. | All non-essential water use is prohibited. | N/A | Water rationing may be put into effect. |
| El Paso County WID #4 | Trigger | Available supply < 80 percent of storage | Available supply < 90 percent of storage for 3 days | Available supply = storage for 3 days | System failure results in reliance on one well | System failure results in loss of capability to provide water |
| El Paso County WID #4 | Response | Voluntary- reduce landscape irrigation | 25 percent reduction; no non-essential use | 50 percent reduction; no non-essential use; reduced irrigation | 75 percent reduction; use alternative supplies | 75 percent reduction; use; no landscape irrigation |

## 7.6 DROUGHT MANAGEMENT WATER MANAGEMENT STRATEGIES

Far West Texas does not consider drought management as a feasible strategy to meet long-term growth in demands or current needs. This strategy is considered a temporary measure aimed at conserving available water supplies during times of drought or emergencies. Drought management is most adequately addressed in the region through the implementation of local drought contingency plans. Far West Texas is supportive of the development and use of these plans during periods of drought or emergency water needs.

Average annual precipitation in Far West Texas varies from about eight inches a year in El Paso County to nearly 15 inches in Jeff Davis County. As a result, the Region is accustomed to managing water supplies in a dry environment. Thus, Far West Texas is probably the best prepared Regional Water Planning Area in in the State to manage their water resources during drought conditions.

# 7.7 OTHER DROUGHT-RELATED CONSIDERATIONS AND RECOMMENDATIONS

### 7.7.1 Texas Drought Preparedness Council and Drought Preparedness Plan

In accordance with TWDB rules, all relevant recommendations from the Drought Preparedness Council were considered in the writing of this Chapter. The Texas Drought Preparedness Council is composed of representatives from multiple State agencies and plays an important role in monitoring drought conditions, advising the governor and other groups on significant drought conditions, and facilitating coordination among local, State, and federal agencies in drought-response planning. The Council meets regularly to discuss drought indicators and conditions across the State and releases Situation Reports summarizing their findings. Additionally, the Council has developed the State Drought Preparedness Plan, which sets forth a framework for approaching drought in an integrated manner to minimize impacts to people and resources. Far West Texas supports the ongoing efforts of the Texas Drought Preparedness Council and recommends that water providers and other interested parties regularly review the Situation Reports as part of their drought monitoring procedures. The Council provided two new recommendations in 2019 to all RWPGs which are addressed in this chapter.

- Follow the outline template for Chapter 7 provided to the regions by Texas Water Development Board staff in April of 2019, making an effort to fully address the assessment of current drought preparations and planned responses, as well as planned responses to local drought conditions or loss of municipal supply.
- Develop region-specific model drought contingency plans for all water use categories in the region that account for more than 10 percent of water demands in any decade over the 50-year planning horizon.

To meet these recommendations, Far West Texas has developed this Chapter to correspond with the sections of the outline template and has provided model DCPs for both municipal and irrigation users.

### 7.7.2 Other Drought Recommendations

The Far West Texas Water Planning Group recognizes that while drought preparedness, including drought contingency plans (DCPs), are an important tool, in some instances drought cannot be prepared for, it must be responded to. The Planning Group maintains that DCPs developed by the local, individual water providers are the best available tool for drought management and fully supports the use and implementation of individual DCPs during times of drought. The Planning Group has reviewed provided DCPs and specific drought response strategies proposed in this Plan and find no unnecessary or counterproductive variations to exist.

Drought in Far West Texas can be defined in three operational definitions; meteorologic, agricultural and hydrologic (see Chapter 1, Section 1.2.6). Because Far West Texas already exists in a meteorological environment that is significantly drier than the rest of the State, it is more logical to consider management strategies that address a diminished or lost water supply source. Primary sources include Rio Grande surface water and groundwater from numerous aquifers.

Rio Grande drought supply is largely the result of meteorological conditions in southern Colorado and New Mexico. Surface water drought management recommendations are:

- Continue to support the US Bureau of Reclamation - Rio Grande Project administration.
- Continue to financially support El Paso County WID#1 projects intended to prevent loss of water due to seepage in canals.
- Continue to legally support the justifiable delivery of apportioned water (Rio Grande Compact) across the New Mexico state line.
- Continue to legally support the justifiable delivery of apportioned water (Rio Grande International Treaty) across the international boundary.

Rural communities other than those in El Paso County are reliant on groundwater sources. Groundwater in Far West Texas is generally not immediately impacted by intermittent drought conditions as does surface water. Therefore, loss of supply is more of an infrastructure issue. Communities in these counties can mostly be classified as small to very small, with limited financial revenues. Thus, the biggest threat to a water-supply loss is the lack of a back-up source. Some communities have only one water-supply well and no interconnect options. The Far West Texas Water Planning Group thus recommends that state and federal agencies with rural-community relief functions provide grant funding opportunities to address this potential water-shortage predicament.

*This page intentionally left blank.*

# CHAPTER 8

# POLICY RECOMMENDATIONS AND UNIQUE SITES

*This page intentionally left blank.*

# 8 POLICY RECOMMENDATIONS AND UNIQUE SITES

An important aspect of the regional water planning process is the opportunity for the Far West Texas Water Planning Group (FWTWPG) to discuss water policy issues that are important to this Region and provide recommendations for the improvement of future water management planning in Texas. The recommendations are designed to present new and/or modified approaches to key technical, administrative, institutional, and policy matters that will help to streamline the planning process, and to offer guidance to future planners regarding specific issues of concern within the Region. This chapter also addresses recommendations of "Ecologically Unique River and Stream Segments" and consideration of "Unique Sites for Reservoir Construction". The FWTWPG approves of the legislative intent of the regional water planning process and supports the continuance of water planning at the regional level.

## 8.1 WATER MANAGEMENT POLICY

1. **Stormwater / Flood Planning**. In 2019, voters approved a constitutional amendment providing for the creation of the Flood Infrastructure Fund to assist in the financing of drainage, flood mitigation, and flood control projects. The FWTWPG fully supports this new initiative and suggest that, in time, the program will grow to encompass projects that encourage retained stormwater as a vital new water-supply resource. Such planning is recognized in this *2021 Far West Texas Water Plan* as a recommended water management strategy. Effective stormwater planning will be beneficial to regional water resources including aquifer recharge and optimization of surface water resources. The FWTWPG looks forward to coordinating with the State's Regional Flood Planning groups (http://www.twdb.texas.gov/flood/index.asp#recentnews).

2. **Needed Funding for Data Collection in Rural Areas**. Rural areas need to be able to access State funding to gather the information needed to draft a substantive regional plan. This funding is needed for test wells, monitoring equipment, observation wells, modeling, and to obtain more data on the West Texas aquifers. Specific data-need recommendations for the rural areas are included in the "Data Needs" section. The FWTWPG should be allowed to request additional funding for the data needs and contract for the studies.

3. **Colonias**. Far West Texas contains a significant portion of the colonias in the State of Texas. While much effort has gone into rectifying the substandard water and wastewater conditions in the region (see Section 1.10 in Chapter 1 of this *Plan*), many of these economically distressed neighborhoods continue to exist. The FWTWPG encourages State and Federal agencies to continue their financial programs so that all citizens, regardless of their social and economic status, can be provided with a safe and healthy living environment. The FWTWPG is specifically appreciative of the reestablishment of the TWDB Economically Distressed Area Program (EDAP) and encourages the legislature to properly fund this vital program.

4. **Rio Grande Interstate Litigation**. The FWTWPG recognizes the potential impact of diminished water-supply availability from the Rio Grande resulting from excess diversion of Rio Grande surface water and the hydrologically connected underground water downstream of Elephant Butte Reservoir that is intended for use within the Rio Grande Project. The FWTWPG considers this action contrary to the purpose and intent of the Rio Grande Compact and encourages the State of Texas to continue its pursuit of rectifying the action through whatever action is deemed most appropriate.

5. **Regionalization.** Participants (municipal utilities) in the FWTWPG continue to maintain a robust regional relationship by helping unserved or underserved water systems become sustainable and resilient. Funding policies may impede this effort by suggesting regionalization through consolidation of water districts. The FWPWPG finds that entities in unserved or underserved areas should still be eligible for financial assistance. The grant or loan eligibility for unserved or underserved service area should be treated independently from the provider of some services through interlocal agreements.

   The FWTWPG finds that many unserved or underserved rural areas lack technical, financial, managerial, or funding to operate some field or administrative aspect required by funding agencies to maintain or provide safe affordable water or wastewater services in a sustainable

manner. However, water utilities contiguous to the local utilities have the capacity to assist as many do through interlocal agreements between the utilities. The FWTWPG promotes these efforts and finds that funding mechanisms should account for regionalized relationships other than consolidation when considering funding for projects. The utilities by virtue of interlocal agreements may be able to satisfy eligibility requirements regarding experience, capacity, and sustainability, which demonstrate the capacity to provide essential and sustainable water and sewer service to the areas in need.

## 8.2 REGIONAL WATER PLANNING PROCESS

1. **Re-emphasis of the Planning Function of the Regional Water Planning Group and Need for More Local Planning Initiatives**. The planning process increasingly focuses too heavily on meeting the technical requirements of the regional water planning process and the TAC rules, to the detriment of allowing for local planning initiatives. The role of the Regional Water Planning Group no longer seems to include "planning"; rather, it meets primarily to ratify deadlines and requirements of the TWDB. Certainly, this seems to contradict the goal of Senate Bill 1. Providing for more local influence of the process and reducing the numerous, standardized checklists of the requirements of the Plan would help. The planning process and the ultimate Plan must be flexible because of the unique characteristics of the border region. The FWTWPG should have the legal ability to consider all water resources available to the Region, regardless of whether or not they are located within Texas.

2. **Elimination of Unfunded Mandate**. The current regulations of the TWDB require local entities to pay for 100 percent of the administrative costs of developing the plans. This is difficult to sell when a local government has to tell its constituents that they have to do with one less full-time deputy, a lower level of funding for the library, and no new fire truck – but that they can afford to pay for a water plan. Trying to force local "buy-in" by requiring local funding causes resentment of the process and antagonism toward the plan. The State should pay for what the State thinks is important. The current 100/100 Plan is an improvement over the original concept (pursuant to which the State was to pay for 75 percent of everything, including administration), but it is still an unfunded mandate, and is still a bad idea – no matter how good the idea being funded.

3. **Modification of Demand Numbers**. Modification of demand numbers should be allowed further into the planning process. Demand errors may not be discovered until the supply-demand analysis is performed. The manner in which the irrigation and livestock demand numbers increase during drought scenarios is inappropriate because other factors influence the demand. For example, during a drought in Far West Texas, livestock are sold, thus reducing the overall demand on groundwater. There needs to be a better understanding of the process of how livestock, drought and water demand interact, and this understanding needs to be reflected in the demand numbers.

4. **Plan Implementation**. Implementation of the plan's recommendations must be the responsibility of the local governments, entities, and individuals within the region. The Water Planning Group is not intended to assume a supervisory or command-and-control role. The Water Planning Group's function will be to monitor implementation and assist the local governments, entities, and individuals within the region as requested.

5. **State Mandated Water Planning**. State mandated water planning for this region began in 1999. The water plan to be completed in 2021 will be the fifth round of planning. The details of water planning in this region are not changing dramatically over five year periods. Funding is needed for the implementation of the water supply projects presented in the Water Plan.

6. Contractual guidelines for the performance of regional water planning should be established at the beginning of each 5-year planning period, and not modified, especially without added funding, during that planning period. Inter-period modifications result in unscheduled distractions, time and expense, in performing the required planning procedures in which the contracts are based. Legislative modifications thus should only be implemented at the beginning of the existing planning period.
7. The Task 5A requirement to develop a scope of work and budget allotment for water management strategy evaluation is unfunded, time consuming, and does not result in better plan development. It is recognized that the requirement is intended to ensure that budget allotments are justifiably spent; however, there is no obvious improvement to the planning process.

