



## **Executive Summary**

The population in the Jemez y Sangre Water Planning Region, which includes Española, Los Alamos, Santa Fe and surrounding areas, has reached the point where the demand for water may exceed available supply during years of average precipitation. During drought years the demand does exceed the supply, particularly for systems that rely on surface water. The cumulative pressure of domestic wells and high-capacity public wells is causing water tables throughout the region to decline. Meanwhile, expectations for obtaining municipal water supplies from river diversions have been compromised by drought. Santa Fe, the largest city and primary job center of the region, has imposed increasingly strict water conservation measures on its citizens. Concurrently, population growth in other parts of the southwestern United States has increased the pressure on limited supplies and raised concerns that water in the Jemez y Sangre region could be exported unless the region's future supply and demand is defined through regional water planning.

These issues helped motivate stakeholders to participate in regional water planning for the Jemez y Sangre region. The droughts that occurred in 2000 and 2002, during the Jemez y Sangre planning process, provided a new sense of urgency in the effort to better understand the balance between supply and demand for water. These droughts also helped to highlight the importance of answering questions such as: How can the region find or save enough water to meet the expected population growth in the next century? How much can conservation or growth management contribute toward reducing demand? How would the agricultural community be impacted if water is transferred to municipal use? Addressing these questions is the focus of the Jemez y Sangre Regional Water Plan.

### **The Purpose of Regional Water Planning**

Regional water planning in New Mexico began with a 1987 federal court ruling that New Mexico could not prohibit the out-of-state transfer of its groundwater unless it actively and effectively planned for its water future. With legislative authority, the New Mexico Interstate Stream Commission established 16 planning regions and charged each with writing a regional water plan.





The Jemez y Sangre Water Planning Region is one of the most diverse in New Mexico, covering all or parts of 3 counties, 2 incorporated municipalities, all or part of 8 Pueblos, a multitude of historic and traditional villages, and some of the fastest growing areas of the state. The Jemez y Sangre Water Planning Council (JySWPC), formed in 1998, consists of representatives from 24 diverse entities, including all the local governments, several state and federal government agencies, water and soil conservation districts, acéquia associations, and interested environmental, business, and technical groups. Representatives of the Pueblos within the region participate as observers.

The central waterbody in the region is the Rio Grande, which enters the region at Embudo, collects runoff from the Sangre de Cristo and Jemez mountain ranges, and exits the region at Cochiti Lake. The Rio Chama enters the region from the northwest, bringing with it central New Mexico's share of water from the San Juan-Chama Project, which captures part of New Mexico's share of the Colorado River. Approximately midway between Embudo and Cochiti Lake is the Otowi Gage. This gage represents a boundary that helps establish New Mexico's Rio Grande water delivery obligations to Texas, as defined by the Rio Grande Compact.

Population growth amplifies the demand for water. The City of Santa Fe and areas of Santa Fe County near the city are among the fastest growing areas in the state. These areas are expected to experience most of the region's growth during the planning period, which extends to 2060.

The purpose of the Jemez y Sangre Regional Water Plan is to assess the available supply of clean, usable surface water and groundwater, to determine the present and future demand for water, and to identify methods for meeting the projected demand through conservation, management, and/or acquisition of water or water rights. The plan has been deliberated over, reviewed, and completed through a process of public participation and technical evaluation. After submission to and acceptance by the Interstate Stream Commission, it will be distributed to public and private water managers so that they can consider and implement the various alternatives as appropriate.





## **Public Welfare: The Guiding Philosophy**

In addition to considering technical issues, the JySWPC was responsible for understanding how water planning relates to the public welfare of the region. Through its membership and a series of public meetings, the Council members gathered input about what constitutes public welfare in the region and ultimately drafted a public welfare statement to represent the philosophy that guides the plan. This statement, the full text of which is provided on the following page, celebrates the rural and wildlands character of north-central New Mexico. It declares that sustainable use of water is a desired goal, cites economic sustainability as an important objective, and calls for preservation of water quality. It insists on water planning in the context of respect for water rights and property rights, especially the senior rights of the Pueblos and acequias. It calls for open, collaborative decision-making in the process.

## **Technical Approach: Determining Available Supply and Projected Demand**

The most critical aspect of water planning is to understand the current availability and present uses of water, and how usage might change over time in conjunction with increased population and economic activity. This plan details the amounts of water used by various sectors, and quantifies water use by diversion type, such as surface water, groundwater, and domestic wells.

The region was divided into ten sub-basins for the purpose of evaluating the hydrogeology and population data. Through the consolidation of technical and demographic data, the Jemez y Sangre WPC developed water budgets for each of the sub-basins in the region, summarized current and projected uses, and compared projected demands to the amount of water available. Finally, to summarize possible alternatives for addressing the projected supply/demand gap, the sub-basins were grouped into five subregions, as shown in Figure ES-1:

- Northern Subregion (Velarde, Santa Clara, and Santa Cruz Sub-Basins)
- Aamodt Subregion (Tesuque and Pojoaque-Nambe Sub-Basins)
- Santa Fe Subregion (Santa Fe, Caja del Rio, and North Galisteo Sub-Basins)
- Los Alamos Sub-Basin
- South Galisteo Sub-Basin





## PUBLIC WELFARE STATEMENT FOR JEMEZ Y SANGRE REGION

Water is the element that interconnects all people and their environment in the Jemez y Sangre region, and the region to the larger environment that is the earth. Every person living in the region expects enough water for basic needs, and every person has the responsibility to protect water resources and use their share wisely. Using the best possible information, water planning and decision making should balance diverse needs and reflect the values of the region.

### Rural and Wildlands Character

Residents of the Jemez y Sangre region place great value and importance on the preservation of the rural character of the region. Urban and rural residents alike appreciate and wish to maintain the historic, agriculture-based communities, rural vistas, wildlife habitat and attributes of natural landscapes including rivers, streams and trees.

