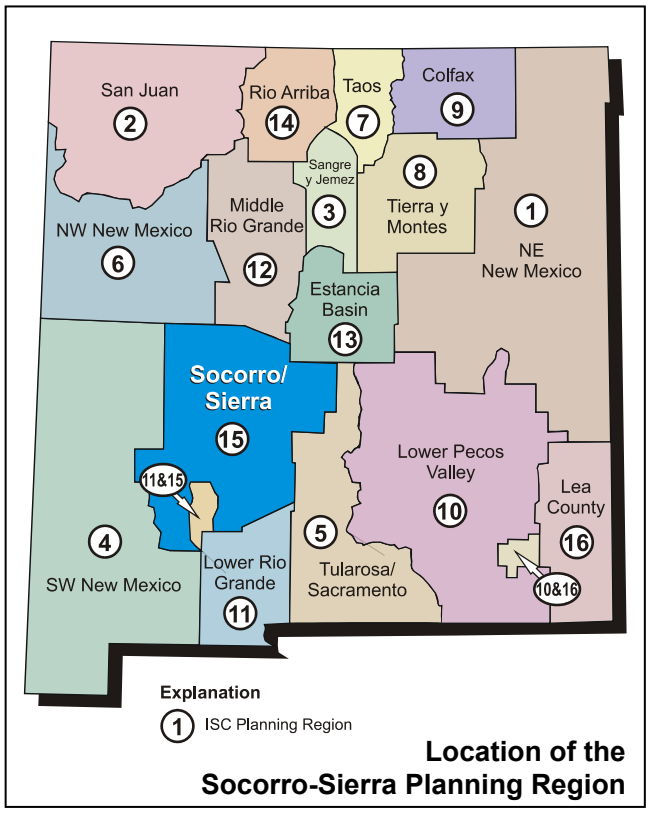
Executive Summary

The Socorro-Sierra water planning region is one of 16 water planning regions in the State of New Mexico that are developing a regional water plan. The region includes all of Socorro and Sierra Counties and is centered on the Rio Grande in central New Mexico (Figure ES-1). Most of the water in the region is used for agriculture along the Rio Grande Valley, for riparian evapotranspiration, and for evaporation from the reservoirs in Sierra County (Figure ES-2).

The purpose of the *Socorro-Sierra Regional Water Plan* is to assess the available supply of surface water and groundwater within the region and to identify methods for meeting the projected demand and protecting the water resources of the region through conservation, water resources management, and protection of the quality and quantity of existing supplies for future use within the region.



Location of the Socorro-Sierra Planning Region

Figure ES-1

The Socorro-Sierra planning activities are overseen by a Steering Committee that is made up of diverse professionals and public participants who represent a wide variety of water interests within Socorro and Sierra Counties, and the designated fiscal agent is the Socorro Soil and Water Conservation District (SWCD). The Socorro-Sierra Steering Committee and the Socorro SWCD retained Daniel B. Stephens & Associates, Inc. (DBS&A), Hydrosphere Resource Consultants, Inc. (Hydrosphere), and Sites Southwest to complete this regional water plan. In addition to these consultants retained by the region, the New Mexico Interstate Stream Commission (ISC) funded S.S. Papadopulos & Associates (SSPA) to evaluate the surface water supply and analyze the hydrologic impacts of alternatives, in conjunction with a larger surface water modeling effort on the Rio Grande.

The ISC's *Regional Water Planning Handbook* serves as a guideline for regional water planning in New Mexico and has been used as an outline for the *Socorro-Sierra Regional Water Plan*. According to the template, a regional water plan must address the following questions:

1. What is the water supply available to the region?
2. What is the region's current and projected future demand for water?
3. What are the region's alternatives for using available supplies to meet projected future water demands (including, to the extent needed, reducing demand)?
4. What are the advantages and disadvantages of each alternative with respect to local values and criteria?
5. What are the best water supply alternatives and how will they be implemented?