## 8.3 WATER RESEARCH NEEDS

- There is a concern that some historical irrigation pumpage reported by the TWDB is inaccurate. The TWDB should continue its irrigation surveys and attempt to improve the estimates with the assistance of local irrigation and groundwater districts.
- A study should be performed to evaluate the feasibility and potential benefits of rechanneling a segment of the Rio Grande below Fort Quitman.
- A significant amount of groundwater is produced from Cretaceous limestone formations in southern Brewster County that exist outside the boundary of the Edwards-Trinity (Plateau) Aquifer. The communities of Lajitas, Terlingua, and Study Butte, along with other rural users rely on this sole source of water to meet their daily needs. An aquifer characterization study is needed to estimate its vertical and lateral extent, sustainable yield, and water quality.
- Provide funding for the development of the Transboundary Aquifer Model of the Mesilla Bolson. Ciudad Juarez has built the infrastructure needed to capture groundwater from the Conejos Medanos Aquifer, which is the southern extension of the Mesilla Bolson. Development of this regional model, will allow water quantity and quality impacts to be evaluated.
- An Integrated Rio Grande Data Management System allowing for regional coordination of the Rio Grande for better management and decision making of irrigation releases and flood control is needed. Also, the Rio Grande Project delivery system is in need of a real-time water quantity and water quality monitoring system so that agriculture, municipal and regulatory agencies can better manage and account for the water. The benefits would improve efficiency, flood control management and warnings of contaminant releases. Thus, information systems analysis and hydrologic operations modeling are recommended.
- Provide research funding for the Rio Grande Salinity Management Coalition (RGSMC). The goal of the coalition is to ultimately reduce salinity concentrations in the Rio Grande, which will allow increased beneficial use of the water for agriculture, urban and environmental purposes.

## 8.4 ECOLOGICALLY UNIQUE RIVER AND STREAM SEGMENTS

As a part of the planning process, each regional planning group may include recommendations for the designation of ecologically unique river and stream segments in their adopted regional water plan (31 TAC 357.8). The Texas Legislature may designate a river or stream segment of unique ecological value following the recommendations of a regional water planning group. As per §16.051(f) of the Texas Water Code, this designation solely means that a state agency or political subdivision of the State may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under this subsection.

Stream segment designation is to be supported by a recommendation package that includes a physical description, maps, photographs, literature citations, and data pertaining to each candidate stream segment. In accordance with the TWDB's rules, the following criteria are to be used when recommending a river or stream segment as being of unique ecological value:

- **Biological Function –** Segments which display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats;
- **Hydrologic Function –** Segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge;
- **Riparian Conservation Areas –** Segments which are fringed by significant areas in public ownership including state and federal refuges, wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes under a governmentally approved conservation plan;
- **High Water Quality/Exceptional Aquatic Life/High Aesthetic Value –** Segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality; or
- **Threatened or Endangered Species/Unique Communities –** Sites along segments where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species, and sites along segments that are significant due to the presence of unique, exemplary, or unusually extensive natural communities.

A quantitative assessment of how recommended water management strategies (Chapter 5) potentially could affect flows deemed important by the FWTWPG to the Ecologically Unique River and Stream Segments (EURSS) was performed by considering the following criteria:

- Distance from the strategy supply source to the EURSS
- Does the strategy groundwater supply source (aquifer) contribute flow to the EURSS
- Does the strategy surface water supply source (Rio Grande) contribute flow to the EURSS
- Percent diminished flow to the EURSS resulting from implementation of the strategy

The FWTWPG chooses to respect the privacy of private landowners and therefore recommends only parts of river and stream segments that are within the management boundaries of State and National Parks, and

conservation lands managed by the Texas Nature Conservancy and Trans Pecos Water Trust at their request. Notification was given to the public that the FWTWPG would consider river and stream segments on private property only if requested by the landowner.

In previous planning periods, the FWTWPG has recommended three streams that lie within the boundaries of state-managed properties, four within National Park boundaries, and specified streams managed by the Texas Nature Conservancy and Texas Land Trust as listed below (Figure 8-1).

- **Rio Grande Wild and Scenic River (Big Bend National Park)** primarily depends on flows from the Rio Conchos and from springs and spring-fed tributaries along the Big Bend stretch of the River. No strategies occur in the aquifers that feed the springs and tributaries. Historically, the Upper Rio Grande (El Paso and Hudspeth Counties) flowed almost unabated through the Far West Texas stretch of the River. However, with today's upstream water demands on the River, only a minor flow from the Upper Rio Grande segment manages to periodically contribute to the Lower Rio Grande segment (Presidio, Brewster and Terrell Counties). Strategies presented in this plan do not significantly reduce this downstream contribution.
- **Terlingua Creek (Big Bend National Park)** flows six miles within Big Bend National Park to its confluence with the Rio Grande immediately downstream of Santa Elena Canyon, an area of exceptional aesthetic value. The National Park Service has declared Terlingua Creek to have exceptional aesthetic value. The Proserpine shiner is a desert fish with a limited geographic range and is threatened primarily by decreased spring flows, habitat loss and alteration of flow regimes. The species only occurs in Texas, and was designated as critically threatened by TPWD in 1977. Terlingua Creek is within the natural habitat of this species.
- **McKittrick Canyon and Chosa Creek (Guadalupe Mountains National Park)** are spring fed at high elevations of the Capitan Reef Aquifer within the Park. Potential groundwater pumped and transported from the Diablo Farms section of the Capitan Reef Aquifer (Strategy E-12) is separated from the spring sources by distance, faulting and elevation. Also, pumping and transport of groundwater from the Bone Spring – Victorio Peak Aquifer in the Dell City area (Strategy E-13) is also separated from the spring sources by distance, faulting and elevation. Thus, pumping from these aquifers should have no impact on aquifer sources that contribute to springflow.
- **Cienega Creek (Chinati Mountains State Natural Area)** is spring fed from high elevation exposures of the Davis Mountains Igneous Aquifer. Only strategy E-66 in Fort Davis consider pumping projects in the Igneous Aquifer. However, the pumping location is distant from this designated stream and thus will have no water flow impact.
- **Alamito and Cienega Creeks (Big Bend Ranch State Park)** are spring fed from high elevation exposures of the Davis Mountains Igneous Aquifer. Only strategy E-66 in Fort Davis consider pumping projects in the Igneous Aquifer. However, the pumping location is distant from this designated stream and thus will have no water flow impact.
- **Alamito Creek (Trans Pecos Water Trust)** is spring fed from high elevation exposures of the Davis Mountains Igneous Aquifer. Only strategy E-66 in Fort Davis consider pumping projects in the Igneous Aquifer. However, the pumping location is distant from this designated stream and thus will have no water flow impact.

- **Independence Creek (Texas Nature Conservancy – Independence Creek Preserve)** is spring fed from the Edwards-Trinity (Plateau) Aquifer. Only one strategy (E-62 Terrell County Mining) considers additional well pumping from the Edwards-Trinity (Plateau) Aquifer. However, this pumping is distant from this designated stream segment and thus will have no water flow impact.
- **Madera Creek, Canyon Headwaters of Limpia Creek, Little Aguja Creek, and Upper Cherry Creek (Texas Nature Conservancy – Davis Mountains Preserve)** are spring fed from high elevation exposures of the Davis Mountains Igneous Aquifer. Only strategy E-66 in Fort Davis consider pumping projects in the Igneous Aquifer. However, the pumping location is distant from this designated stream and thus will have no water flow impact.

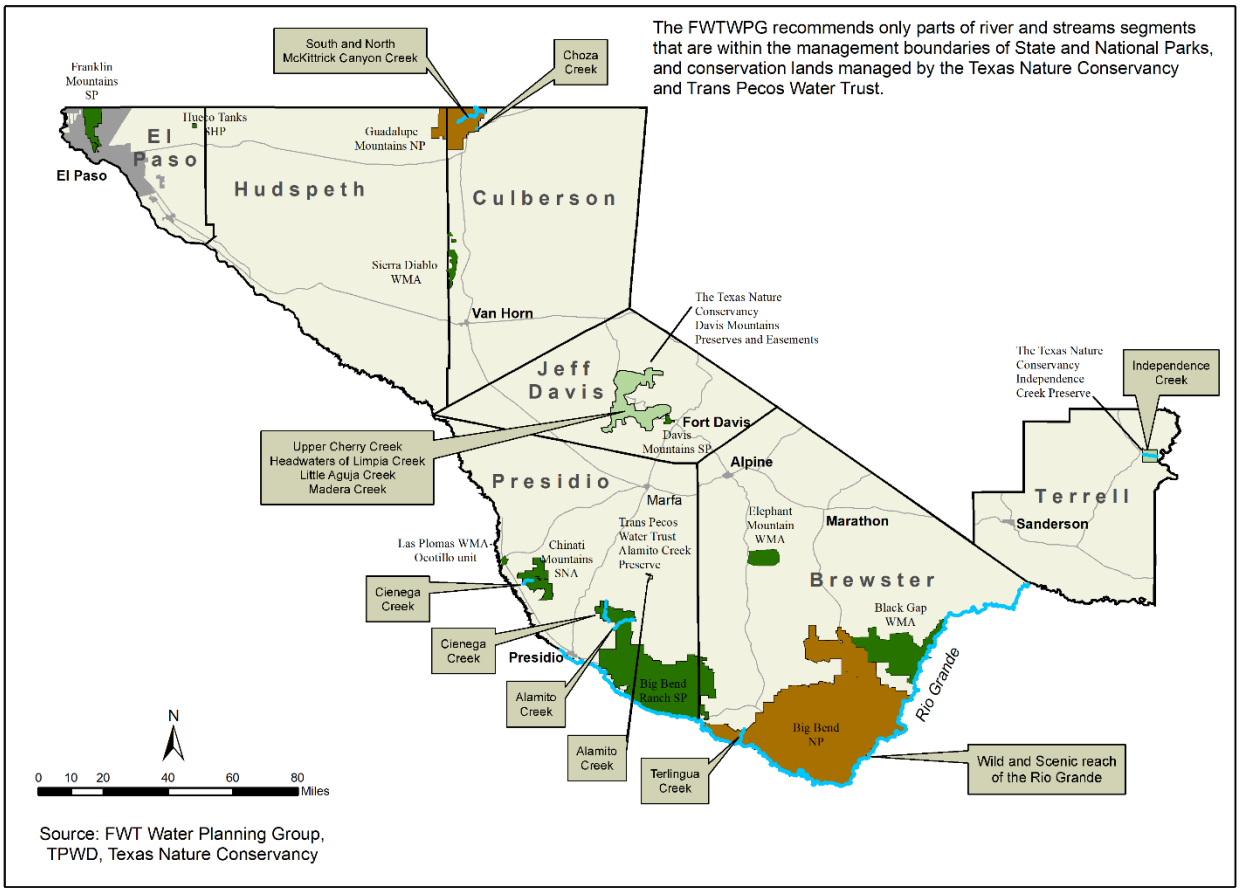



**Figure 8-1. Recommended Ecologically Unique River and Stream Segments**

## 8.5 CONSIDERATION OF UNIQUE SITES FOR RESERVOIR CONSTRUCTION

The regional water planning process gives each of the 16 regional water planning groups the opportunity to recommend stream locations for designation as “Unique Sites for Reservoir Construction". The regional water planning process legislation and rules list many criteria to determine if a site is qualified for such designation.

The availability of water is one of the most important criteria in the selection of a reservoir site - if not the most important criterion. The low rainfall totals and the spotty nature of precipitation in Far West Texas limit the potential for sufficient runoff to maintain desired water levels in reservoirs.

Many canyons in the mountainous areas of Far West Texas might not retain large volumes of water because of the fractured and often highly permeable bedrock that forms the walls and floors of these topographic features. Any attempt to develop a reservoir in Far West Texas will require extensive and costly geological, geotechnical, and hydrological investigations to determine whether a site is suitable. The program of work would also require detailed state and federal environmental impact assessments. With regard to the Rio Grande, the 1944 International Treaty between the United States and Mexico specifies that a reservoir project considered by one country have the other country’s permission. Furthermore, the treaty stipulates that international reservoirs are to be operated by both countries.