### Water Sustainability

Residents understand that the history of the region reflects water scarcity and cycles of drought. It is a high priority of residents of the region to serve current and future human needs without long-term depletion of the available water supply, while maintaining acceptable water quality and healthy interdependent ecological systems. Sustainability requires a combination of efforts, including encouraging conservation and efficiency by all sectors at every scale, discouraging activities that deplete or degrade the water supply, planning for population growth and land use, seeking new water sources that do not impair other regional values, and improving the use of existing water supplies.

### Economic Sustainability

Each sub-region has unique economic needs and conditions that depend on the availability of water. It is important to have quality jobs and a healthy economy in order to maintain a good quality of life in the long term.

### Water Quality

Water quality is a significant consideration in the region's water supply. In many sub-basins, the available groundwater has been compromised by contamination, either human caused or natural. Wastewater treatment and reuse of treated water should be expanded throughout the region. The available water should be protected from potential contamination from the impacts of human activities or natural events.

### Rights and Responsibilities

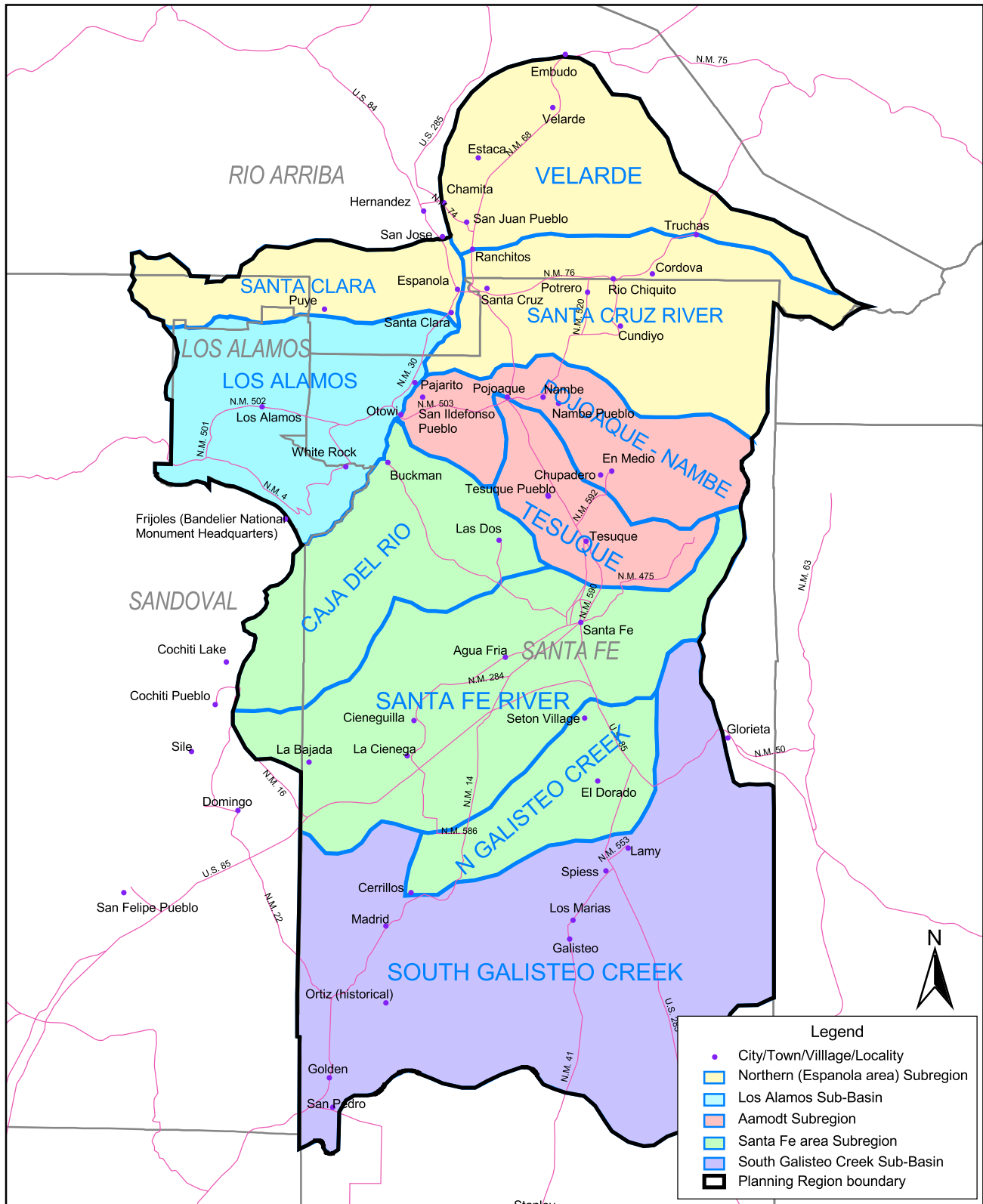
Water planning must be carried out in a context of respect for water rights and property rights. Like all rights, the right to use water, especially in an arid region, is married to the responsibility to use water efficiently and wisely. The Jemez y Sangre region respects the senior water rights of the pueblos in the region and recognizes pueblos' tribal sovereignty.

### Decision Making

In this demographically and geographically diverse region, it is necessary for all governmental and private entities to work together to achieve the goal of a balanced and sustainable water future. Fostering healthy, vibrant communities requires a commitment to open, inclusive dialogue and decision making.



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JEMEZ Y SANGRE REGIONAL WATER PLAN  
Jemez y Sangre Subregions





Water planning and management is affected by numerous municipal, state, tribal, and federal laws that protect water quality and control the transfer, use, and quantity of diversions. Accordingly, the legal issues that affect the management of water resources in the region were considered in the evaluation of supply, demand, and alternatives for meeting that demand.