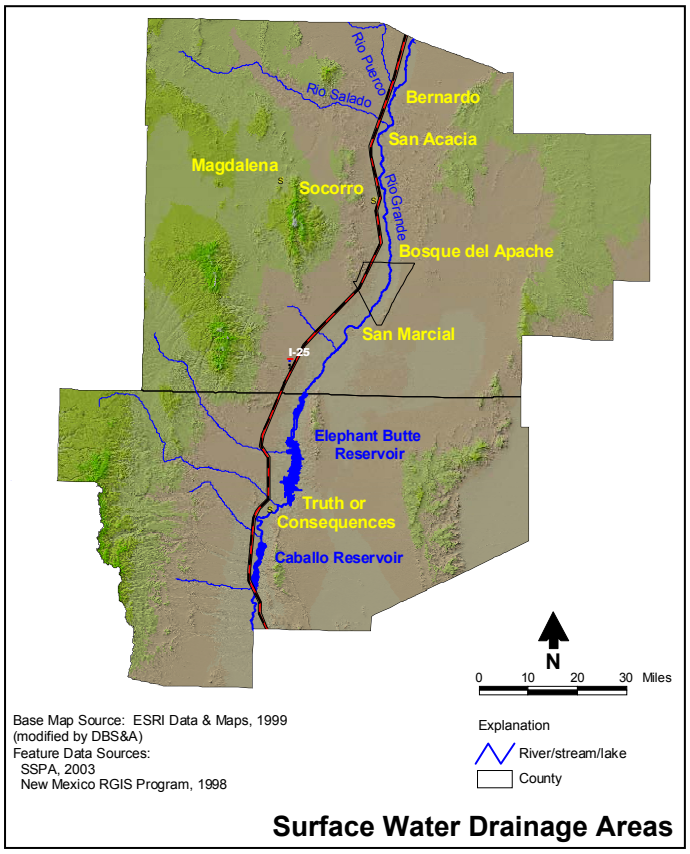


Figure ES-2

To address these questions, this plan discusses both the physical availability of water and the water rights and legal constraints that affect the availability of water, projects future demands for water, and identifies and evaluates alternatives for meeting future demands.

Socorro-Sierra Planning Region

The Socorro-Sierra planning region encompasses all of Socorro and Sierra Counties in central New Mexico (Figure ES-1), covering an area of approximately 11,000 square miles. Elevations

range from about 4,100 feet above mean sea level in the southern portion of the region to over 10,000 feet above mean sea level in the mountains.

Socorro County includes two incorporated areas, Magdalena and Socorro, while Sierra County includes four incorporated areas, Elephant Butte, Truth or Consequences, Williamsburg, and Hillsboro. Socorro, in Socorro County, is the largest municipality in the planning region with a population of approximately 8,900 in 2000, and Truth or Consequences, in Sierra County, is the second largest town with a population of approximately 7,300. The total populations of Socorro and Sierra Counties have doubled over the last 30 years and are currently about 18,100 for Socorro County and 13,300 for Sierra County.

Land ownership within the planning region is primarily a mixture of private, U.S. Forest Service, State of New Mexico, and Bureau of Land Management land, with a large portion of Department of Defense land in the southeast area. Most of the land in the region is used as rangeland, with agriculture taking place near the Rio Grande. Almost 3 million acres of land are held by 403 farms and ranches. Cattle, alfalfa, and chile are the major commodities in the region. The Middle Rio Grande Conservancy District supplies water to farmers along the Rio Grande Valley in the northern part of the region, and Elephant Butte Irrigation District supplies farmers below Elephant Butte Reservoir. The La Joya Acequia Association and several smaller ditch associations are also located within the region.

In addition to agriculture, recreation is a key component of the local economy in Sierra County. Elephant Butte is the largest reservoir and the largest state park in New Mexico, and the mild climate of the area makes this park a popular year-round destination. Elephant Butte Reservoir draws recreational users from New Mexico and from throughout the southwest, and many businesses in the communities of Elephant Butte and Truth or Consequences provide services to these users. Preservation of adequate water to support the recreational industry at Elephant Butte is a key water planning concern for the Socorro-Sierra region.

Legal Issues

One of the most significant legal issues affecting the availability of water supplies in the Socorro-Sierra region is the Rio Grande Compact, which apportions the Rio Grande among

New Mexico, Texas, and Colorado. The Compact requires delivery of a certain amount of water (which varies from year to year depending on annual flows) to each signatory state as the Rio Grande flows downstream, effectively limiting use of the Rio Grande and stream-connected groundwater in New Mexico.

The Socorro-Sierra water planning region lies within the middle and lower sections of the Rio Grande, which are important for Compact accounting purposes. The middle section of the Rio Grande begins at Cochiti Reservoir (north of this planning region) and ends at Elephant Butte Reservoir in Sierra County, and encompasses both the Middle Rio Grande and Socorro-Sierra water planning regions. The lower section of the Rio Grande extends south of Elephant Butte Reservoir and is primarily in the Lower Rio Grande water planning region. As part of the accounting process, the evaporation from Elephant Butte Reservoir is considered part of the depletions in the Middle Rio Grande.