On watercourses other than the Rio Grande, the water use reported to the TCEQ by surface water right holders gives some clues as to which watercourses are the most reliably used and therefore could be investigated for potential reservoir sites. Reported water use data, provided by the Rio Grande Watermaster and by TCEQ, have been examined to identify holders of surface water rights who can divert water in amounts greater than 1,000 acre-feet per year. The analysis indicates that Musquiz and Maravillas Creeks in Brewster County are probably the most reliable surface water sources.

On Alamito Creek in Presidio County, there is an existing recreational reservoir authorized to impound 18,700 acre-feet, but diversions are not authorized and therefore no use amounts are reported. Whether this reservoir stays reliably full is unknown, and the reliability of Alamito Creek in general is unknown.

A feasibility study for a recreational lake site near Alpine was previously conducted and consideration was given to its municipal water supply potential. The project was abandoned because of its high cost-to-yield potential.

Additional off-channel reservoir sites, as well as flood protection dam sites on major arroyos have been studied by the Hudspeth County Conservation and Reclamation District #1, El Paso-Hudspeth County Soil Conservation District, and the Hudspeth County Commissioners Court. None of these sites have been selected for construction. Additional flood retention dams have been considered for the El Paso area. These retention dams would have the added benefit of increasing recharge of the local aquifer by increasing infiltration of the retained water into the bolson deposits.

The firm yield for any reservoirs constructed on even the most reliable Far West Texas watercourses is not likely to exceed 2,000 acre-feet per year. For this reason, the *2021 Far West Texas Water Plan* does not recommend any watercourse for designation as “Unique Sites for Reservoir Construction.”

*This page intentionally left blank.*

# CHAPTER 9

# WATER INFRASTRUCTURE FINANCING ANALYSIS

*This page intentionally left blank.*

# 9 WATER INFRASTRUCTURE FINANCING ANALYSIS

The Infrastructure Financing Report (IFR) survey presented in this chapter identifies the state financing options proposed by entities in this *Plan* to meet future infrastructure needs. Chapter 5 provides recommended water management strategies for numerous communities in Far West Texas that either have a projected water supply deficit and recommended strategies to meet that need, or have an identified need for a water supply infrastructure project, which may require state financial assistance. These entities were surveyed to determine their proposed method(s) for financing the estimated capital costs involved in implementing the water supply strategies recommended in the *2021 Far West Texas Water Plan*.

Unlike infrastructure financing surveys conducted for previous regional water plans, questions during this planning cycle focused on projected needs for financial assistance from programs administered by the TWDB. The TWDB will aggregate the projected requests for funding from these programs from the 16 water planning regions to provide a picture of estimated long-term infrastructure funding needs to the State Legislature.

## 9.1 TWDB FUNDING PROGRAMS

The TWDB offers financial assistance for the planning, design and construction of projects identified in Regional Water Plans or the State Water Plan. Programs available include the State Water Implementation Fund for Texas (SWIFT), Water Infrastructure Fund (WIF), the State Participation Fund (SP), and the Economically Distressed Areas Program (EDAP). To be eligible to apply for funding from the SWIFT source, the applicant must be a political subdivision of the state, or in some cases a water supply corporation and the proposed project must be a recommended water management strategy in the most recent approved Regional Water Plan or State Water Plan.

### 9.1.1 State Water Implementation Fund for Texas (SWIFT)

The Texas Legislature created the SWIFT to provide affordable, ongoing state financial assistance for projects in the state water plan. Passed by the Legislature and approved by Texas voters through a constitutional amendment, the SWIFT helps communities develop and optimize water supplies at cost-effective rates. The program provides low-interest loans, extended repayment terms, deferral of loan repayments, and incremental repurchase terms for projects with state ownership aspects. Recognizing the benefit of conservation and the needs of rural Texas, the legislation directed that not less than 10% of the SWIFT funding should support projects for rural communities and agricultural water conservation; and not less than 20% of the funds should support water conservation and reuse projects.

### 9.1.2 Water Infrastructure Fund (WIF)

The Water Infrastructure Fund (WIF) provides subsidized interest rate loans for planning, design and construction. The WIF-Deferred fund offers the option of deferring all interest and principal payments for up to 10 years for planning, design and permitting costs, while the WIF-Construction fund offers subsidized interest for all construction costs including planning, acquisition, design, and construction.

### 9.1.3 State Participation Fund (SP)

The State Participation Fund (SP) is geared towards large projects which are regional in scope and meant to capitalize on economies of scale in design and construction, but where the local project sponsors are unable to assume the debt for an optimally sized facility. The TWDB assumes a temporary ownership interest in the project, and the local sponsor repays the cost of the funding through purchase payments on a deferred schedule. The goal of the program is to build a project that will be the right size for future needs, even if that results in the short term in building excess capacity, rather than constructing one or more smaller projects now.

### 9.1.4 Rural and Economically Distressed Areas (EDAP)

Both grants and zero percent interest loans for planning, design and construction costs are offered through these programs, which are available to eligible small, low-income communities. Rural and economically distressed areas that meet population, income and other criteria are eligible to apply for these funds. EDAP funding eligibility also requires adoption of the Texas Model Subdivision Rules by the applicant planning entities.

## 9.2 INFRASTRUCTURE FINANCE SURVEY

The survey instrument is prefaced with an explanation of its purpose in identifying the need for financial assistance programs offered by the State of Texas and administered by the TWDB. The available funding programs (SWIFT, WIF, SP and EDAP) are summarized, and the survey participant is asked to: 1) identify the amounts they might request from each funding source for each identified project or strategy; and 2) the earliest date the funds would be needed, by fund type. Water user groups with multiple strategies to meet future water needs are only surveyed for strategies with a capital cost.

All communities listed in Chapter 5 water management strategies were presented with surveys provided by the TWDB. The survey along with supporting documentation that summarized the water management strategies included in the *Regional Plan* for that entity were delivered to the mayor or the city/utility manager and follow-up contacts were made with each entity to encourage response to the survey. Table 9-1 presents the surveys responses.

**Table 9-1. Infrastructure Finance Survey**

To be Provided by TWDB

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

*This page intentionally left blank*

.

# CHAPTER 10
# PUBLIC PARTICIPATION
# AND
# PLAN ADOPTION

*This page intentionally left blank.*

# 10 PUBLIC PARTICIPATION AND PLAN ADOPTION

The Far West Texas Water Planning Group (FWTWPG) members recognized from the beginning the importance of involving the public in the planning process. Chapter 10 contains an overview of the FWTWPG representation, the Group's commitment to public involvement, and specific activities that insured that the public was informed and involved in the planning process and the implementation of the plan. Chapter 10 appendices contain responses to comments on the Initially Prepared Plan by the Public (Appendix 10A), TWDB (Appendix 10B), and TPWD (Appendix 10C).

## 10.1 REGIONAL WATER PLANNING GROUP

The TWDB initially appointed a coordinating body for Far West Texas, based on names submitted by the public for consideration. Senate Bill 1 provisions mandate that one or more representatives of the following water user groups be seated on each water planning group: agriculture, counties, electric generating utilities, environment, industries, municipalities, river authorities, public, small business, water districts, and water utilities. The FWTWPG has since expanded its membership based on familiarity with persons who could appropriately represent industries, tourism, real estate and economic development. Because there is no river authority in Far West Texas, this sector is not represented; however, its function is maintained by El Paso County Water Improvement District #1, who is the primary representative of the Rio Grande Project. New to this planning period, additional voting members have been appointed to represent Groundwater Management Areas.

In addition to these required interest groups, the FWTWPG added the following: travel and tourism, groundwater conservation districts, building and real estate, economic development, Fort Bliss Garrison Command and legislative representatives. The voting members of the FWTWPG are only compensated for allowable travel expenses and have voluntarily devoted considerable amounts of their time and talent to develop the regional water plan. Current Planning Group members and their alternates are listed in Table 10-1.

**Table 10-1. Current Group Members and Their Alternates**

| Water Use Category | Committee Member | County | Alternate Member | County |
|---|---|---|---|---|
| Agriculture | Rick Tate | Presidio | | |
| Agriculture | Tim Leary | Brewster | | |
| Real Estate | David Etzold | El Paso | Ray Adauto | El Paso |
| Counties | Teresa Todd | Jeff Davis | Val Beard | Brewster |
| Counties | Vacant | | | |
| Counties | Vincent Perez | El Paso | Jose Landeros | El Paso |
| Economic Develop. | Brad Newton | Presidio | John Anthony Razo | Presidio |
| Environment | Jeff Bennett | Brewster | Kevin Urbanczyk | Brewster |
| Elec. Generating Util. | Jessica Christianson | El Paso | Teresa Sosa | El Paso |
| GMA#4 | Summer Webb | Culberson | | |
| Groundwater Dist. | Randy Barker | Hudspeth | Talley Davis | Hudspeth |
| Groundwater Dist. | Janet Adams | Jeff Davis | Jim Espy | Jeff Davis |
| Industries | V.J. Smith | El Paso | | |
| Municipalities | Becky Brewster | Culberson | | |
| Municipalities | Scott Reinert | El Paso | John Belliew | El Paso |
| Municipalities | Vacant | | | |
| Public | Arlina Palacios | El Paso | Katthryn Hairston | El Paso |
| Public | Dave Hall | El Paso | Darryl S. Vereen | El Paso |
| Public | Sterry Butcher | Presidio | Patt Sims | Presidio |
| Small Business | Dan Dunlap | Presidio | | |
| Travel/Tourism | Mike Davidson | Brewster | David Crum | Jeff Davis |
| Water Districts | Jim Ed Miller | Hudspeth | Bill Skov | El Paso |
| Water Districts | Chuy Reyes | El Paso | Johnny Stubbs | El Paso |
| Water Utilities | Albert Miller | Jeff Davis | Scott Adams | Jeff Davis |

In addition to the FWTWPG members, 13 non-voting members are appointed. Their function is to provide advice and guidance, based on their respective areas of expertise or geographic areas. Two non-voting liaisons were assigned from Regions F and J adjacent to Far West Texas. The non-voting members and their alternates are listed in Table 10-2, while Officers and Executive Committee Members are listed in Table 10-3.

**Table 10-2. Non-Voting Members and Their Alternates**

| Non-Voting Member | Agency/Organization | Alternate Member | Agency |
|---|---|---|---|
| Filiberto Cortez | USBR | Woody Irving/Mike Landis | USBR |
| Michael Lemonds | GLO | | |
| William Finn | IBWC | Clifford Regensberg | IBWC |
| Hector Garza | USGS | | |
| Zhuping Sheng | TX AgriLife Research | | |
| Russell Martin | TPWD | Jonah Evans | TPWD |
| Rusty Ray | TSW&SCB | | |
| Ryan Slocum | Small Business | | |
| Larissa Place | TDA | | |
| BJ Tomlinson | Fort Bliss | | |

**Table 10-3. Officers and Executive Committee Members**

| Member | Position |
|---|---|
| Chuy Reyes | Chairman |
| Scott Reinert | Vice-Chairman |
| Janet Adams | Secretary |
| Teresa Todd | EC Member |
| Rebecca Brewster | EC Member |
| Dave Hall | EC Member |

## Interregional Planning Council

The TWDB is required by Texas Water Code Section 16.052 to appoint an Interregional Planning Council made up of one member from each regional water planning group (RWPG). The purpose of the Council is to:

- Improve coordination among the RWPGs, and between the RWPGs and the TWDB in meeting goals of the state water planning process;
- Facilitate dialogue regarding regional water management strategies; and
- Share operational best practices of the regional water planning process.

The FWTWPG has appointed Scott Reinert to this position.

## 10.2 PROJECT MANAGEMENT

During the first planning cycle, work on the *Far West Texas Water Plan* was divided along two parallel tracks; (1) an urban track representing the metropolitan portion of El Paso County, and (2) a rural track representing the other six rural counties and the eastern portion of El Paso County. Work developed along the two-track approach was integrated at appropriate intervals to ensure a unified, coherent regional plan. During subsequent planning cycle, this approach was augmented, and the entire FWTWPG worked together on the *Regional Plan* from start to finish. However, the two tracks are still considered to ensure that voting membership is equally represented.

