RIO CHAMA WATER PLAN
EXECUTIVE SUMMARY

OVERVIEW

Regional water planning in New Mexico, funded by the Interstate Stream Commission, is intended to answer three questions for each of New Mexico's sixteen planning regions:

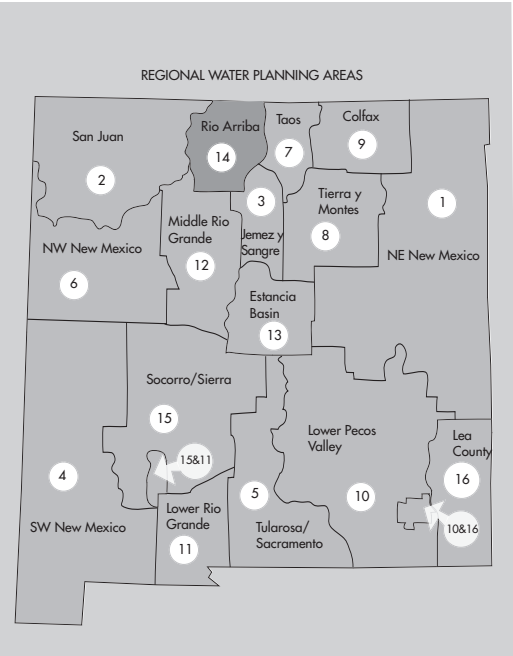
- How much water is available?
- How much water is being used now, and how much will be needed in the future?
- What is the best way to make sure we have enough water for our future needs?

This water plan provides answers to these questions for the watershed of the Rio Chama, Planning Region 14 on the map below. Certain basic facts have become clear in several years of research, and these are the essential background for understanding water in our region.

Ninety percent of the water produced within the Rio Chama watershed, an average of 376,000 acre-feet per year, leaves the region and flows down the Rio Grande. Nevertheless, shortages of both irrigation and domestic water occur chronically throughout the region.

An average of 26,700 acre-feet per year is depleted within the region by intentional human activities. About 25,100 acre-feet of that is depleted (evaporated or transpired) for irrigation or livestock, while about 1,600 acre-feet is depleted for domestic and commercial uses.

Agricultural water needs will probably remain constant, while domestic and commercial needs will at least double over the next 40 years.



The San Juan-Chama Project has added an average of 92,700 acre-feet per year to the Rio Chama and delivered about 67,900 acre-feet to downstream users, but almost no San Juan-Chama water is used within the region.

Reservoir evaporation is a significant "use" of water, depleting over 5,000 acre-feet of native water and nearly 25,000 acre-feet of San Juan-Chama Project water every year.

About 8 percent of our intentional depletions come from ground water, but this provides nearly 90 percent of all domestic and commercial water for the region's 12,250 residents. No existing evidence suggests any large undeveloped ground water reserves, although hydrologic data are scarce in most of the region.

Water and the way we use it has strong cultural value here. Acequia irrigation made possible a cherished way of life in the Chama valley, and still determines the look of the landscape and the fabric of our communities. The acequia system provides the framework for community government as well as water delivery in northern New Mexico. The preservation of traditional communities, local culture, agricultural opportunities, and the historic acequia system are widely shared and deeply felt values that shape our water plan.

Keeping the water we have within our communities and our region, including providing adequate safe drinking water, is the most important overall water planning objective for the Rio Chama watershed.

THE PLANNING PROCESS

In 1995, the New Mexico Interstate Stream Commission contracted with Rio Arriba County to produce a water plan for Region 14, the Rio Chama watershed. The County arranged for the Rio de Chama Acequias Association (RCAA) to coordinate the planning work. Fred Vigil, President of the RCAA, supervised planning activities including the data gathering, public participation, and administrative oversight. He was assisted by other officers of the RCAA: Vice President Aubrey Owen, Secretary Agapita Martinez, Treasurer Joseph M. Salazar, and Records Manager Fidel Trujillo. David Morgan of La Calandria Associates, Inc. and Linda Fluk, an independent geological consultant, were contracted to do most of the technical work, with assistance from Cipriano Martinez and Miguel Santistevan. Legal consultation was provided by Fred Waltz, Esq.

The first step in the water planning process was to establish a Citizens' Advisory Committee, with fifteen members drawn from throughout the region, selected because of their interest and involvement in both community and water issues. This Committee, along with other interested residents, participated in a workshop led by staff from the Interstate Stream Commission and Western Network (a nonprofit facilitator), to become familiar with the process of regional water planning. Following the workshop, additional Advisory Committee meetings were held to identify common concerns about water in the region and to set the agenda for the technical work to be done.