Compliance with the Compact has been an ongoing challenge to the State of New Mexico, and extended drought could make future Compact compliance difficult. When storage in Elephant Butte is less than approximately 400,000 acre-feet (as is currently the case), New Mexico cannot increase the amount of water stored in reservoirs constructed after 1929, including El Vado Reservoir, which is used by the Middle Rio Grande Conservancy District. Although the Compact doesn't represent a legal issue for the region directly, it nevertheless could impact water availability if the State of New Mexico is unable to meet delivery obligations for several years.

Another important legal issue that affects water supplies in the Socorro-Sierra region is the Endangered Species Act. Almost all of the Rio Grande in Socorro County is part of the critical silvery minnow habitat corridor designated by the U.S. Fish and Wildlife Service (USFWS). A critical habitat designation means that all federal agencies are required to consult with the USFWS on any project they fund, authorize, or carry out that may affect the critical habitat. If a federal agency determines that the project will affect endangered or threatened species or designated critical habitat, the agency asks the USFWS to review its action. Proposed projects on state-owned, tribal, or private lands are evaluated only if they involve a federal permit or license, are funded by federal money, or require some other form of federal involvement.

The ability to use water in New Mexico is constrained by the availability of water rights. In the Socorro-Sierra region, surface water is considered to be fully appropriated (i.e., no further water rights are available). The majority of water rights are used by farmers in the two irrigation districts in the region, the Middle Rio Grande Conservancy District and Elephant Butte Irrigation District. Municipalities and other state and federal governmental entities hold state water rights as well. As with all water planning in the State of New Mexico, the prior and paramount rights of the pueblos along the Rio Grande upstream of the region represent a significant unknown in determining future water supply availability. Only a general stream adjudication will determine the rights of all users in the Middle Rio Grande, and this could take many years to complete.

Because the waters of the Rio Grande are fully appropriated, increased demand by the growing communities north of the Socorro-Sierra planning region creates a market for transfer of agricultural water rights from the region. Such transfers have already occurred and applications are presently pending. Evaluation of ways to minimize these transfers is an important component of the *Socorro-Sierra Regional Water Plan.*

Portions of eight declared groundwater basins are located within the region, with part of an undeclared groundwater basin occupying a small portion of the northeast corner of the region (Figure ES-3). Any withdrawal of groundwater from the declared basins requires a groundwater permit from the Office of the State Engineer (OSE). The most important issue in administering the groundwater in the Socorro-Sierra region is the impact of withdrawals on the flows in the Rio Grande.

Surface Water Supply

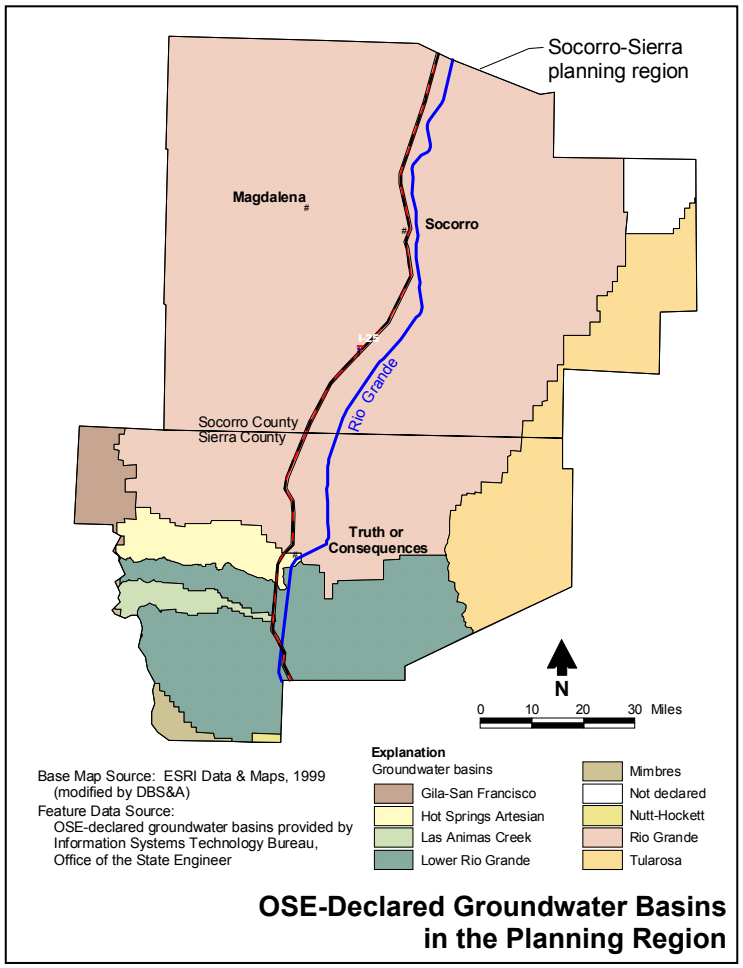
Surface inflow components to the Middle Rio Grande in the Socorro-Sierra planning region include flow from the Rio Puerco, Rio Salado, and ungaged tributaries east and west of the Rio Grande. The Rio Puerco and Rio Salado are ephemeral streams that join the Rio Grande just south of Bernardo and just north of San Acacia, respectively (Figure ES-2).