## **Measuring Supply: Water Resources and How They Are Used**

A major task in the development of the Jemez y Sangre Regional Water Plan was the quantification of water resources in the region: where water comes from, how it travels through streams and rivers, and how it percolates into the ground. To develop these estimates, the JySWPC contracted with Duke Engineering & Services to conduct a water supply study, the findings of which were incorporated into the regional water plan.

### ***Surface Water***

The region's surface supply comes from two main sources: (1) the Rio Grande and Rio Chama, which flow into the region from the north and (2) tributary streams derived from melting snow from the higher peaks that flank the region on the east and west. Most regional surface water is used for agriculture, although the City of Santa Fe receives about 40 percent of its water supply from snowmelt and other precipitation that is captured in dams in the Santa Fe River watershed above the City. A significant amount of the surface water in the region evaporates directly into the atmosphere or indirectly through transpiration from vegetation.

Two efforts are underway, one led by the City of Santa Fe and Santa Fe County, and the other by the City of Española, to construct diversion structures on the Rio Grande. These structures would allow the lead entities to directly capture their respective shares of water from the San Juan-Chama Project. Other entities in the region with rights to San Juan-Chama Project water are Los Alamos County, the Pojoaque Valley Irrigation District, and San Juan Pueblo.





## **Groundwater**

Groundwater provides most of the water used by municipalities, unincorporated subdivisions, private homes, and many businesses in the region, and also provides a small amount of the water used for irrigated agriculture. The City of Santa Fe, Española, and Los Alamos County all operate well fields, as do smaller or unincorporated communities such as Eldorado, south of Santa Fe. Significant pumping has caused water tables to decline in some aquifers. In some cases this has resulted in dry wells, dry springs, and other supply problems.

Groundwater occurs throughout the region in a number of distinct geologic formations. Some formations are thick aquifers with substantial storage, while others are thin and yield only small amounts of water because of specific geologic conditions.

## **Water Usage in the Region**

In the Jemez y Sangre Water Planning Region, 70 percent of the water is used for agriculture and 30 percent is used for municipal, domestic, and industrial purposes. Surface water provides 98.8 percent of the supply for irrigation diversions, with the remainder coming from groundwater. Groundwater provides about 80 percent of the municipal, domestic, and industrial uses; the remaining 20 percent is diverted from surface water (Santa Fe River for the City of Santa Fe). Domestic wells produce about 35 percent of the groundwater diversion for municipal and domestic uses.

Most irrigation occurs in the Velarde, Santa Cruz, and Pojoaque-Nambe Sub-Basins, with lesser amounts in the Santa Clara, Tesuque, Santa Fe River, and South Galisteo Sub-Basins.

## **Measuring Demand: Demographics**

As population increases in the region, the demand for water will increase. Population growth is a function of the rates of births, deaths, in-migration, and out-migration. For a projection of what the population would be in the future based on recent demographic trends, the JySWPC turned to the University of New Mexico's Bureau of Business and Economic Research, which projected





a “most-likely” population and a “low” growth projection for the region. A deliberate effort was made not to constrain the projections by making assumptions about water or land availability or possible policy changes that would change the projection, as it is important for decision makers to understand what would happen if constraints are not imposed. Actions to constrain population were the focus of an alternative studied later in the planning process.

Although the population of the Jemez y Sangre region nearly doubled from 1970 to 2000, population growth is projected to slow in the first half of this century because of an increasing median age and a declining fertility rate. Based on the most-likely projection, the population of region is projected to increase from about 160,000 in 2000 to about 360,000 by 2060. The projected net in-migration for Los Alamos and Rio Arriba Counties is negative, whereas the projection for Santa Fe shows a positive net in-migration, accounting for 40 to 60 percent of growth in the sub-basins within Santa Fe County. While the Santa Fe Sub-Basin accounts for more than half of the population in the region in the year 2000, its relative percentage will shrink by 2060.

### **Summing it Up: Present and Future Water Demand and Uses**

Demand projections provided in this plan focus on municipal, industrial, commercial, and domestic use. In terms of the amount of irrigated acreage, the regional trend in agriculture in the region is downward. Therefore, an increase in the number of agricultural acres was not projected and the amount of water used by irrigation was assumed to remain constant. In general, water diverted for agricultural uses is not measured (metered) or monitored. Combined with a lack of adjudication, this results in uncertainty about the how much wet water is actually being used for irrigation, the amount of acreage in production, and the amount and priority dates of water rights.

Future nonagricultural water demand was estimated based on the projected population multiplied by the average per capita usage, assumed to be 0.15 acre-feet per person per year (approximately 134 gallons per day) for each sub-basin except the Santa Fe Sub-Basin. For Santa Fe, a multiplier of 0.183 acre-foot per year (approximately 163 gpcd) was used for populations supplied by the municipal system and approximately 0.10 acre-foot was used for







those served by domestic wells. Using these calculations, the nonagricultural demand for water in 2060 is projected to be 31,500 acre-feet per year greater than the current demand. Based on projected growth, demand would be most concentrated in the Santa Fe, North Galisteo, Tesuque, Santa Cruz, and Nambe-Pojoaque Sub-Basins.

### **General Findings: The Heart of the Matter**

The availability of water in the Jemez y Sangre region is critical for the future quality of life, social stability, and economic health of regional residents. This plan takes a longer view than the usual 40-year planning horizon utilized by the New Mexico Office of the State Engineer by projecting supply and demand to the year 2060. This plan focuses attention on both (1) the problems related to meeting current demands with existing supplies and (2) addressing the projected gap between supply and demand. The JySWPC offers the following general findings in support of the recommendations put forth in this plan.