The planning decisions and recommendations made in the *Far West Texas Water Plan* will have far-reaching and long-lasting social, economic, and political repercussions on each community involved in this planning effort and on individuals throughout the Region. Therefore, involvement of the public is a key factor for the success and acceptance of the *Plan*. Open discussion and citizen input is encouraged throughout the planning process and helps planners develop a *Plan* that reflects community values and concerns. Some members of the public participate almost as non-voting members.

To insure public involvement, notice of all Planning Group and subcommittee meetings was posted in advance, mailed to a list of over 200 interested parties including mayors, county judges, water rights holders, public school superintendents, water districts, and concerned citizens; and e-mailed to an additional 350 interested parties. All meetings were held in publicly accessible locations with sites rotating among rural and urban locations throughout the counties in the Region. Special public meetings were held to gather input on the development of specific aspect of the *Plan*. Prior to submittal of the *Initially Prepared Plan* to the TWDB, a copy of the *Draft 2021 Far West Texas Water Plan* was provided for inspection in the county clerk's office and in at least one library in each county, and online on the Rio Grande COG website. Following public inspection of the Initially Prepared Plan, one public meeting was conducted to present results of the planning process and gather public input and comments.

To provide a public access point, an internet web site www.riocog.gov contains timely information that includes names of planning group members, bylaws, meeting schedules, agendas, minutes, meeting backup materials, and important documents, including groundwater conservation district management plans, technical reports, draft chapters for review, planning schedules and budgets, and links to water-related sites. Summaries of most of the planning group meetings were e-mailed to the full list of interested parties, to enable persons who were unable to attend to stay up to date on the planning process. Every document that was e-mailed or mailed to Planning Group Members for their review was also e-mailed to the interested parties list, made available on the FWTWPG website, and provided in hard copy at all public meetings. In addition, news stories concerning water planning-related issues were regularly distributed to all interested parties.

## 10.3 PLANNING GROUP MEETINGS AND PUBLIC HEARINGS

All meetings of the FWTWPG, including committee meetings, were open to the public and visitors were encouraged to express their opinions and concerns, or to make suggestions regarding the planning process. The locations of the meetings were originally rotated between all seven counties so that all citizens within the Region would have an equal opportunity to attend. However, because of increased public attendance, the meetings were held predominantly in Alpine, Marfa, Van Horn and Clint, where adequate facilities could be arranged.

In accordance with the State Open Meetings Act, meeting notices were posted in the following newspapers and were reported by the following radio stations:

- El Paso Inc.
- West Texas County Courier
- Hudspeth County Herald
- Van Horn Advocate
- Alpine Avalanche
- Jeff Davis County News/Mountain Dispatch
- Presidio International
- Big Bend Sentinel
- Terrell County News Leader
- KALP FM (Alpine)
- KVLF AM (Alpine)

A final public hearing was held in Clint, Texas on April 14, 2020 to receive comments on the *Initially Prepared Plan*. Responses to all public, TWDB and TPWD comments are included in this chapter as Appendix 10A, Appendix 10B and Appendix 10C.

Copies of the *Initially Prepared Plan* were available at the following locations:

County Clerk's Office:

- Brewster County
- Culberson County
- El Paso County
- Hudspeth County
- Jeff Davis County
- Presidio County
- Terrell County

Public Libraries:

- Alpine Public Library, 805 W. Ave E, Alpine
- Marathon Public Library, 106 N. 3rd, Marathon
- Big Bend High School Library, 550 Roadrunner, Terlingua
- Van Horn City-County Library, 410 Crockett St., Van Horn
- El Paso Public Library, 501 N. Oregon, El Paso
- Law Library, El Paso County Courthouse, 500 E. San Antonio
- Clint ISD/Public Library, 12625 Alameda, Clint
- Grace Grebing Public Library, 110 N. Main, Dell City
- Ft. Hancock ISD/Public Library, 101 School Drive, Ft. Hancock
- Jeff Davis County Library, 100 Memorial Square, Ft. Davis
- Marfa Public Library, 115 E. Oak, Marfa
- City of Presidio Library, 2440 O'Reilly St., Presidio
- Valentine Public Library, Valentine
- Terrell County Public Library, 105 E. Hackberry, Sanderson

The final *2021 Far West Texas Water Plan* was adopted by the FWTWPG on September XX, 2020, and was delivered to the TWDB by October 14, 2020. The *Plan* is posted on the Planning Groups (Rio Grande Council of Governments) website: http://westtexaswaterplanning.org/.

## 10.4 COORDINATION WITH OTHER REGIONS

The FWTWPG has exchanged liaisons with adjoining Region F and the Plateau Region (Region J). The responsibility of the liaisons is to report on any issues of common interest between adjoining regions. The FWTWPG also coordinated with Region F on groundwater supplies in Jeff Davis County that were exported to Reeves County for municipal use.

## 10.5 PLAN IMPLEMENTATION

Following final adoption of the *2021 Far West Texas Water Plan*, copies of the *Plan* were provided to each municipality and county commissioner's court in the Region. Early in the next planning cycle, each city will be asked to review the *Plan* and to recommend needed improvements. Each community will also be asked to consider their specific short-range and long-range goals with those presented in the *Plan*. Based on the results of this input, the FWTWPG members may consider plan amendments prior to the conclusion of the next planning period.

# APPENDIX 10-A

# RESPONSE TO PUBLIC COMMENTS

**(To be provided)**

# APPENDIX 10-A

# RESPONSE TO TWDB COMMENTS

**(To be provided)**

# APPENDIX 10-A

# RESPONSE TO TPWD COMMENTS

**(To be provided)**

# CHAPTER 11

# IMPLEMENTATION AND COMPARISON TO THE PREVIOUS REGIONAL WATER PLAN

*This page intentionally left blank.*

# 11 IMPLEMENTATION AND COMPARISON TO THE PREVIOUS REGIONAL WATER PLAN

Chapter 11 provides a survey of the level of implementation and identified impediments to the development of previously (*2016 Plan*) recommended Water Management Strategies that have affected progress in meeting projected water-supply needs. To best appreciate the continued improvements to the Far West Texas water planning process, this Chapter also offers a comparison of key components in the *2016 Far West Texas Water Plan* to those in this current *2021 Far West Texas Water Plan*. And, this Chapter also assesses the progress of the Far West Texas planning area in encouraging cooperation between water user groups for the purpose of achieving economies of scale and otherwise incentivizing strategies that benefit the entire region.

## 11.1 IMPLEMENTATION OF PREVIOUS REGIONAL WATER PLAN

Information needed to report on the level of implementation and identified impediments to the development of previously (*2016 Plan*) recommended Water Management Strategies that have affected progress in meeting projected water-supply needs was collected through an online survey instrument administered by the TWDB. Additional methods that were considered for identifying projects that may potentially have been implemented include:

- Tracking changes since the last Plan;
- Using TWDB funding records; and
- Using conservation implementation reports submitted to the TWDB.

Survey results are provided in Table 11-1.

**Table 11-1. 2021 Far West Texas Strategy Implementation Survey** **(TWDB to provide a Survey Tool. Current headings are invalid.)**

| Sponsor | Recommended Water Management Strategy | Capital Costs | Infrastructure Type | At what level of implementation is the project? | If not implemented, why? | Initial Volume of Water Provided (acft/yr) | Funds Expended to Date ($) | Project Cost ($) | Year the Project is Online | Is this a phased project? | (Phased) Ultimate Volume (acft/yr) | (Phased) Ultimate Project Cost ($) | Year project reaches maximum capacity? | What is the project funding source(s)? | Included in the 2016 Plan? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

# 11.2 COMPARISON TO PREVIOUS PLAN

The following section includes a summary of how the *2021 Plan* differs from the *2016 Plan*. Comparisons include:

- Water demand projections;
- Drought of record and the hydrologic and modeling assumptions on which the *2021 Plan* is based;
- Source water availability;
- Existing water supplies of WUGs and WWPs;
- WUG and WWP needs; and
- Recommended and alternative water management strategies.

Comparisons include an explanation for the changes that occurred regarding each of the categories.

### 11.2.1 Water Demand Projections

The following Table 11-2 provides a comparison between *2016 and 2021 Plan* water demand projections by county, while Table 11-3 compares demand projects by water-use category. The overall decrease in water demand in the *2021 Plan* is mostly the result of significantly lower irrigation and manufacturing use projections.

**Table 11-2. Water Demand Projections Comparison by County (Acre-Feet/Year)**

| County | Plan | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|---|
| Brewster | 2016 | 5,192 | 5,210 | 5,190 | 5,181 | 5,176 | 5,171 |
| | 2021 | 4,925 | 4,958 | 4,950 | 4,952 | 4,960 | 4,966 |
| Culberson | 2016 | 41,461 | 41,395 | 40,739 | 39,664 | 38,611 | 37,634 |
| | 2021 | 40,984 | 41,772 | 41,953 | 41,695 | 41,443 | 41,250 |
| El Paso | 2016 | 406,422 | 421,884 | 430,571 | 445,175 | 461,048 | 476,929 |
| | 2021 | 307,830 | 324,380 | 339,295 | 355,288 | 371,529 | 387,190 |
| Hudspeth | 2016 | 180,360 | 176,653 | 173,040 | 169,502 | 166,032 | 162,635 |
| | 2021 | 116,959 | 116,960 | 116,979 | 116,996 | 117,008 | 117,022 |
| Fort Davis | 2016 | 3,520 | 3,497 | 3,475 | 3,458 | 3,439 | 3,425 |
| | 2021 | 1,687 | 1,677 | 1,669 | 1,664 | 1,664 | 1,664 |
| Presidio | 2016 | 6,938 | 6,530 | 6,533 | 6,566 | 6,596 | 6,625 |
| | 2021 | 6,265 | 5,953 | 6,046 | 6,170 | 6,287 | 6,400 |
| Terrell | 2016 | 1,511 | 1,604 | 1,556 | 1,416 | 1,283 | 1,178 |
| | 2021 | 1,774 | 1,877 | 1,840 | 1,705 | 1,582 | 1,484 |
| **Total** | **2016** | **645,404** | **656,773** | **661,104** | **670,962** | **682,185** | **693,597** |
| | **2021** | **480,424** | **497,577** | **512,732** | **528,470** | **544,473** | **559,976** |

**Table 11-3. Water Demand Projections Comparison by Water-User Category (Acre-Feet/Year)**

| Water Use Category | Plan | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|---|
| Municipal | 2016 | 133,761 | 147,990 | 161,620 | 176,250 | 191,117 | 205,328 |
| | 2021 | 139,241 | 153,458 | 167,131 | 181,839 | 196,770 | 211,047 |
| County-Other | 2016 | 8,057 | 8,509 | 8,980 | 9,545 | 10,080 | 10,595 |
| | 2021 | 3,266 | 4,048 | 4,760 | 5,506 | 6,214 | 6,885 |
| Manufacturing | 2016 | 16,144 | 17,271 | 18,361 | 19,288 | 20,764 | 22,353 |
| | 2021 | 7,033 | 8,163 | 8,163 | 8,163 | 8,163 | 8,163 |
| Mining | 2016 | 6,069 | 7,093 | 7,863 | 8,147 | 8,511 | 9,066 |
| | 2021 | 7,835 | 8,859 | 9,629 | 9,913 | 10,277 | 10,832 |
| Steam Electric Power | 2016 | 6,937 | 8,111 | 9,541 | 11,284 | 13,410 | 15,937 |
| | 2021 | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 | 10,545 |
| Livestock | 2016 | 2,997 | 2,997 | 2,997 | 2,997 | 2,997 | 2,997 |
| | 2021 | 2,101 | 2,101 | 2,101 | 2,101 | 2,101 | 2,101 |
| Irrigation | 2016 | 471,439 | 464,802 | 451,742 | 443,451 | 435,306 | 427,321 |
| | 2021 | 310,403 | 310,403 | 310,403 | 310,403 | 310,403 | 310,403 |

### 11.2.2 Drought of Record and Hydrologic and Modeling Assumptions

The **drought of record** consideration for water supply analysis for both the *2016 and 2021 Plans* is the drought of the 1950s. However, the *2016 Plan* does recognize that the current drought conditions as particularly witnessed in the summer of 2011 with a significantly low lake level at Elephant Butte Reservoir and corresponding cutback on irrigation allocations is having a significant impact on local water supply sources. The *2021 Plan* continues to recognize that, compared to the rest of the State, Far West Texas is perennially under drought or near-drought conditions. The *Plan* also recognizes that consistent flows of the Rio Grande of less than 250 cfs below Presidio has detrimental impacts on the local agricultural economy as well as threatens important wildlife habitat.