The surface water supply in the Rio Grande and its tributaries was modeled as part of a larger ongoing ISC surface water study. Surface water flows are highly variable. According to

modeling conducted by SSPA, the mean annual flow on the Rio Grande at the Socorro-Valencia County line is about 245,000 acre-feet per year (ac-ft/yr), after accounting for Rio Grande Compact delivery obligations.

Groundwater Supply

Significant supplies of groundwater are present in the Santa Fe Group and alluvial deposits in the Rio Grande Valley. The OSE conjunctively manages these supplies; that is, it considers the effect of groundwater withdrawals on flows in the Rio Grande. As with surface water, therefore, development of these supplies in the region is limited by the availability of water rights and by the Rio Grande Compact.



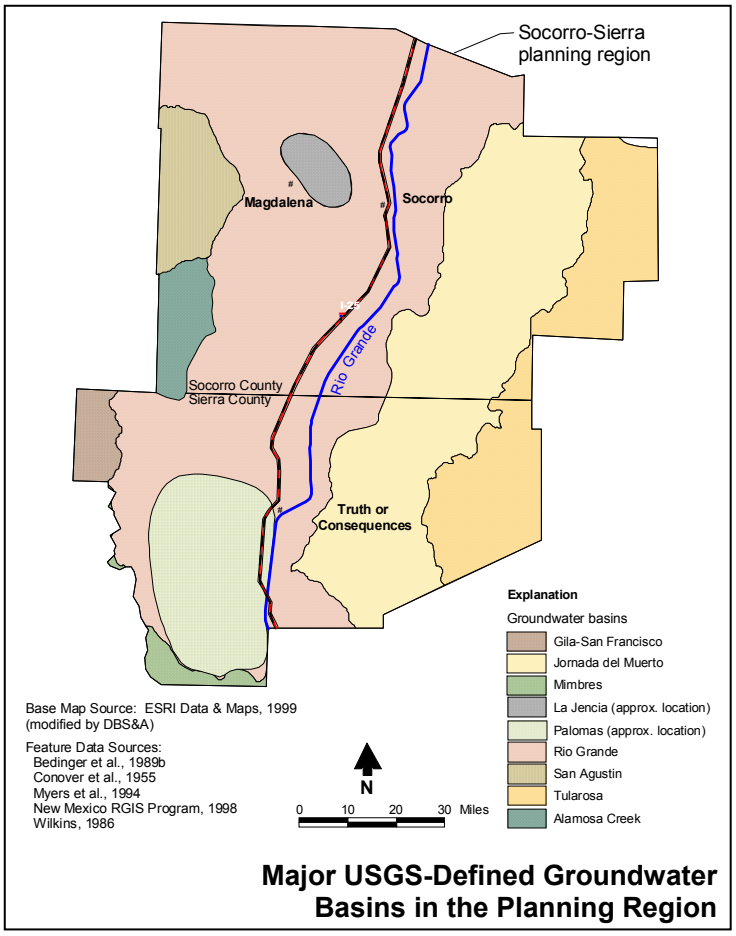
OSE-Declared Groundwater Basins in the Planning Region

Figure ES-3

Because of water rights and Compact limitations on development of groundwater supplies near the Rio Grande, and because these supplies were being considered as part of the ISC water supply study, the groundwater assessment work completed as part of the *Socorro-Sierra Regional Water Plan* focused on groundwater resources that are more removed from the Rio Grande, including the San Agustin, Alamosa Creek, Jornada del Muerto, and Tularosa geologic basins. While the San Agustin, Alamosa Creek, and Jornada del Muerto are distinct geologic basins as defined by the U.S. Geological Survey (Figure ES-4), they lie within the OSE-declared Rio Grande Basin (Figure ES-3). Hence, any additional use of these supplies

will require an OSE permit, which would consider the impact of withdrawals on the Rio Grande. The findings regarding the physical availability of water in these basins are:

- The San Agustin Basin is a topographically closed basin located in Socorro and Catron Counties. Approximately 460 square miles of its 2,000-square-mile area are located within the planning region. The basin contains a potentially significant supply of potable water (about 2.8 million to 21.9 million acre-feet); however, the ability to develop and use this water is constrained legally by the need to obtain water rights to offset impacts to the Rio Grande.



Major USGS-Defined Groundwater Basins in the Planning Region

Figure ES-4

- The Alamosa Creek Basin is located in the west-central portion of the planning region. Approximately 300 square miles of the basin's 400 square miles lie within Socorro County, and approximately 5 square miles lie in Sierra County (its remaining area is in Catron County). This relatively small basin may provide a minor supplemental supply of potable water (about 460,000 to 3 million acre-feet), but is also subject to legal constraints, primarily by the need to obtain water rights to offset impacts to the Rio Grande.

- The Jornada del Muerto Basin is a north-south trending basin lying east of and parallel to the Rio Grande Valley in the eastern portions of Socorro and Sierra Counties. It is more than 120 miles long and ranges in width from 12 to 30 miles; its area is about 2,700 square miles. The basin contains significant quantities of groundwater (approximately 11.5 million to 87 million acre-feet); however, to be suitable for most uses, much of the groundwater would require treatment to remove excess salts. Additionally, any withdrawals that would impact the Rio Grande will require the transfer of water rights.

- The Tularosa Basin trends north-south and lies parallel to and east of the Jornada del Muerto. The basin's total area is 6,500 square miles; however, only two quadrants of the northern portion of the basin, about 950 square miles of total area, lie within the Socorro-Sierra planning region. Sierra County contains approximately 500 square miles of the basin, and Socorro County contains about 450 square miles of the basin's Chupadera Platform highlands. The Tularosa Basin contains small amounts of fresh water (about 2.4 million to 12.9 million acre-feet), primarily in alluvial fans located in the southern part of the basin within the Socorro-Sierra planning region.

In summary, though significant quantities of groundwater are present in the region, use of the water is constrained in some locations by water quality issues and, especially in areas near the Rio Grande, water rights. In addition, not all of the water in storage can be economically withdrawn, and if withdrawal rates are too high, ground subsidence might occur.

Water Demand

To project expected future water demands, an estimate of future population growth in the planning region is needed. Accordingly, a detailed demographic study was undertaken for the Socorro-Sierra planning region to help project future population trends. Using standard demographic projection models calibrated against historical data, high-, middle-, and low-range estimates for population trends between 2000 and 2040 were developed. These projections show that the human population in the planning region is expected to grow on the order of 70 percent over the next 40 years to reach approximately 60,000 in 2040.

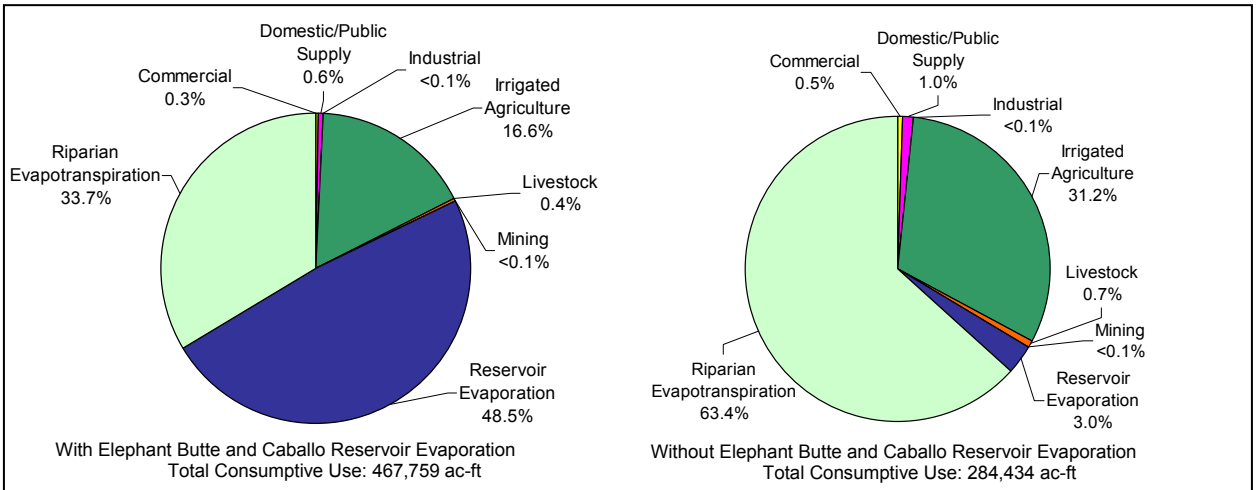
Current water demands were analyzed for the water use categories identified by the OSE. In addition, because such a large proportion of the overall depletions in the planning region are from riparian habitat, riparian evapotranspiration was also evaluated. The water use categories considered are:

- Public supply (both municipal and rural)
- Self-supplied domestic
- Irrigated agriculture
- Livestock
- Commercial
- Mining
- Industrial
- Power
- Reservoir and open water evaporation
- Riparian evapotranspiration

The relative percentages of water use within the region, both with and without Elephant Butte and Caballo evaporation, are shown on Figure ES-5. Because Elephant Butte and Caballo Reservoirs serve many users, most of whom are outside the planning region, it is useful to consider the demands both with and without the Sierra County reservoir evaporation.

Over the study period (from 1975 to 2000), water uses for all of these categories were relatively stable except for municipal and rural public water systems, which exhibited slow growth in line with historical population growth. As expected, surface water and groundwater depletion for irrigated agriculture varied from year to year (presumably in concert with annual precipitation variability), but no clear increasing or decreasing trends were apparent in water use data for this category. Current demand and expected future trends in the primary water use categories in the region are as follows:

- A total of 3,900 ac-ft/yr is currently used to meet municipal, commercial, and domestic needs, and this demand is expected to grow by 5,200 ac-ft/yr to 9,100 ac-ft/yr in 2040.



2000 OSE Water Use and Riparian Evapotranspiration in the Planning Region

Figure ES-5

- Agricultural diversion demands are about 200,000 ac-ft/yr, or 78,950 ac-ft/yr consumptive use, 96 percent of which is derived from surface water. Irrigated agriculture is projected to remain consistent with current levels over the 40-year planning period.

- Livestock uses about 3,200 ac-ft/yr and is not expected to increase over the next 40 years.

- Reservoir evaporation varies from year to year depending on the surface area of the reservoirs, ranging from about 100,000 ac-ft/yr to almost 300,000 ac-ft/yr.

- Riparian evapotranspiration is estimated to deplete about 160,000 ac-ft/yr in the planning region.

Ability of Supplies to Meet Demand

The estimated water supply available to the region and the projected demand were compared to assess the ability of the supply to meet demand in the future. An overall reconciliation of supply and demand (called a water budget) for the Rio Grande Basin is provided in Figure ES-6. The inflows and depletions shown on the figure are based on results of modeling conducted by