### **Findings Related to the Vulnerability of Water Supply**

- The amount of water diverted from groundwater in some areas is much greater than the recharge rate, resulting in water level declines.
- Surface water, which comprises 74 percent of the water supply to the region, is vulnerable to drought, watershed health degradation, and secondary effects following catastrophic fires.
- In most years water supplies are insufficient to entirely fulfill all existing surface water rights in the region. Therefore, communities that are planning to utilize surface water to meet demands will be vulnerable most years without a contingency plan.
- Water supplies are vulnerable to water quality degradation resulting from catastrophic fire, septic tanks, or other contaminant sources.





- Evaluation of sustainability and development potential of groundwater resources within the region would benefit from a better understanding of the hydrogeology and a regional numerical groundwater and surface water model that is acceptable to all parties.
- Determination of seniority and quantity of water rights is not possible in the absence of adjudications. Until adjudications are complete, innovative solutions that require quantification of water rights for analysis and implementation cannot be pursued.
- Domestic wells divert an estimated 7,700 acre-feet from the region (based on a per capita demand rate) supplying 35 percent of the water supply for municipal/domestic needs in the region. In some areas, domestic wells are affecting surface water supplies and senior water rights holders.

#### **Findings Related to the Projected Gap Between Supply and Demand**

- Under current trends, the population in the region is projected to potentially increase from 160,000 in 2000 to 360,000 people in 2060.
- Population growth of an additional 200,000 people would increase residential and commercial water demand by 31,500 acre-feet per year at current per capita water demand rates. This represents an average gap, with more severe shortfalls expected in drought years.
- The available San Juan-Chama water with return flow credits cannot meet the entire projected increase for the region, even if the maximum contracted firm yield is available. In the most optimistic assessment, existing San Juan-Chama contracts would meet only 40 percent of the projected gap; therefore, additional alternatives must be pursued.
- Meeting the remaining increased municipal/industrial water demand with agricultural water rights may have negative public welfare implications if the transactions do not take the needs of the region's communities into consideration.





- The quantity of water rights that may be for sale from agriculture is not known. However, to meet 50 percent of the projected gap of 31,500 acre-feet per year in 2060, approximately 60 percent of the agricultural land within the region, or 10 percent of the agricultural land within the Middle Rio Grande Conservancy District, would have to be retired. A greater percent of land likely would need to be retired or their water rights leased to account for the vulnerability during drought periods.
- The projected gap between supply and demand cannot be entirely eliminated through conservation.
- Reduction of the projected increase in demand of 31,500 in 2060 by 50 percent could be achieved by eliminating all outdoor watering with potable water by all residents. Such severe conservation measures may be detrimental to public welfare of the region. A reduction in the projected increase in demand of 25 percent could be achieved with less severe compromises to the quality of life.
- The projected gap between supply and demand cannot be entirely eliminated through growth management.
- Growth management, if successfully implemented, could reduce the projected increase in demand of 31,500 acre-feet by 2060 by as much as 50 percent, but this may only shift the growth from one area to another if not implemented consistently throughout the region. Growth management may have negative public welfare effects and is difficult to implement.

## **Evaluating Alternatives: Informed Collaboration**

In February 2001, the Alternatives Subcommittee of the JySWPC, composed of Council members and over 20 citizens from Velarde, Española, Tesuque, Galisteo, Santa Fe, and Los Alamos, developed a system of evaluating and ranking alternatives that were suggested by the public to protect and restore water resources, improve efficiency, protect against drought, and fill the gap between supply and projected demand. The committee organized an innovative





workshop, called a charrette, that brought together experts in hydrology, law, economics, engineering, land use planning, agriculture, and other disciplines to begin evaluating the feasibility of the alternatives with regard to a variety of aspects. The committee evaluated and identified alternatives aimed at closing the actual supply/demand gap and those aimed at stabilizing and preserving existing water supplies.

## **Tough Decisions: Closing the Supply/Demand Gap**

A Council subcommittee developed four scenarios that could be used to close the supply/demand gap. These scenarios were aimed at focusing attention on key policy questions that will have to be addressed by government leaders in order to fulfill the future demand for water. This focus on the broad policy directions led to an informed debate and deliberation by the JySWPC. All identified scenarios assumed that the contracted San Juan-Chama water with return flow credits would be utilized, but focused on one or more additional approaches to close the gap. The four scenarios are:

- Emphasizing water conservation to reduce projected demands
- Emphasizing growth management to reduce projected demands
- Emphasizing acquisition of agricultural water rights
- Emphasizing a combination of the above three scenarios along with leasing of Jicarilla Apache San Juan-Chama water

Following public meetings during which these scenarios were presented to people throughout the entire region, options were developed at the subregion level to reflect more specific conditions. The analysis of these options clearly demonstrated that the water supply/demand gap cannot be met entirely with San Juan-Chama water or through conservation or growth management. A combination of alternatives must be pursued, all of which have public welfare implications. Decision makers are called upon to strike the appropriate balance between the tough decisions that face the region.

Rather than dictating how local water supply problems should be addressed, the JySWPC developed option charts for each of the subregions so that decision makers could develop





scenarios to suit their own particular conditions and priorities. These option charts, outline the available alternatives and indicate the degree to which each alternative can be used to meet the projected gap. However, the options charts provide only a simplistic representation of the available alternatives and do not depict the complexities and interconnections among alternatives.

Subregion scenarios were developed to illustrate a combination of alternatives that could be used to meet the projected demand gap under both average and drought conditions during each decade of the planning period. Two known drought cycles were used to build the scenarios for each of the subregions. In addition, the subregion scenarios all rely on the population projections and water supply estimates developed as part of the planning process. All scenarios include projections showing that less surface water, including include San Juan-Chama Project water, would be available during a drought. This should be kept in mind as some potential approaches to closing the supply/demand gap, which include purchasing (surface) water rights from agricultural interests for municipal domestic and industrial uses, will be vulnerable to drought.