### 11.2.3 Source Water Availability

**Surface water availability** for both the *2016 and 2021 Plans* is based on Run 3 of the TCEQ Water Availability Models (WAMs) for the Rio Grande and Pecos Rivers. Rio Grande flows entering Texas from New Mexico are subject to the requirements set forth in the Rio Grande Compact and administered through the Rio Grande Project.

**Groundwater availability** in both the *2016 and 2021 Plans* is based on the Modeled Available Groundwater (MAG) volumes that may be produced on an average annual basis to achieve a Desired Future Condition (DFC) as adopted by Groundwater Management Areas (GMAs) (per Texas Water Code §36.001). Groundwater availability volumes for parts of the Region where MAGs are not determined by the TWDB are calculated separately based on science-based aquifer hydrologic characteristics.

Surface water source availability differs between the two *Plans* as a result of an updated running of the WAM. Likewise, changes in groundwater availability results from updated GMA criteria and MAG runs. Compared to 2016 source-supply volumes, 2021 surface water volumes decreased, groundwater volumes decreased, and reuse volumes increased. In total, projected source-supply volumes decreased by

approximately nine percent from the *2016 Plan* to the *2021 Plan*. The following Table 11-4 depicts these changes.

**Table 11-4. Comparison of Source Supply Availability**
**(Acre-Feet/Year)**

| Water Supply Source | FWTWP | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|---|
| Surface Water | 2016 | 91,037 | 91,037 | 91,037 | 91,037 | 91,037 | 91,037 |
| | 2021 | 65,763 | 65,763 | 65,763 | 65,763 | 65,763 | 65,763 |
| Groundwater | 2016 | 901,251 | 901,050 | 900,758 | 900,551 | 900,420 | 900,420 |
| | 2021 | 835,350 | 835,149 | 834,857 | 834,650 | 834,404 | 834,166 |
| Reuse | 2016 | 37,336 | 39,273 | 41,133 | 43,256 | 45,439 | 47,436 |
| | 2021 | 48,251 | 49,528 | 50,653 | 51,877 | 53,033 | 54,339 |
| **Total Source Supply** | **2016** | **1,029,624** | **1,031,360** | **1,032,928** | **1,034,844** | **1,036,896** | **1,038,893** |
| | **2021** | **949,364** | **950,440** | **951,273** | **952,290** | **953,200** | **954,268** |

### 11.2.4 Existing Water Supplies of WUGs and WWPs

Table 11-5 and 11-6 compare *2016 Plan and 2021 Plan* water supplies available to Water User Groups (WUGs) based on the current infrastructure ability of each to obtain water supplies. These abilities primarily include existing infrastructure, water-rights limitations, and groundwater conservation district permit limitations. Municipal WUGs differ between the two Tables due to the change to utility base in the *2021 Plan*.

**Table 11-5. 2016 Existing Water Supplies of WUGs**
**(Acre-Feet/Year)**

| County | Water User | Supply source | 2016 Plan |
|---|---|---|---|
| Brewster | Alpine | Igneous Aquifer | 1,428 |
| | Alpine | Igneous Aquifer \| Jeff Davis County | 738 |
| | County-Other | Edwards-Trinity Plateau Aquifer | 28 |
| | County-Other | Igneous Aquifer | 554 |
| | County-Other | Marathon Aquifer | 96 |
| | County-Other | Other Aquifer | 388 |
| | Manufacturing | Igneous Aquifer | 4 |
| | Mining | Igneous | 0 |
| | Mining | Other Aquifer | 0 |
| | Livestock | Capitan Reef Complex | 112 |
| | Livestock | Edwards-Trinity Plateau Aquifer | 112 |
| | Livestock | Igneous Aquifer | 112 |
| | Livestock | Marathon Aquifer | 31 |
| | Livestock | Other Aquifer | 0 |
| | Livestock | Rio Grande Livestock Local Supply | 19 |
| | Irrigation | Igneous Aquifer | 291 |
| | Irrigation | Other Aquifer | 2,381 |
| | Irrigation | Rio Grande Run-Of-River | 600 |
| | **Brewster County Total Existing Supply** | | **6,894** |
| Culberson | Van Horn | West Texas Bolsons Aquifer | 1,351 |
| | County-Other | Edwards-Trinity Plateau Aquifer | 3 |

**Table 11-5. (Continued) 2016 Existing Water Supplies of WUGs**
**(Acre-Feet/Year)**

| County | Water User | Supply source | 2016 Plan |
|---|---|---|---|
| Culberson | County-Other | Rustler Aquifer | 1 |
| | County-Other | West Texas Bolsons Aquifer | 136 |
| | Mining | Rio Grande Other Local Supply | 78 |
| | Mining | Rustler Aquifer | 47 |
| | Mining | West Texas Bolsons Aquifer | 90 |
| | Livestock | Edwards-Trinity Plateau | 29 |
| | Livestock | Rio Grande Livestock Local Supply | 15 |
| | Livestock | Rustler Aquifer | 28 |
| | Livestock | West Texas Bolsons Aquifer | 228 |
| | Irrigation | Capitan Reef Complex | 7,563 |
| | Irrigation | West Texas Bolsons Aquifer | 32,422 |
| | **Culberson County Total Existing Supply** | | **41,991** |
| El Paso | Anthony | Hueco-Mesilla Bolson Aquifer | 1,202 |
| | Clint | Hueco-Mesilla Bolson Aquifer | 276 |
| | El Paso | Direct Reuse | 6,000 |
| | El Paso | Hueco-Mesilla Bolson Aquifer | 115,000 |
| | El Paso | Rio Grande Run-Of-River | 10,000 |
| | El Paso County Tornillo WID | Hueco-Mesilla Bolson Aquifer | 484 |
| | El Paso WCID #4 | Hueco-Mesilla Bolson Aquifer | 1,065 |
| | Fort Bliss | Hueco-Mesilla Bolson Aquifer | 1,622 |
| | Fort Bliss | Rio Grande Run-Of-River | 0 |
| | Horizon City | Hueco-Mesilla Bolson Aquifer | 2,222 |
| | Horizon City | Rio Grande River Alluvium Aquifer Brackish | 884 |
| | Horizon Regional MUD | Hueco-Mesilla Bolson Aquifer | 1,746 |
| | Horizon Regional MUD | Rio Grande River Alluvium Aquifer Brackish | 694 |
| | Lower Valley WD | Hueco-Mesilla Bolson Aquifer | 1,121 |
| | Lower Valley WD | Rio Grande Run-Of-River | |
| | Socorro | Hueco-Mesilla Bolson Aquifer | 2,959 |
| | Socorro | Rio Grande Run-Of-River | |
| | Vinton | Hueco-Mesilla Bolson Aquifer | 400 |
| | Vinton | Rio Grande Run-Of-River | |
| | County-Other | Hueco-Mesilla Bolson Aquifer | 6,278 |
| | Manufacturing | Hueco-Mesilla Bolson Aquifer | 7,297 |
| | Mining | Hueco-Mesilla Bolson Aquifer | 680 |
| | Mining | Rio Grande Other Local Supply | 3,026 |
| | Mining | Rio Grande River Alluvium Aquifer Brackish | 2,000 |
| | Steam Electric Power | Hueco-Mesilla Bolson Aquifer | 3,286 |
| | Livestock | Hueco-Mesilla Bolson Aquifer | 603 |
| | Livestock | Rio Grande Livestock Local Supply | 26 |
| | Irrigation | Rio Grande Indirect Reuse | 37,697 |
| | Irrigation | Rio Grande River Alluvium Aquifer Brackish | 80,000 |
| | Irrigation | Rio Grande Run-Of-River | 56,631 |
| | **El Paso County Total Existing Supply** | | **343,327** |
| Hudspeth | Sierra Blanca | West Texas Bolsons Aquifer \| Culberson | 842 |
| | County-Other | Bone Spring Victorio-Peak Aquifer | 63 |
| | County-Other | Hueco-Mesilla Bolson Aquifer | 122 |
| | County-Other | Rio Grande River Alluvium Aquifer Brackish | 731 |
| | Manufacturing | Rio Grande River Alluvium Aquifer Brackish | 10 |
| | Mining | Rio Grande Other Local Supply | 240 |
| | Mining | Rio Grande River Alluvium Aquifer Brackish | 21 |
| | Mining | West Texas Bolsons Aquifer | 220 |
| | Livestock | Bone Spring Victorio-Peak Aquifer | 23 |
| | Livestock | Capitan Reef Complex Aquifer | 10 |

**Table 11-5. (Continued) 2016 Existing Water Supplies of WUGs**
**(Acre-Feet/Year)**

| County | Water User | Supply source | 2016 Plan |
|---|---|---|---|
| Hudspeth | Livestock | Hueco-Mesilla Bolson Aquifer | 64 |
| | Livestock | Other Aquifer | 322 |
| | Livestock | Rio Grande Livestock Local Supply | 81 |
| | Livestock | West Texas Bolsons Aquifer | 41 |
| | Irrigation | Bone Spring Victorio-Peak Aquifer | 63,843 |
| | Irrigation | Capitan Reef Complex Aquifer | 5,000 |
| | Irrigation | Rio Grande Indirect Reuse | 334 |
| | Irrigation | Rio Grande River Alluvium Aquifer Brackish | 14,000 |
| | Irrigation | Rio Grande Run-Of-River | 816 |
| | **Hudspeth County Total Existing Supply** | | **86,783** |
| Jeff Davis | Fort Davis | Igneous Aquifer | 343 |
| | County-Other | Edwards-Trinity Plateau Aquifer | 10 |
| | County-Other | Igneous Aquifer | 428 |
| | County-Other | Rio Grande River Alluvium Aquifer | 196 |
| | County-Other | West Texas Bolsons Aquifer | 38 |
| | Livestock | Edwards-Trinity Plateau Aquifer | 117 |
| | Livestock | Igneous Aquifer | 70 |
| | Livestock | Other Aquifer | |
| | Livestock | Rio Grande Livestock Local Supply | 25 |
| | Livestock | Rio Grande River Alluvium Aquifer | 212 |
| | Livestock | West Texas Bolsons Aquifer | 71 |
| | Irrigation | Igneous Aquifer | 735 |
| | Irrigation | Rio Grande Other Local Supply | 50 |
| | Irrigation | West Texas Bolsons Aquifer | 2,572 |
| | **Jeff Davis County Total Existing Supply** | | **4,867** |
| Presidio | Marfa | Igneous Aquifer | 1,774 |
| | Presidio | West Texas Bolsons Aquifer | 3,589 |
| | County-Other | Igneous Aquifer | 353 |
| | County-Other | Other Aquifer | 223 |
| | County-Other | West Texas Bolsons Aquifer | 12 |
| | Mining | Other Aquifer | 403 |
| | Livestock | Igneous Aquifer | 81 |
| | Livestock | Other Aquifer | 143 |
| | Livestock | Rio Grande Livestock Local Supply | 41 |
| | Livestock | West Texas Bolsons Aquifer | 143 |
| | Irrigation | Igneous Aquifer | 400 |
| | Irrigation | Rio Grande Run-Of-River | 6,140 |
| | Irrigation | West Texas Bolsons Aquifer | 2,461 |
| | **Presidio County Total Existing Supply** | | **15,763** |
| Terrell | Sanderson | Edwards-Trinity Plateau Aquifer | 527 |
| | County-Other | Edwards-Trinity Plateau Aquifer | 61 |
| | Mining | Edwards-Trinity Plateau Aquifer | 184 |
| | Mining | Rio Grande Other Local Supply | 40 |
| | Livestock | Edwards-Trinity Plateau Aquifer | 234 |
| | Livestock | Rio Grande Livestock Local Supply | 4 |
| | Irrigation | Edwards-Trinity Plateau Aquifer | 415 |
| | Irrigation | Rio Grande Run-Of-River | 676 |
| | **Terrell County Total Existing Supply** | | **2,141** |
| **Far West Texas Total Existing Water Supply** | | | **501,766** |