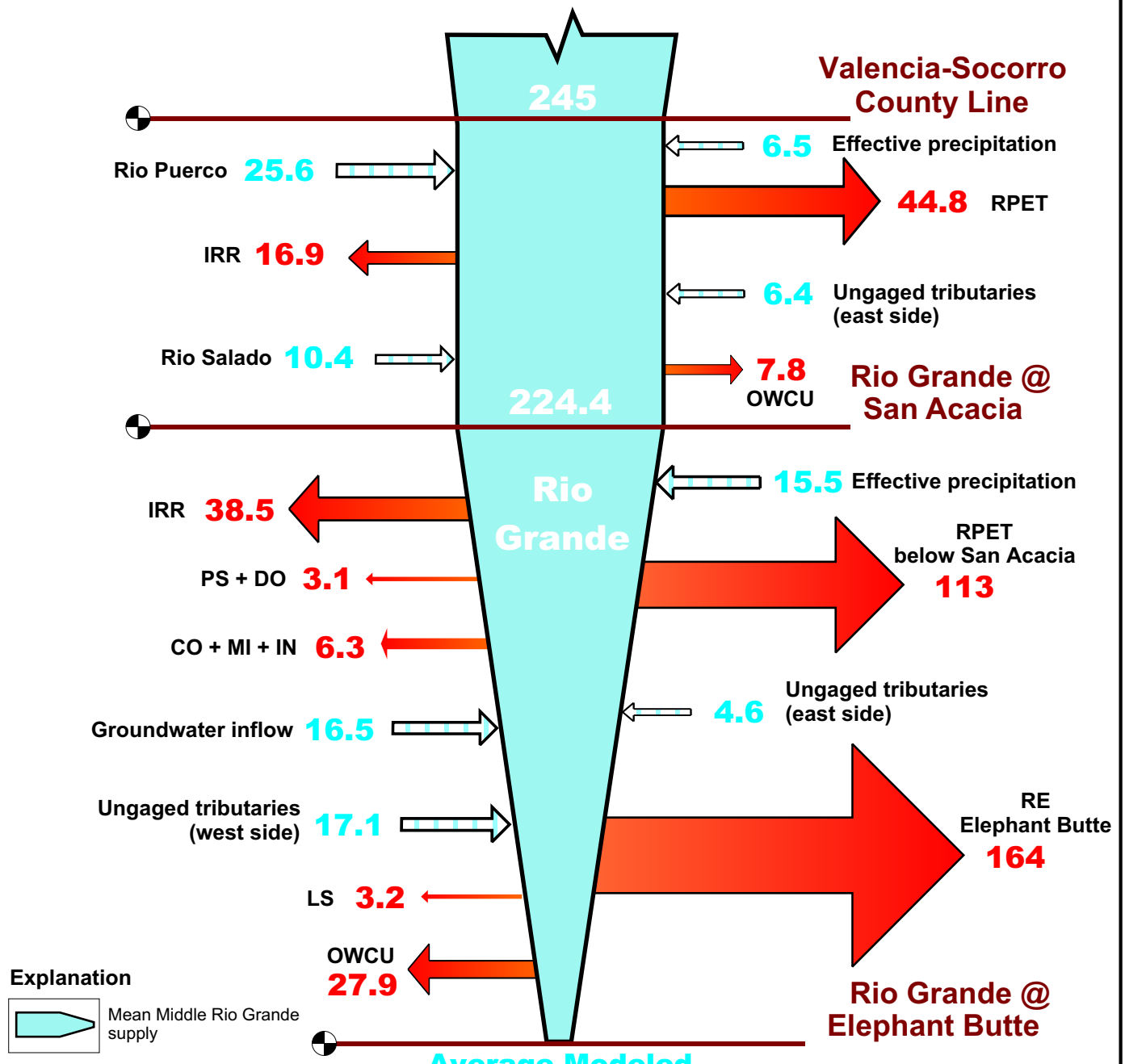
SSPA using current water supply conditions and water demand estimates developed for the region. The water supply to the Rio Grande Basin is comprised of flows in the Rio Grande itself together with connected groundwater and tributary inflows (the inflows shown in Figure ES-6 have been corrected to account for depletions upstream of the region and for Compact delivery requirements). Demands from both human and natural (i.e., riparian evapotranspiration) processes deplete those supplies, and full satisfaction of all demands would result in a net mean modeled deficit (i.e., demand is greater than the available supply) of approximately 77,900 acre-feet per year.

In addition, the water budget shown in Figure ES-6 represents only the average annual budget; actual supply varies greatly from year to year. For example, in drought years, demands exceed supplies by even greater amounts, and if upstream storage is not adequate, downstream delivery obligations cannot be met without more severely curtailing uses. Results of modeling conducted by SSPA indicated that in a low-flow year (10th percentile year, or year with annual flow lower than 90 percent of all annual flows measured over the long-term), the supply falls short of meeting demand by 194,000 acre-feet.

Based on the water budget developed for the Rio Grande, as well as water supply and demand information compiled for outlying basins, the following conclusions were reached:

- The Rio Grande, including the aquifers that are connected to this river, is a fully appropriated system. Endangered species and Rio Grande Compact obligations place significant constraints on the system. Though demands in the region have mostly been met with available supplies on the Rio Grande, this condition will change over multi-year drought periods, such as the one currently ongoing, when upstream storage is insufficient to supply the needs of all the users on the Rio Grande.