## **Recommendations: Roadmap for the Future**

The JySWPC adopted the following recommendations for the implementation of the Jemez y Sangre Regional Water Plan. The first two recommendations, which are unnumbered, have overarching impacts on the implementation of the remaining numbered recommendations. The numbered recommendations are grouped into five categories. Recommendations under Categories I, II, and III describe actions that address management, protection, and restoration of water supplies, none of which will result in new wet water rights. Recommendations under Categories IV and V describe actions that will address the projected water supply/demand gap.

The implementation of recommendations under Categories I through III will depend on appropriate staffing or funding from regulatory and natural resource management agencies and/or local governmental entities. The Jemez y Sangre Regional Water Plan does not specifically detail how communities should close the projected gap between supply and demand as discussed under Categories IV and V; instead, it provides options that communities can





implement to close this gap. Communities with a projected gap that cannot be closed with a moderate level of conservation and/or the use of San Juan-Chama Project water will have to use measures that may impact public welfare of the region. These impacts may include:

- Impacts to quality-of-life, if more severe conservation measures are implemented
- Private property rights, if growth management measures are pursued
- Degradation of the rural character of the region, if water rights are transferred from agriculture to urban use

To minimize public welfare impacts to communities, municipalities with the greatest projected demands should consider developing partnerships with agricultural communities. These partnerships could be used to foster transactions that minimize negative impacts to the region. An example of this type of partnership/transaction is the funding of conservation measures (e.g., lining of irrigation ditches or leveling of fields) that would reduce agricultural demands and transfer “saved” water to urban uses. Careful study of irrigation systems and the current fate of “lost” water would be required to determine the efficacy of such a plan. Adjudication of water rights would be desirable before such a plan is implemented to determine the value and risk or vulnerability of the water rights transaction. Other partnerships/transactions may involve the transfer of agricultural water only during times of drought or working with communities that no longer have agrarian-based economies.

The Category I through V recommendations were developed from white papers that were presented at the planning charrette. These white papers detail the technical, legal, and estimated costs of the various alternatives and discuss how these alternatives might be implemented. The JySWPC has indicated which recommendations it intends to pursue as a council. Entities within the region need to first set their own priorities and then pursue appropriate recommendations alone or in combination with partners. Each community or water utility should conduct a feasibility study to prioritize planned water projects and to weigh the cost benefits and other implications of various alternatives.

Many of the recommendations presented below are either underway or under consideration, as evidenced by the results of the water system survey conducted by the JySWPC. For example,





demand reduction may already be occurring due to land use ordinances implemented by Santa Fe and Rio Arriba Counties, or through conservation efforts by the City of Santa Fe.

***Recommendation: Create Advisory Boards***

Water advisory boards should be established for areas with specific mutual interests. These boards would serve as a foundation for pursuing the implementation of the recommended alternatives under Categories I through V. The JySWPC will serve as an interim committee to help move this process forward and will act as an advocate for recommendations. As indicated below, workshops will be held to develop strategic plans and to develop funding approaches for implementation of some of the regional alternatives. Most alternatives will need to be pursued by individual communities or through partnerships. Actions such as reducing the use of septic tanks and domestic wells by providing regional services may best be implemented through a water advisory board or other mechanism.

***Recommendation: Adjudicate Water Rights***

Adjudication of water rights, presently underway by New Mexico Office of the State Engineer (OSE), should be expedited to better define the water rights in the region, including those rights not presently being put to use. Quantification of water rights and determination of priority dates impact many of the recommendations discussed below. For instance, the development of drought contingency plans, discussed in Recommendation 20, is impacted by the priority dates of water rights held or leased by communities. If water banking is part of the drought contingency plan, the vulnerability of the leased water during a drought must be understood. The transfer or lease of water rights, subject to Recommendation 24, is impacted by the determination of whether or not the right has been put to beneficial use. While the lack of adjudication does not prevent such a transfer, it does result in uncertainty in determining the relative value and vulnerability of the water right during drought periods. In addition, adjudication of the water rights above the Otowi Gage would help New Mexico determine if water rights based on the 1929 condition of the Rio Grande Compact are being used.





### **Category I: Recommended Actions to Protect Existing Supplies**

1. *Restore watersheds.* Pursue restoration of piñon-juniper, ponderosa pine, and higher elevation vegetative zones (e.g., mixed conifer) to reduce risk of catastrophic fire and severe erosion and subsequent filling of reservoirs with sediment and debris. Watershed restoration may also improve overall ecosystem health, reduce runoff during high intensity storms, prolong duration of flow in ephemeral and intermittent streams, increase annual yield of surface flows, establish healthy riparian areas, and improve water quality.

Some watershed projects are presently underway in various areas of the Jemez y Sangre region. To help initiate additional projects, the JySWPC will convene a workshop to develop strategies for creating partnerships and seeking funding for this alternative.

2. *Manage storm water to enhance recharge.* Develop municipal or county procedures and/or projects that capture storm water to enhance aquifer recharge and minimize erosion. Much of the moisture in the region results from high intensity rainfall events. Under historical natural conditions, this moisture was released slowly through runoff or recharge. However, with the increasing surface area of roads, parking lots, and roofs, precipitation moves into storm drainage systems much more quickly. Actions that reduce runoff velocity will enhance recharge to aquifers and reduce erosion in acéquias and streams.

Municipalities should conduct a thorough review of drainage in urban areas to identify recharge areas for supply wells and feasible locations for detention ponds, infiltration basins, or instream measures to enhance recharge that are consistent with the Rio Grande Compact. The City of Santa Fe, El Vadito de los Cerrillos, and the State Land Office have storm water management ordinances, and Los Alamos County is proposing such an ordinance. The JySWPC will develop a subcommittee to work on strategies for educating appropriate authorities about methods for enhancing storm water management.