**Table 11-6. 2021 Existing Water Supplies of WUGs**
**(Acre-Feet/Year)**

| County | Water User | Supply Source | 2021 Plan |
|---|---|---|---|
| Brewster | Alpine | Igneous Aquifer \| Brewster County | 1,238 |
| | Alpine | Igneous Aquifer \| Jeff Davis County | 1,234 |
| | Lajitas Municipal Services | Other Aquifer \| Brewster Cretaceous Alluvium | 331 |
| | Marathon WSSS | Marathon Aquifer | 242 |
| | County-Other | Edwards-Trinity Plateau Aquifer | 23 |
| | County-Other | Igneous Aquifer | 446 |
| | County-Other | Other Aquifer \| Brewster Cretaceous Alluvium | 217 |
| | Livestock | Capitan Reef Complex Aquifer | 30 |
| | Livestock | Edwards-Trinity Plateau Aquifer | 97 |
| | Livestock | Igneous Aquifer | 112 |
| | Livestock | Marathon Aquifer | 15 |
| | Livestock | Other Aquifer \| Brewster Cretaceous Alluvium | 112 |
| | Irrigation | Igneous Aquifer | 291 |
| | Irrigation | Marathon Aquifer | 309 |
| | Irrigation | Other Aquifer \| Brewster Cretaceous Alluvium | 1,236 |
| | Irrigation | Rio Grande Run-Of-River | 1,551 |
| | **Brewster County Total Existing Supply** | | **7,484** |
| Culberson | Van Horn | West Texas Bolsons Aquifer | 1,016 |
| | County-Other | Edwards-Trinity Plateau Aquifer | 3 |
| | County-Other | Rustler Aquifer | 2 |
| | County-Other | West Texas Bolsons Aquifer | 152 |
| | Manufacturing | West Texas Bolsons Aquifer | 6 |
| | Mining | Capitan Reef Complex Aquifer | 2,000 |
| | Mining | Rustler Aquifer | 0 |
| | Mining | West Texas Bolsons Aquifer | 2,045 |
| | Livestock | Capitan Reef Complex Aquifer | 55 |
| | Livestock | Edwards-Trinity Plateau Aquifer | 20 |
| | Livestock | Igneous Aquifer | 15 |
| | Livestock | Rustler Aquifer | 31 |
| | Livestock | West Texas Bolsons Aquifer | 164 |
| | Irrigation | Capitan Reef Complex Aquifer | 5,525 |
| | Irrigation | West Texas Bolsons Aquifer | 32,005 |
| | **Culberson County Total Existing Supply** | | **43,039** |
| El Paso | Anthony | Hueco-Mesilla Bolson Aquifer | 1,532 |
| | East Biggs Water System | Hueco-Mesilla Bolson Aquifer | 1,242 |
| | East Montana Water System | Hueco-Mesilla Bolson Aquifer | 1,241 |
| | El Paso County Tornillo WID | Hueco-Mesilla Bolson Aquifer | 807 |
| | El Paso County WCID 4 | Hueco-Mesilla Bolson Aquifer | 1,855 |
| | El Paso Water Utilities | Direct Reuse | 6,000 |
| | El Paso Water Utilities | Hueco-Mesilla Bolson Aquifer | 115,000 |
| | El Paso Water Utilities | Rio Grande Run-Of-River | 10,000 |
| | Federal Correctional Institution La Tuna | Hueco-Mesilla Bolson Aquifer | 2,016 |
| | Fort Bliss Water Services | Hueco-Mesilla Bolson Aquifer | 7,158 |
| | Haciendas Del Norte WID | Hueco-Mesilla Bolson Aquifer | 306 |
| | Horizon Regional MUD | Hueco-Mesilla Bolson Aquifer | 3,649 |
| | Horizon Regional MUD | Other Aquifer \| Rio Grande Alluvium | 1,578 |
| | Lower Valley WD | Hueco-Mesilla Bolson Aquifer | 4,356 |
| | Paseo Del Este MUD 1 | Hueco-Mesilla Bolson Aquifer | 1,629 |
| | County-Other \| Vinton Hills Estates | Hueco-Mesilla Bolson Aquifer | 120 |
| | County-Other \| Vinton Hills Subdivision | Hueco-Mesilla Bolson Aquifer | 280 |

**Table 11-6. (Continued) 2021 Existing Water Supplies of WUGs**
**(Acre-Feet/Year)**

| County | Water User | Supply Source | 2021 Plan |
|---|---|---|---|
| | County-Other | Hueco-Mesilla Bolson Aquifer | 6,278 |
| | Manufacturing | Hueco-Mesilla Bolson Aquifer | 7,297 |
| | Mining | Hueco-Mesilla Bolson Aquifer | 810 |
| | Mining | Other Aquifer \| Rio Grande Alluvium | 1,347 |
| | Steam Electric Power | Hueco-Mesilla Bolson Aquifer | 3,285 |
| | Livestock | Hueco-Mesilla Bolson Aquifer | 205 |
| | Livestock | Other Aquifer \| Rio Grande Alluvium | 33 |
| | Irrigation | Hueco-Mesilla Bolson Aquifer | 7,392 |
| | Irrigation | Other Aquifer \| Rio Grande Alluvium | 54,834 |
| | Irrigation | Rio Grande Indirect Reuse | 34,169 |
| | Irrigation | Rio Grande Run-Of-River | 36,605 |
| | **El Paso County Total Existing Supply** | | **311,024** |
| Hudspeth | Esperanza Water Service | Hueco-Mesilla Bolson Aquifer | 484 |
| | Hudspeth County WCID 1 | West Texas Bolsons Aquifer | 532 |
| | County-Other \| Dell City | Bone Spring-Victorio Peak Aquifer | 63 |
| | County-Other \| Fort Hancock WCID | Other Aquifer \| Rio Grande Alluvium | 270 |
| | County-Other | Hueco-Mesilla Bolson Aquifer | 23 |
| | Mining | Hueco-Mesilla Bolson Aquifer | 52 |
| | Mining | Other Aquifer \| Rio Grande Alluvium | 21 |
| | Mining | West Texas Bolsons Aquifer | 210 |
| | Livestock | Bone Spring-Victorio Peak Aquifer | 84 |
| | Livestock | Capitan Reef Complex Aquifer | 7 |
| | Livestock | Hueco-Mesilla Bolson Aquifer | 11 |
| | Livestock | Other Aquifer \| Diablo Plateau | 281 |
| | Livestock | West Texas Bolsons Aquifer | 77 |
| | Irrigation | Bone Spring-Victorio Peak Aquifer | 68,495 |
| | Irrigation | Capitan Reef Complex Aquifer | 4,213 |
| | Irrigation | Other Aquifer \| Rio Grande Alluvium | 52,187 |
| | Irrigation | Rio Grande Indirect Reuse | 334 |
| | Irrigation | Rio Grande Run-Of-River | 725 |
| | **Hudspeth County Total Existing Supply** | | **128,069** |
| Jeff Davis | Fort Davis WSC | Igneous Aquifer | 468 |
| | County-Other \| City of Valentine | West Texas Bolsons Aquifer | 29 |
| | County-Other | Igneous Aquifer | 315 |
| | County-Other | Pecos Valley \| Edwards-Trinity (Plateau) Aquifer | 0 |
| | Mining | Igneous Aquifer | 153 |
| | Livestock | Igneous Aquifer | 299 |
| | Livestock | Pecos Valley \| Edwards-Trinity (Plateau) Aquifer | 108 |
| | Livestock | West Texas Bolsons Aquifer | 63 |
| | Irrigation | Igneous Aquifer | 735 |
| | Irrigation | Pecos Valley \| Edwards-Trinity (Plateau) Aquifer | 70 |
| | Irrigation | West Texas Bolsons Aquifer | 561 |
| | **Jeff Davis County Total Existing Supply** | | **2,801** |
| Presidio | Marfa | Igneous Aquifer | 2,097 |
| | Presidio | West Texas Bolsons Aquifer | 3,766 |
| | County-Other | Igneous Aquifer | 289 |
| | County-Other | West Texas Bolsons Aquifer | 193 |
| | Mining | West Texas Bolsons Aquifer | 403 |
| | Livestock | Igneous Aquifer | 224 |
| | Livestock | West Texas Bolsons Aquifer | 142 |

**Table 11-6. (Continued) 2021 Existing Water Supplies of WUGs**
**(Acre-Feet/Year)**

| County | Water User | Supply Source | 2021 Plan |
|---|---|---|---|
| Presidio | Irrigation | Igneous Aquifer | 605 |
| | Irrigation | Rio Grande Run-Of-River | 6,140 |
| | Irrigation | West Texas Bolsons Aquifer | 2,256 |
| | **Presidio County Total Existing Supply** | | **16,115** |
| Terrell | Terrell County WCID 1 | Edwards-Trinity Plateau \| Pecos Valley \| Trinity Aquifers | 476 |
| | County-Other | Edwards-Trinity Plateau \| Pecos Valley \| Trinity Aquifers | 75 |
| | Mining | Edwards-Trinity Plateau \| Pecos Valley \| Trinity Aquifers | 190 |
| | Livestock | Edwards-Trinity Plateau \| Pecos Valley \| Trinity Aquifers | 206 |
| | Irrigation | Edwards-Trinity Plateau \| Pecos Valley \| Trinity Aquifers | 473 |
| | Irrigation | Edwards-Trinity Plateau \| Pecos Valley \| Trinity Aquifers | 441 |
| | **Terrell County Total Existing Supply** | | **1,861** |
| **Far West Texas Total Existing Water Supply** | | | **510,393** |

### 11.2.5 WUG and WWP Needs

Water supply needs occur when an entity's (WUG's) projected water demand (Table 11-2 and Table 11-3) exceeds it's supply availability (Table 11-5 and Table 11-6). Table 11-7 and Table 11-8 compare those entities in the *2016 and 2021 Plans* that are projected to experience a water supply need at some decade in the next 50 years. The dramatic difference between WUG needs in the two *Plans* is primarily the result of the decreased source supply availability (Table 11-4) shown in the *2021 Plan*.