Natural depletions, including riparian evapotranspiration and reservoir evaporation from Elephant Butte Reservoir account for more than 75 percent of the total depletions in the Rio Grande basin portion of the Socorro-Sierra water planning region. Much of these depletions are downstream of the major water users in the region, and reductions in the depletions would therefore not directly benefit the region. However, the region would benefit indirectly from



Explanation

- Mean Middle Rio Grande supply
- Inflow (tributaries and groundwater)
- Depletions (crops, riparian evapotranspiration, reservoir evaporation, and urban)

CO	Commercial
MI	Mining
PS	Public water supply
DO	Self-supplied domestic
RE	Reservoir evaporation
RPET	Riparian evapotranspiration
IRR	Irrigated agriculture
LS	Livestock
OWCU	Open water consumptive use
IN	Industrial

Notes:

1. Values represent average annual flow in thousands of acre-feet per year.
2. Riparian evapotranspiration depletions based on USBR ET toolbox data, as reported by SSPA (2003); agricultural and evaporation depletions from SSPA (2003); other depletions based on year 2000 data.
3. Rio Grande flows represent simulated flows minus Compact obligations derived from risk model output (SSPA, 2003).
4. Model addresses the regional supply from the Socorro County line to Elephant Butte Reservoir. Irrigation from Elephant Butte Irrigation District is not included.
5. The modeled obligation deficit is based on full satisfaction of demands under current supply conditions. Negative number indicates that Compact requirements will not be met without changes to the supply/demand regime.

SOCORRO-SIERRA REGIONAL WATER PLAN

Rio Grande Basin Average Annual Water Budget in Socorro-Sierra Planning Region

Daniel B. Stephens & Associates, Inc.
12-15-03 JN 9469

Figure ES-6

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reductions in the natural depletions, because to the extent that more water is available to meet Compact delivery and endangered species obligations, supplies for users within the region will be more secure.

- Based on the results of the probabilistic water budget modeling, the available water supply is not adequate to meet all demands in dry to average years, and either reduced demands, storage from wetter years, improved water supply management, or development of new resources will be required to address the needs of the region and to ensure Compact compliance.

- Groundwater resources that are connected to the Rio Grande have not been fully developed; that is, increased groundwater pumping from these resources is physically possible. However, development of stream-connected groundwater is constrained by water rights: to increase depletions of groundwater, water rights must be transferred from existing surface water or groundwater resources.

- There may be some opportunity for development of groundwater resources in areas that are farther away from the Rio Grande. For the San Agustin Basin, the Jornada del Muerto Basin, and the Tularosa Basin, groundwater recharge and storage estimates suggest that small quantities of water could potentially be developed without adverse impacts. However, site-specific evaluations of potential impairment and connection with the Rio Grande would be required. Additionally, the undeveloped nature of these basins and their large distance from major water users suggest that development of these supplies would be challenging.

Alternatives for Meeting Future Water Demand

The Steering Committee identified 44 alternatives that could help to close the gap between water supplies and projected demand in the region. These alternatives were classified by the Steering Committee into seven categories:

- Increase or preserve water supply

- Implement conservation plans and programs
- Reduce urban and agricultural water demand
- Improve water-use efficiency and management
- Maintain or improve water quality
- Plan for future growth
- Implement legal, institutional, and economic improvements to water use and management

Based on a thorough scoring and review process, the Steering Committee identified key alternatives for the region:

- *Agricultural water conservation.* Agriculture is a large use sector in the region, and efforts to use agricultural water efficiently are becoming increasingly important. During drought periods in particular, the region can benefit by being able to more efficiently deliver water to crops. The region considered alternatives related to improving conveyance efficiencies, improving on-farm water management, and controlling brush and weeds along ditches. A comprehensive water conservation plan was developed and is appended to the regional water plan.

- *Reduction in riparian evapotranspiration and open water evaporation through removal of exotic species and improvements to the Elephant Butte delta.* Because riparian evapotranspiration and open water evaporation are such large components of the region's water budget, significant savings can be made through these programs. Alternatives considered included removal of exotic vegetation throughout the region, as well as a specific alternative that focused on reducing evaporative losses in the Elephant Butte delta. Though the savings from these alternatives will not result in new water rights that are available for use within the region, they indirectly benefit the region, because to the extent that more water is available to meet Compact delivery and endangered species obligations, supplies for users within the region will be more secure.

- *Encouraging retention of water rights in the region.* A key issue throughout the Socorro-Sierra planning process has been the need to protect the local economy and values from

impacts that could result from transfers of large quantities of water rights out of the planning region. The ability to prevent condemnation of water rights, which could also protect against out-of-region transfers, was also evaluated.

Other alternatives considered in the plan include alternatives that address issues related to managing watersheds to increase yields, adopting and implementing local water conservation plans and drought contingency plans, identifying and protecting areas vulnerable to contamination, ensuring viable supplies for new development, and developing economic potential for non-native species removal. In addition to the priority alternatives evaluated in the regional water plan, recommendations and implementation priorities were provided for all 44 alternatives.