3. *Conduct pilot cloud seeding project.* Form partnerships and explore funding mechanisms for pilot cloud seeding projects. Although the effectiveness of a cloud seeding project would need to be demonstrated, and associated water rights may be impossible to establish due to difficulty in proving ownership of water, cloud seeding holds promise for increasing snowpack and surface supplies for existing water rights holders and enhancing stream flow for health of ecosystems. Ideal localities for cloud seeding include areas where watershed elevation is above 9,000 feet. The JySWPC will convene a workshop to develop partnerships, seek funding for one or several pilot cloud seeding projects, and work with ongoing state initiatives.
  
4. *Pursue sustainable management of water resources through better understanding of hydrogeology.* Establish a regional technical advisory group to guide aquifer study and management activities. The JySWPC has identified a need for a regional model that will facilitate better understanding and management of regional water resources (and support the development of Critical Management Areas [CMAs]). Decision makers within the region need a regional model that incorporates hydrologic boundaries of aquifer systems and is capable of simulating actual hydrologic processes. Part of developing a hydrologic model is to determine if sufficient data exist to support the development of a new model or the modification of existing models.

Working together, decision makers within the region will be better positioned to secure funding from entities such as the Water Trust Board for hydrologic studies needed to provide information about decisions critical to the region's water resources. Most importantly, if a model is developed through a consensus process, stakeholders will have greater confidence in the model results and its utility as a planning tool.

5. *Evaluate establishing critical management areas to protect groundwater resources.* Establish CMAs to limit groundwater production in areas where senior water rights and stream and spring flow are threatened. The entities that wish to pursue this option should work with the OSE to define areas appropriate for consideration. For example, candidates for CMA designation might include areas where water supplies are diminishing or senior water rights are affected. Entities interested in CMAs should also





work with the OSE to develop appropriate best management practices such as the stringent regulation of domestic wells. JySWPC will host a workshop to further discuss the development of CMAs.

6. *Develop conjunctive use strategies.* Explore the potential of combining surface and groundwater rights to maximize renewable supplies when available, and to preserve aquifers for periods of drought. Water resource management could be enhanced if water purveyors have the flexibility to alternate between the use of surface water and groundwater depending on availability of the supplies. During wet periods, water purveyors should rely on surface water and rest the aquifer. This will help reduce vulnerability during periods of drought. To conjunctively manage water rights, permission of the OSE must be obtained, and modeling will be needed to support an OSE application. A regional model that has the buy-in of neighboring water users who are likely to protest such an application would provide an essential foundation for proceeding with this alternative. The City of Santa Fe, Eldorado, El Vadito de los Cerrillos, Cuatro Villa Mutual Domestic Water Users, and Santa Fe County currently have or have proposed conjunctive use strategies.
  
7. *Appropriate flood flows.* Pursue appropriation of flood flows on the Rio Grande or its tributaries during years when Elephant Butte is spilling. New Mexico cannot accrue a debt under the Rio Grande compact during years when the Elephant Butte Reservoir spills. Thus, diversions of surface water could be increased during these years, provided that senior water right users and the environment are not harmed. Although only 6 of the last 60 years have been spill years, the potential to use excess flow during spill years through existing water diversion facilities or to store the water for future use could help the region reduce its dependence on groundwater. Santa Fe County has already submitted an application to appropriate excess flows. However, environmental groups, such as Rio Grande Restoration, have protested a similar application by the City of Albuquerque and have indicated that they would protest additional applications. The application will need to be supported by technical analyses to address issues of potential impairment and determine if such an appropriation would be detrimental to the health of the Rio Grande. Should the application be successful, local governmental entities could





develop contracts or joint powers agreements to establish allocations for appropriated water and a plan for diverting and storing it when it becomes available. The recommendation for conjunctive use and for aquifer storage and recovery should be pursued in conjunction with this strategy to allow for effective use of flood flows.

8. *Remove trace constituents to protect human health.* Consider requiring local or regional water supply systems in areas where trace constituents (arsenic, uranium, nitrate, fluoride, etc.) exceed water quality standards. In areas where water quality is naturally poor or degraded due to septic tanks, regional water systems are the most effective method to provide safe, potable supply. The northern portion of the Jemez y Sangre Water Planning Region is a good candidate for such systems due to widespread instances of poor quality water in the valley between Española and Pojoaque. Water planners in all sectors need more data on groundwater contamination, including concentrations, sources, trends, and depth. This information will help them to prioritize areas that would best be served by water systems rather than domestic wells. Cañoncito at Apache Canyon, the City of Santa Fe, El Vadito de los Cerrillos, and Santa Fe County are proposing upgrades to treatment facilities.
  
9. *Address septic tank water quality degradation.* Monitor and reduce contamination from septic tanks through the most applicable method. A better understanding of water quality deterioration from septic tanks is necessary, particularly in areas with fractured granite or basalt, areas where the depth to groundwater is shallow, or areas with other conditions that reduce natural denitrification processes. Once the problem is better characterized, contamination could be addressed through either extending service to homes from local or regional wastewater treatment plants or establishing regular maintenance plans to provide routine pumping and inspection of septic tanks, as appropriate.
  
10. *Cleanup of contaminated groundwater and surface water.* Support increased funding to the New Mexico Environment Department (NMED) to pursue investigation and remediation of “orphaned” groundwater contamination sites for which no responsible party has been identified. Support increased funding for NMED to address





contamination of surface water, including acéquias, which are particularly vulnerable to contamination.

11. *Continue funding programs to protect surface water and groundwater.* Support ongoing monitoring and regulation by the NMED and Pueblos for various programs that serve to protect the surface water and groundwater in the region.
12. *Support restoration of stream reaches to their designated uses.* The U.S. Environmental Protection Agency and NMED should aggressively pursue protection of stream reaches to meet total maximum daily load standards to prevent further environmental degradation.