**Table 11-7. 2016 WUG and WWP With Needs**
**(Acre-Feet/Year)**

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Culberson County** | | | | | | |
| Mining | 291 | 1,025 | 1,178 | 895 | 628 | 425 |
| **El Paso County** | | | | | | |
| El Paso Water | | | | 8,978 | 19,602 | 29,792 |
| Fort Bliss | 26 | 40 | 74 | 128 | 178 | 228 |
| Horizon City | 1,352 | 3,203 | 4,941 | 6,669 | 8,308 | 9,853 |
| Horizon Regional MUD | 1,233 | 2,582 | 3,851 | 5,115 | 6,317 | 7,451 |
| Lower Valley Water District | 2,453 | 3,228 | 3,965 | 4,734 | 5,500 | 6,227 |
| Socorro | 217 | 488 | 757 | 1,069 | 1,406 | 1,732 |
| County Other | 368 | 764 | 1,220 | 1,754 | 2,259 | 2,745 |
| Manufacturing | 8,841 | 9,968 | 11,058 | 11,985 | 13,461 | 15,050 |
| Mining | | | | 242 | 987 | 1,833 |
| Steam Electric Power | 3,651 | 4,825 | 6,255 | 7,998 | 10,124 | 12,651 |
| Irrigation | 75,165 | 71,278 | 60,950 | 55,026 | 50,512 | 46,834 |
| **Hudspeth County** | | | | | | |
| Mining | | | | 2 | 11 | 21 |
| Irrigation | 94,847 | 91,139 | 87,508 | 83,952 | 80,470 | 77,060 |
| **Terrell County** | | | | | | |
| Mining | 449 | 552 | 516 | 382 | 259 | 161 |

**Table 11-8. 2021 WUG and WWP With Needs**
**(Acre-Feet/Year)**

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|---|---|---|---|---|---|
| **Culberson County** | | | | | | |
| Irrigation | 333 | 333 | 333 | 333 | 333 | 333 |
| **El Paso County** | | | | | | |
| El Paso Water | | 1,354 | 11,480 | 22,495 | 32,908 | 44,662 |
| Horizon Regional MUD | 2,709 | 5,816 | 8,735 | 11,641 | 14,403 | 17,008 |
| Lower Valley Water District | 1,358 | 2,207 | 3,042 | 3,934 | 4,833 | 5,689 |
| Paseo Del Este MUD 1 | | 462 | 351 | | | |
| County-Other \| Vinton Hills Estates | | | | 4 | 24 | 42 |
| County-Other \| Vinton Hills Subdivision | | | | 10 | 54 | 96 |
| Manufacturing | | 860 | 860 | 860 | 860 | 860 |
| Mining | 1,851 | 2,469 | 3,105 | 3,791 | 4,536 | 5,382 |
| Steam Electric Power | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 |
| Irrigation | 16,570 | 13,042 | 13,042 | 13,042 | 13,042 | 13,042 |
| **Hudspeth County** | | | | | | |
| County-Other | 35 | 38 | 38 | 38 | 38 | 39 |
| Mining | 196 | 168 | 185 | 200 | 209 | 219 |
| **Terrell County** | | | | | | |
| Mining | 483 | 586 | 550 | 416 | 293 | 195 |

### 11.2.6 Recommended and Alternate Water Management Strategies

A total of 64 water management strategies (Table 11-9) for 30 water user groups (WUGs) were recommended in the *2016 Plan*, with a total capital cost of $1,903,771,872. As a result of more WUGs projecting a water supply need in the *2021 Plan*, a total of 65 strategies (Table 11-10) for 24 WUGs were recommended with a total capital cost of $2,169,328,445.00.

**Table 11-9. Summary of 2016 Plan Recommended Water Management Strategies**
**(Acre-Feet per Year)**

| County | Water User Group | Strategy | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | |
| Brewster | Brewster County-Other Marathon WSSService | Water loss audit and main-line repair | E-1 | 40 | 40 | 40 | 40 | 40 | 40 | $265,000 |
| | Brewster County-Other Rio Grande Village BBNP | Water loss audit and main-line repair | E-2 | 6 | 6 | 6 | 6 | 6 | 6 | $616,000 |
| Culberson | *Culberson County Mining | Additional groundwater wells | E-3 | 590 | 590 | 590 | 590 | 590 | 590 | $608,000 |
| | | Additional groundwater well | E-4 | 590 | 590 | 590 | 590 | 590 | 590 | $675,000 |
| El Paso | *City of Anthony | Public conservation education | E-5 | 7 | 9 | 10 | 11 | 12 | 13 | $0 |
| | | Arsenic treatment facility | E-6 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | $9,952,000 |
| | *City of El Paso (EPWU) | Municipal conservation programs | E-7 | 1,870 | 2,110 | 1,160 | 2,550 | 5,530 | 5,910 | $0 |
| | | Advanced purified water at the Haskell and NW WWTPs | E-8 | 3,000 | 7,500 | 12,000 | 16,500 | 21,000 | 24,000 | $395,241,000 |
| | | Advanced purified water at the Bustamante WWTP | E-9 | 8,000 | 9,000 | 10,000 | 10,000 | 10,000 | 10,000 | $94,096,000 |
| | | Recharge of Hueco Aquifer groundwater with treated surface water from Jonathan Rogers Plant | E-10 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $1,800,000 |
| | | Treatment & reuse of agricultural drain water | E-11 | | 8,100 | 8,100 | 8,100 | 8,100 | 8,100 | $125,000,000 |

**Table 11-9. (Continued) Summary of 2016 Plan Recommended Water Management Strategies**
**(Acre-Feet per Year)**

| County | Water User Group | Strategy | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | |
| El Paso | *City of El Paso (EPWU) | Expansion of local well fields | E-12 | 3,880 | 7,760 | 11,640 | 15,520 | 19,400 | 23,280 | $32,712,000 |
| | | Brackish Groundwater at the Jonathan Rogers WTP | E-13 | 11,000 | 11,000 | 11,000 | 11,000 | 11,000 | 11,000 | $65,924,000 |
| | | Expansion of the Kay Bailey Hutchinson Desal Plant | E-14 | 1,260 | 2,520 | 2,520 | 2,520 | 2,520 | 2,520 | $37,200,000 |
| | | Groundwater from Hueco Ranch | E-15 | | | 5,000 | 5,000 | 5,000 | 5,000 | $156,000,000 |
| | | Groundwater from Southern Hudspeth County | E-16 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | $98,980,000 |
| | | Expansion of the Jonathan Rogers WTP | E-17 | 6,500 | 6,500 | 6,500 | 6,500 | 6,500 | 6,500 | $95,186,653 |
| | | Riverside Regulating Reservoir | E-18 | 1,500 | 1,500 | 1,500 | 1,500 | 1,500 | 1,500 | $93,526,200 |
| | | Groundwater from Diablo Farms | E-19 | | | | 10,000 | 10,000 | 10,000 | $273,507,000 |
| | | Groundwater from Dell City area | E-20 | | | | | 10,000 | 20,000 | $257,901,000 |
| | *Lower Valley Water District | Public conservation education | E-21 | 36 | 43 | 51 | 59 | 66 | 73 | $0 |
| | | Purchased water from EPWU | E-22 | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 | 4,356 | 0 |
| | *City of Socorro | Public conservation education | E-23 | 32 | 34 | 37 | 40 | 44 | 47 | $0 |
| | | Purchased water from LVWD | E-24 | 2,959 | 2,959 | 2,959 | 2,959 | 2,959 | 2,959 | $0 |
| | *Horizon City | Public conservation education | E-25 | 45 | 63 | 80 | 98 | 114 | 130 | $0 |
| | | Purchased water from Horizon MUD | E-26 | 3,106 | 3,106 | 3,106 | 3,106 | 3,106 | 3,106 | $0 |
| | *Horizon Regional MUD | Public conservation education | E-27 | 37 | 50 | 63 | 76 | 88 | 99 | $0 |
| | | Additional wells & expansion of desal plant | E-28 | | | | | | | |

**Table 11-9. (Continued) Summary of 2016 Plan Recommended Water Management Strategies**
**(Acre-Feet per Year)**

| County | Water User Group | Strategy | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | |
| El Paso | *Fort Bliss | Public conservation education | E-29 | 16 | 17 | 17 | 18 | 18 | 19 | $0 |
| | | Purchased water from EPWU | E-30 | 435 | 435 | 435 | 435 | 435 | 435 | $0 |
| | El Paso County Tornillo WID | Additional groundwater well & transmission line | E-31 | 333 | 333 | 333 | 333 | 333 | 333 | $1,726,000 |
| | | Arsenic treatment facility | E-32 | 276 | 276 | 276 | 276 | 276 | 276 | $3,114,000 |
| | City of Vinton | High capacity water lines for improved distribution of water from EPWU | E-33 | 400 | 400 | 400 | 400 | 400 | 400 | $4,192,000 |
| | *El Paso County Other | Purchased water from EPWU | E-34 | 6,278 | 6,278 | 6,278 | 6,278 | 6,278 | 6,278 | $0 |
| | *El Paso County Irrigation (EPCWID #1) | Irrigation scheduling | E-35 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 | $0 |
| | | Tailwater reuse | E-36 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 | $0 |
| | | Improvements to water district delivery system | E-37 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | $157,777,783 |
| | *El Paso County Manufacturing | Purchased water from EPWU | E-38 | 7,297 | 7,297 | 7,297 | 7,297 | 7,297 | 7,297 | $0 |
| | *El Paso County Mining | Additional groundwater wells | E-39 | 1,840 | 1,840 | 1,840 | 1,840 | 1,840 | 1,840 | $969,000 |
| | *El Paso County Steam Electric Power | Purchased water from EPWU | E-40 | 3,286 | 3,286 | 3,286 | 3,286 | 3,286 | 3,286 | $0 |
| Hudspeth | Hudspeth County Other (Dell City) | Water loss audit and main-line repair | E-41 | 1 | 1 | 1 | 1 | 1 | 1 | $120,000 |
| | | Brackish groundwater desal facility | E-42 | 111 | 111 | 111 | 111 | 111 | 111 | $1,299,000 |
| | Hudspeth County Other (Fort Hancock WCID) | Water loss audit and main-line repair | E-43 | 2 | 2 | 2 | 2 | 2 | 2 | $265,000 |

**Table 11-9. (Continued) Summary of 2016 Plan Recommended Water Management Strategies**
**(Acre-Feet per Year)**

| County | Water User Group | Strategy | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | |
| Hudspeth | Hudspeth County Other (Fort Hancock WCID) | Additional well & RO treatment facility | E-44 | 565 | 565 | 565 | 565 | 565 | 565 | $6,109,000 |
| | Hudspeth County Other (City of Sierra Blanca) Hudspeth Co. WCID #1 | Additional transmission line to supply connections outside of the District | E-45 | 351 | 351 | 351 | 351 | 351 | 351 | $1,429,000 |
| | *Hudspeth Irrigation (HCCRD #1) | Additional groundwater wells | E-46 | 230 | 230 | 230 | 230 | 230 | 230 | $173,000 |
| | Hudspeth Irrigation (HCUWCD #1) | Irrigation scheduling | E-47 | 3,535 | 3,535 | 3,535 | 3,535 | 3,535 | 3,535 | $0 |
| | | Tailwater reuse | E-48 | 589 | 589 | 589 | 589 | 589 | 589 | $0 |
| | *Hudspeth County Mining | Additional groundwater well | E-49 | 30 | 30 | 30 | 30 | 30 | 30 | $449,000 |
| Jeff Davis | Fort Davis WSC | Additional groundwater well | E-50 | 274 | 274 | 274 | 274 | 274 | 274 | $507,000 |
| | | Additional transmission line to connect Fort Davis WSC to Fort Davis Estates | E-51 | 114 | 114 | 114 | 114 | 114 | 114 | $1,068,000 |
| Presidio | City of Marfa | Additional groundwater well | E-52 | 785 | 785 | 785 | 785 | 785 | 785 | $1,143,000 |
| | City of Presidio | Water supply for the City of Presidio | E-53 | | | | | | | |
| Terrell | *Terrell County Mining | Additional groundwater wells | E-54 | 560 | 560 | 560 | 560 | 560 | 560 | $738,000 |