**Category II: Recommended Actions to Improve System Efficiency**

13. *Require wastewater reuse.* Encourage new subdivisions (particularly those relying on imported water) that will be served by a new or existing wastewater treatment system to plan for wastewater reuse, either through the use of greywater or treated effluent, which can be used for return flow credits, watering turf, or other nonpotable uses. The use of septic tanks for wastewater disposal degrades water quality and reduces options for wastewater reuse. The OSE has convened a committee to develop guidelines for building water efficient homes, including the reuse of greywater and black water. JySWPC will continue to work with this committee to educate the public and decision makers about methods of wastewater reuse, including greywater reuse. Wastewater is currently being used by the City of Santa Fe, Hyde Park Water Users Association, Las Campanas, and Los Alamos County, and is under consideration by many other communities.
14. *Encourage rainwater collection.* Encourage rainwater catchment to supplement outdoor watering and reduce dependence on potable water. Residents and businesses should be encouraged or required by ordinance to harvest roof water, to the extent practical, before this water enters municipal or natural drainage networks. Landowners would build and maintain roof water harvesting tanks or ponds according to local government





requirements. The OSE committee for building water efficient homes, of which the JySWPC is a participant, is developing guidelines for encouraging rainwater collection and storm water harvesting.

15. *Line ditches.* Consider lining ditches or utilizing piping, where appropriate, to extend supplies to all users. The effectiveness of a ditch-lining project is site specific and may have undesired effects such as loss of riparian habitat or bosque. Ditch lining may help farms located at the end of a ditch to receive their full supply by reducing water loss from infiltration. Acéquia del Cano and the Cuatro Villa Mutual Domestic Water Users Association have ongoing projects to line ditches and the Lower Cerro Gordo Ditch Association has proposed a ditch-lining project.
16. *Remove sediment in Santa Cruz Reservoir and investigate Nambe Reservoir.* Remove sediment in Santa Cruz reservoir to increase reservoir capacity by 1,800 acre-feet and enhance operation of the system. The U.S. Bureau of Reclamation should investigate the potential for increasing storage capacity in Nambe Reservoir by removing sediment.
17. *Repair leaks in water systems.* Conduct water audit and replace old and leaking water lines to reduce system demands. The average water loss in a municipal or mutual domestic system may exceed 10 percent. While this lost water may help recharge wells that produced the water, the recharge is not immediate and the loss reduces water system performance. Repairing leaks will help water purveyors meet daily demands, particularly where infrastructure is strained in terms of meeting peak demands. Community and municipal systems need to better understand the losses that occur through leaks by conducting water audits and developing plans and budgets to replace leaking pipes.
18. *Consider aquifer storage and recovery of excess water.* Consider aquifer storage and recovery as a viable method of managing excess water, when and if such water is made available through treated effluent or capture of flood flows from the Rio Grande (in years when Elephant Butte has spilled). Further study is required to determine if aquifer storage and recovery would be a viable beneficial method to store excess water.





Considering the water supplies available to date, the direct use of excess surface water, which will result in reduced groundwater pumping, is likely the optimal approach.

19. *Pursue increased storage capacity in Abiquiu Reservoir.* Pursue increased storage capacity by securing the 17,000 acre-feet of storage easements in Abiquiu Reservoir that are within the authorized amount. If a greater amount of storage capacity is desired (to hold flood flows or other water rights), the region would need to seek authorization from Congress. However, storage amounts above the 200,000 acre-feet (the total authorized storage amount of the reservoir once the 17,000 acre-feet is secured) would inundate homes and roads and may have negative ecological and aesthetic consequences. Increased storage capacity is especially desirable in the short term to increase the pool of water available, as the need for additional storage will be lessened when the City and County of Santa Fe begin diverting water directly from the Rio Grande rather than through the Buckman well field. Increased storage could also be used to appropriate flood flows, as described in Recommendation 7.

### ***Category III: Recommended Actions to Address Drought***

20. *Develop drought contingency plans.* Develop or maintain drought contingency plans, including measures such as emergency conservation ordinances and/or provisions for temporary leasing from other sources. Drought management can be undertaken at a regional level through cooperative agreements or locally by individual counties, municipalities, community water systems, acéquias, irrigation districts, or Pueblos within the region. Drought planning that addresses both local and regional mitigation efforts will be most effective.

The following actions would be required to develop and implement a regional drought plan:

- Convene a meeting of water users/stakeholders to develop a regional drought plan or small-scale drought plans.





- Conduct technical analyses to evaluate the correlation between historical data and drought triggers and to define appropriate triggers.
- Conduct an analysis of drought severity and vulnerability of water supplies.
- Evaluate vulnerability of water rights to priority calls that may be made during a drought.
- Evaluate and adopt mitigation measures through a series of meetings that develops consensus on appropriate measures.

Communities that rely on surface water supply should also consider the need for contingency alternate supplies in case of catastrophic fire or for routine firefighting. The City of Santa Fe, El Vadito de los Cerrillos Mutual Domestic Water Users, La Vista Home Owners Association, and Santa Fe County have emergency water conservation ordinances for drought management. Acéquias, irrigation districts, and Pueblos have systems in place for sharing water during drought periods that have worked for hundreds of years. Communities that plan to shift their supply to surface water must develop drought contingency plans to be prepared for drought periods. Communities that rely on groundwater may also need to develop drought contingency plans to accommodate increasing demands during drought periods, particularly if the water supply system is struggling to meet demands in an average year.

#### ***Category IV: Recommended Actions to Reduce Projected Demand***

21. *Pursue water conservation.* Pursue water conservation through a variety of measures.

Municipalities that want to reduce demand through conservation need to:

- Know their customers' use habits.
- Elevate water conservation consciousness by establishing incentive rates.