**Table 11-10. Summary of 2021 Plan Recommended Water Management Strategies**
**(Acre-Feet per Year)**

| County | Water User Group | Strategy | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost (Table 5-3) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | |
| Brewster | City of Alpine | Modification to wastewater treatment facility & irrigation system | E-1 | 25 | 25 | 25 | 25 | 25 | 25 | $74,400 |
| | | Irrigation application of captured rainwater runoff | E-2 | 70 | 70 | 70 | 70 | 70 | 70 | $14,500 |
| | Marathon WSSService | Water loss audit and main-line repair | E-3 | 12 | 12 | 12 | 12 | 12 | 12 | $255,000 |
| | Lajitas Municipal Services | Water loss audit and main-line repair | E-4 | 51 | 51 | 51 | 51 | 51 | 51 | $2,545,000 |
| | Brewster County Other (Study Butte Terlingua WS) | Water loss audit and main-line repair | E-5 | 25 | 25 | 25 | 25 | 25 | 25 | $3,054,000 |
| Culberson | *Culberson County Irrigation | Conservation - Irrigation scheduling | E-6 | 107 | 107 | 107 | 107 | 107 | 107 | $0 |
| | | Additional groundwater wells | E-7 | 333 | 333 | 333 | 333 | 333 | 333 | $510,000 |
| El Paso | Town of Anthony | Arsenic treatment facility | E-8 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 | $10,334,000 |
| | | Additional groundwater well | E-9 | 960 | 960 | 960 | 960 | 960 | 960 | $1,913,000 |
| | *El Paso Water | Municipal conservation programs | E-10 | 4,950 | 5,530 | 5,080 | 9,940 | 13,140 | 17,820 | $1,071,000 |
| | | Advanced water purification at the Bustamante WWTP | E-11 | 8,500 | 9,200 | 9,900 | 10,600 | 10,600 | 10,600 | $142,608,000 |
| | | Advanced water purification at the Haskell Street RWP | E-12 | | | | | | 8,900 | $189,356,000 |
| | | Expansion of the Kay Bailey Hutchison Desal Plant | E-13 | | | | | 5,000 | 5,000 | $26,490,000 |
| | | Hueco Bolson Artificial Recharge | E-14 | | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $38,003,000 |
| | | Riverside Regulating Reservoir | E-15 | | | 3,250 | 3,250 | 3,250 | 3,250 | $6,754,036 |
| | | Groundwater from Dell City Area (Phase 1) | E-16 | | | 10,000 | 10,000 | 10,000 | 10,000 | $569,357,000 |
| | | Groundwater from Dell City Area (Phase 2) | E-17 | | | | 10,000 | 10,000 | 10,000 | $320,226,000 |

**Table 11-10. (Continued) Summary of 2021 Plan Recommended Water Management Strategies**
**(Acre-Feet per Year)**

| County | Water User Group | Strategy | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost (Table 5-3) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | |
| El Paso | *El Paso Water ALTERNATE STRATEGIES | Treatment and reuse of agricultural drain water | E-18 | | | 2,700 | 2,700 | 2,700 | 2,700 | $21,466,000 |
| | | Expansion of Canutillo Mesilla Bolson Well Field | E-19 | | 7,760 | 11,640 | 15,520 | 19,400 | 23,280 | $6,444,000 |
| | | Lower Valley well head RO | E-20 | | | 5,000 | 5,000 | 5,000 | 5,000 | $52,681,000 |
| | | Expansion of Jonathan Rogers WTP | E-21 | | | 6,500 | 6,500 | 6,500 | 6,500 | $88,679,000 |
| | | Conjunctive treatment of groundwater and surface water at the Upper Valley WWTP | E-22 | | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | $72,873,000 |
| | | Advanced water purification at the Fred Hervey WWTP | E-23 | | | 10,000 | 10,000 | 10,000 | 10,000 | $140,394,000 |
| | *Lower Valley Water District | Public conservation education | E-24 | 57 | 66 | 74 | 83 | 92 | 100 | $237,461 |
| | | Loop lines inside current connections | E-25 | | | | | | | |
| | | Purchase water from EPW | E-26 | 1,344 | 2,185 | 3,012 | 3,895 | 4,785 | 5,632 | $591,000 |
| | | Surface water treatment plant & transmission line | E-27 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $74,338,000 |
| | | Groundwater from proposed Well field | E-28 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | $39,240,000 |
| | | Groundwater from proposed Well field | E-29 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | 6,800 | $36,110,000 |
| | | Wastewater treatment facility and ASR | E-30 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 | 5,589 | $23,509,000 |
| | *Horizon Regional MUD | Water loss audit and main-line repair | E-31 | 197 | 274 | 346 | 418 | 487 | 551 | $255,000 |
| | | Public conservation education | E-32 | 79 | 110 | 140 | 169 | 196 | 222 | $136,793 |
| | | Additional wells & expansion of desal plant | E-33 | 16,786 | 16,786 | 16,786 | 16,786 | 16,786 | 16,786 | $71,809,000 |
| | Haciendas Del Norte WID | Water loss audit and main-line repair | E-34 | 12 | 13 | 15 | 16 | 17 | 19 | $764,000 |
| | East Montana WS | Water loss audit and main-line repair | E-35 | 41 | 46 | 50 | 54 | 59 | 63 | $1,018,000 |
| | El Paso County Tornillo WID | Additional groundwater well & transmission line | E-36 | 333 | 333 | 333 | 333 | 333 | 333 | $2,060,000 |

**Table 11-10. (Continued) Summary of 2021 Plan Recommended Water Management Strategies**
**(Acre-Feet per Year)**

| County | Water User Group | Strategy | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost (Table 5-3) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | |
| El Paso | *El Paso County Other (Vinton Hills) | Public conservation education | E-37 | 2 | 3 | 3 | 4 | 5 | 5 | $6,072 |
| | | Purchase water from EPW | E-38 | 0 | 0 | 0 | 14 | 77 | 137 | $143,000 |
| | | High capacity water lines for improved distribution of water from EPW | E-39 | 0 | 0 | 0 | 400 | 400 | 400 | $17,075,000 |
| | *El Paso County Irrigation (EPCWID #1) | Irrigation scheduling | E-40 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 | 1,740 | $102,595 |
| | | Tailwater reuse | E-41 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 | 1,723 | $973,368 |
| | | Improvements to water district delivery system | E-42 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 | $157,777,783 |
| | | Riverside Regulating Reservoir | E-43 | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 | $6,754,036 |
| | | New Wasteway 32 River Diversion Pumping Point | E-44 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $4,055,887 |
| | *El Paso County Manufacturing | Manufacturing Conservation | E-45 | 0 | 430 | 430 | 430 | 430 | 430 | $0 |
| | | Purchase water from EPW | E-46 | 0 | 860 | 860 | 860 | 860 | 860 | $1,049,000 |
| | *El Paso County Mining | Mining Conservation | E-47 | 278 | 370 | 466 | 569 | 680 | 807 | $0 |
| | | Additional groundwater wells | E-48 | 4,251 | 4,251 | 4,251 | 4,251 | 4,251 | 4,251 | $1,208,000 |
| | *El Paso County Steam Electric Power | Power Conservation | E-49 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 | 3,630 | $0 |
| | | Purchase water from EPW | E-50 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | 7,260 | $951,000 |
| Hudspeth | Hudspeth County Other (Dell City) | Brackish groundwater desal facility | E-51 | 111 | 111 | 111 | 111 | 111 | 111 | $1,636,000 |
| | *Hudspeth County Other (City of Sierra Blanca - Hudspeth Co. WCID #1) | Public conservation education | E-52 | 1 | 2 | 2 | 2 | 2 | 2 | $3,513 |
| | | Replace water-supply line from Van Horn | E-53 | 39 | 39 | 39 | 39 | 39 | 39 | $18,432,000 |
| | | Local groundwater well | E-54 | 16 | 16 | 16 | 16 | 16 | 16 | $940,000 |
| | | Groundwater well NE of Van Horn | E-55 | 39 | 39 | 39 | 39 | 39 | 0 | $2,132,000 |
| | | Groundwater well West of Van Horn | E-56 | 39 | 39 | 39 | 39 | 39 | 39 | $636,000 |
| | *Hudspeth County Mining | Mining Conservation | E-57 | 29 | 25 | 28 | 30 | 31 | 33 | $0 |

**Table 11-10. (Continued) Summary of 2021 Plan Recommended Water Management Strategies**
**(Acre-Feet per Year)**

| County | Water User Group | Strategy | Strategy ID | Strategy Supply (Acre-Feet/Year) | | | | | | Total Capital Cost (Table 5-3) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | |
| Hudspeth | *Hudspeth County Mining | Additional groundwater well | E-58 | 219 | 219 | 219 | 219 | 219 | 219 | $306,000 |
| Jeff Davis | Fort Davis WSC | Additional groundwater well | E-59 | 274 | 274 | 274 | 274 | 274 | 274 | $584,000 |
| | | Transmission line to connect Fort Davis WSC to Fort Davis Estates | E-60 | 114 | 114 | 114 | 114 | 114 | 114 | $1,671,000 |
| | Jeff Davis County Other (Town of Valentine) | Additional groundwater well | E-61 | 129 | 129 | 129 | 129 | 129 | 129 | $783,000 |
| Presidio | City of Presidio | Water loss audit and main-line repair | E-62 | 35 | 37 | 38 | 41 | 43 | 45 | $509,000 |
| | | Additional groundwater well | E-63 | 120 | 120 | 120 | 120 | 120 | 120 | $5,509,000 |
| Terrell | *Terrell County Mining | Mining Conservation | E-64 | 72 | 88 | 83 | 62 | 44 | 29 | $0 |
| | *Terrell County Mining ALTERNATE STRATEGY | Additional groundwater wells | E-65 | 470 | 470 | 470 | 470 | 470 | 470 | $921,000 |

## 11.3 PROGRESS OF REGIONALIZATION

Six of the seven counties that comprise Far West Texas are highly rural with each county containing only one or two communities of significant size. Generally, these rural communities are totally self-supportive without need or justification for regional / shared water supply projects. The one variable in this scenario is the shared supply between the communities of Van Horn and Sierra Blanca.

Sierra Blanca (Hudspeth County WCID #1) 40 miles to the west of Van Horn has yet to locate and develop a local water supply and has historically relied on groundwater from the Wild Horse Flat (West Texas Bolsons) aquifer in the same well-field region as Van Horn's well-field. Van Horn has assisted Sierra Blanca by transporting water from this shared well-field to a pipeline that moves the water to Sierra Blanca. While this arrangement has worked adequately in the past, the community of Sierra Blanca is motivated to become less reliant on the existing groundwater supply from the Wild Horse Flat aquifer by attempting to locate and develop a supply source closer to town. This *2021 Far West Texas Water Plan* provides strategy recommendations for both enhancing the existing water-supply source and repairing the transmission pipeline, as well as addressing the search for a water source that is less dependent on Van Horn.

The greatest population density in the Region occurs in El Paso County (97 percent of total regional population) along the Rio Grande corridor, with El Paso Water (EPW) providing 77 percent of the water to this area of rapid population expansion. Thus, regionalization has been and will continue to be an important aspect of water-management planning. EPW provides water to the City of El Paso and to six other communities including Fort Bliss military reservation and to the Lower Valley Water District (LVWD). EPW also provides water to manufacturing, steam-electric, mining, and numerous colonias in the County. To meet the growing water-supply needs for EPW's service area, the utility plans to maximize local sources and eventually import additional supplies from the Dell City area.

Regionalization begins with the cooperative agreements between EPW and the El Paso County Water Improvement District #1 (EPCWID#1) that controls almost all the Rio Grande water rights in the County primarily for irrigation use. Shared projects and agreements allow a portion of Rio Grande supply to be used for municipal supply, while the irrigation district makes use of return flows. The LVWD currently receives all its treated water supply from EPW and in turn redirects this water to its own customers.

Another regional cooperative project occurs with the Kay Bailey Hutchison Desalination Facility between EPW and Fort Bliss. Project facilities, including brackish groundwater source wells, treatment plant, and disposal wells, are located on Fort Bliss property, while EPW owns and maintains the facility. Fort Bliss receives a large portion of their supply needs from this project, while EPW is provided with a drought-proof resource to blend in with their other supply sources.

Regionalization thus plays a key role in moving both surface water and groundwater supplies to the numerous end-users in the County. This *2021 Far West Texas Water Plan* continues to support regionalization by recognizing that future water supplies can best be shared in this desert community through cooperative management.

The FWTWPG would like to offer another perspective on regionalization. Participants in the FWTWPG continue to maintain a robust regional relationship by helping affected water systems become sustainable and resilient. However, funding policies may impede this effort by suggesting regionalization through consolidation of water districts. The FWPWPG finds that entities in unserved or underserved areas should

still be eligible for financial assistance. The grant or loan eligibility and need to the unserved or underserved service area should be treated independently from the provider of some services through the interlocal agreements. This perspective is further discussed in Recommendation Chapter 8, Section 8.1, Number 5.

*This page intentionally left blank*