- Provide ongoing education and outreach to all customer groups on how to save potable water through appropriate landscaping and use of nonpotable water for irrigation.
- Encourage the installation of conservation fixtures (efficient toilets, showerheads, sprinklers, evapotranspiration controllers, low-flow washing machines, recirculating hot water systems, drip irrigation, etc.) through rebates or other incentive programs.
- Encourage energy-saving fixtures and habits to reduce the amount of water used at power plants, which impacts water demand in other regions.
- Establish efficiency in new developments through regulations.

Conservation is most critical in the Santa Fe, Caja del Rio, North Galisteo, and South Galisteo Sub-Basins, which have very uncertain future water supplies for meeting projected demand. The communities of Santa Fe, Eldorado, Cerrillos, Madrid, Galisteo, Sunrise Springs and Santa Fe County have adopted water conservation ordinances. All communities in the region should adopt similar ordinances to discourage the waste of water.

22. *Pursue growth management to reduce demand.* Governmental entities that wish to pursue this option should conduct an educational and consensus-building program to formulate an approach. The approach should be perceived as egalitarian in the way it affects people and groups and should be integrated with other community goals. While growth management should not be considered only as a last resort, if the projected water supply/demand gap is not closed through conservation efforts or increasing the water supply (including San Juan-Chama Project water), growth management will be the final option for closing the gap.

Demand reduction through growth management may be essential in the South Galisteo Sub-Basin, where the outlook for future water supplies is bleak. Growth management may also be necessary as part of the water plan for North Galisteo, Santa Fe, and Caja







del Rio Sub-Basins, where the ability to increase the water supply is uncertain. Growth management is currently utilized by the City of Española, City of Santa Fe, Madrid Water Cooperative, Rancho Galisteo, Santa Fe County, and Cuatro Villa Domestic Water Users Association.

**Category V: Recommended Actions to Increase Water Supply**

23. *Utilize San Juan-Chama Project water as appropriate.* The City and County of Santa Fe presently divert San Juan-Chama Project water through the Buckman well field; however, the City's ability to divert San Juan-Chama water through this method is limited by the aquifer capacity. Los Alamos County has nearly completed a feasibility study for developing San Juan-Chama Project water. A direct diversion of San Juan-Chama water, combined with the flexibility to utilize the well field during periods when river flow is low, will enhance resource management.

To the extent that other San Juan-Chama water may be available for purchase or lease (from Los Alamos, the Jicarilla Apache, San Juan Pueblo, etc.), the City and County of Santa Fe should pursue agreements to use such water, even for a short period (20 years), to offset past pumping of the Buckman well field. This will be essential, particularly if the City is unable to increase the San Juan-Chama water in storage over the next few years. The City of Española should also pursue diversion of its San Juan-Chama water, combined with a conjunctive use strategy that will allow for use of groundwater during times of drought. Diverters of San Juan-Chama water may have an opportunity to develop strategies for delivering water that will benefit other needs, such as those of the silvery minnow, without compromising their contracted amount or compact obligations (i.e., releasing contracted amount during periods of low flow).

24. *Transfer water rights through consensus process.* Pursue transfer of water rights from agriculture to urban use through partnerships/transactions that take into account community concerns. Inventory the processes that allow for consensus-based transactions in other areas of New Mexico or in other states where areas of origin have been protected. Develop mechanisms and pursue options for developing area of origin





protections that are appropriate for this region. Consideration of practical minimum flow requirements must be included in any transaction to evaluate impairment to the acéquias. The JySWPC will convene a subcommittee to seek funding to develop the inventory of successful models for consensus-based transactions. The JySWPC will work with parties interested in pursuing consensus-based transactions. The City of Santa Fe, Santa Fe County, and Las Campanas have transferred water rights in the past and propose to transfer additional water rights in the future. The State Land Office and Sunlit Hills of Santa Fe may also consider transferring water rights in the future.

25. *Limited use of domestic wells.* Continue to allow developments to be based on individual domestic wells in areas where senior water rights are not impaired, spring flows and stream flows are not impacted to the detriment of the Rio Grande Compact, and environment and water quality are suitable. Areas in the Velarde Sub-Basin near the Rio Grande may meet these criteria. However, if well usage causes New Mexico to exceed the 1929 condition on the Rio Grande above the Otowi Gage, new domestic wells may be in conflict with the Rio Grande Compact. All domestic wells are subject to a priority call and individuals should be aware of the risk involved in providing a supply based on a very junior water right. CMAs that restrict domestic wells should be developed in areas where new domestic wells are a problem. County and municipal governments have authority to limit drilling of domestic wells where water service connections are available or through lot size restrictions. Currently, the City of Santa Fe, Santa Fe County, El Vadito de los Cerrillos, La Vista Home Owners Association, and the Madrid Water Cooperative restrict the drilling of domestic wells within their service boundaries.

## The Bottom Line: Conclusions

Many of the recommendations under Categories I, II, and III involve actions that are regional in nature or best suited to partnerships among interested parties. Establishment of a funded water advisory board or other entity will assist with the task of implementation of these recommendations. Because many government entities are focused on addressing immediate emergencies, long-term goals such as better groundwater management and watershed





restoration may end up on the “back burner” without assistance from a water advisory board or similar entity.

The recommendations under Categories IV and V for reducing the projected gap between supply and demand involve balancing the public welfare implications that each alternative presents. Decision makers must balance the desire for economic development based on growth against the hardships resulting from extreme conservation measures or the potential changes in the character of the region that may accompany the transfer of water rights from agriculture to urban uses. Some stakeholders will argue that economic development can occur without growth and others will claim that a significant portion of the agricultural water rights are not being used anyway, and that the regional character is already changing due to the low profitability of farming. These issues are complex and will take a great deal of work to resolve. The goal of the JySWPC is to play an active role in education and interaction with the public as communities work to address their water supply problems.