In the years that followed, discussions about the water plan have taken place in many settings: at meetings of acequia commissioners and parciantes; at meetings to discuss the Rio Arriba County General Plan; at public meetings held in communities around the Rio Chama watershed specifically to discuss regional water planning; and in individual meetings and other personal communication with key stakeholders such as elected officials, Rio Arriba County staff, water system operators, and acequia association officials. A final round of meetings, each in a different location within the Rio Chama watershed, was held during the summer of 2003. About 60 community members, both those who attended meetings and those who could not, responded to questionnaires about water issues in their locality. The Rio Arriba County Commission conducted a working session on the Water Plan in April of 2005, prior to submission to the Interstate Stream Commission.

PUBLIC WELFARE

Public welfare in our region, as it relates to water, requires a safe and adequate water supply for domestic use, adequate water for agriculture and livestock, and a proper method of treating wastewater to prevent contamination of surface or underground water resources. The most important objectives expressed by residents in public meetings on the water plan throughout the region were to keep existing water rights in the region to maintain the rural acequia agricultural lifestyle, and to provide safe drinking water while protecting the environment.

It is imperative that federal and State agencies work with Rio Arriba County, the village of Chama, acequias, Native American tribes and Pueblos, mutual domestic water associations, and individual stake holders in a non-adversarial climate to achieve the public welfare objectives of the regional water plan. More specifically, protection of public welfare is one of the most important considerations the State Engineer is required to bear in mind when deciding whether to approve an application to change the place and/or purpose of use of a water right.

In the Rio Chama planning region, public welfare depends on the stability and vitality of our communities that contribute historically unique and economically valuable tradition, culture, and landscape to New Mexico. There are three key principles critical to maintaining our community stability and vitality:

- **Keep water within our region for our future needs**
- **Provide safe, adequate, and reliable domestic and community water supplies**
- **Protect the culture as well as the physical infrastructure of the acequia system.**

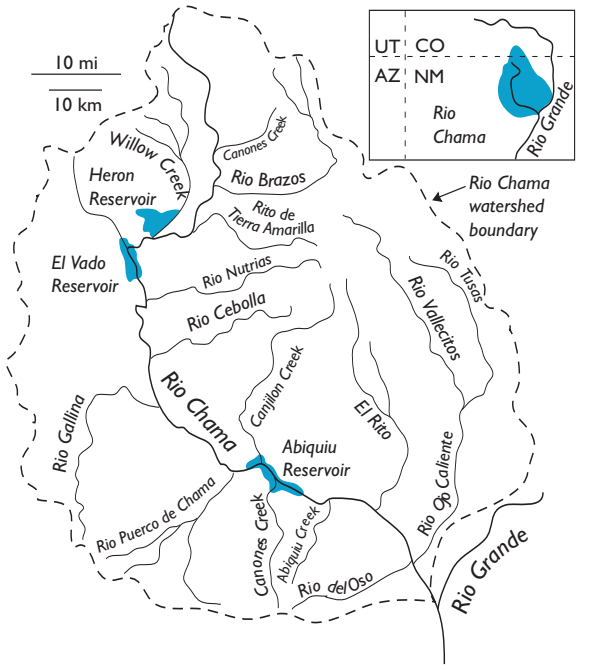
Flexibility to meet changing needs is essential, but must be balanced against the protection needed to maintain our culture and community structure. Most importantly, the extensive experience and local expertise of acequia and community water system officers should be given great deference by the State Engineer in considering transfer requests. Local communities are in the best position to determine what degree of flexibility in water rights transfers, and what kinds of new uses, may improve our economy and rural way of life without destabilizing long-standing and essential practices and traditions. Local background and expertise must be accorded very significant respect in the State Engineer's deliberations.

LEGAL ISSUES

The legal framework for water management in the Rio Chama watershed is established in three principal ways: by international treaties and interstate compacts; by statutory law; and by legal precedent in court decisions. The principal treaties and compacts that affect our region include the Treaty of Guadalupe Hidalgo, the Kearny Code, the 1906 Treaty with Mexico governing water in the Rio Grande, the Rio Grande Compact, and the Colorado River Compact. Relevant New Mexico water law is codified in the state constitution, the water code, and in various environmental statutes. Federal laws affecting our region include the San Juan-Chama Act, the Endangered Species Act, the National Environmental Policy Act, the Wild and Scenic Rivers Act, and the Water Pollution Control Act (the "Clean Water Act"). Many of the day-to-day requirements affecting water use in the region stem from agency procedures, interpretations, and regulations rather than from statutory language itself. The principal state agencies involved include the Office of the State Engineer, the Interstate Steam Commission, the Environment Department, and the Energy, Minerals, and Natural Resources Department. The main federal agencies affecting water in the Rio Chama are the Bureau of Reclamation, the Corps of Engineers, the Fish and Wildlife Service, the Forest Service, and the Bureau of Land Management.

Water rights within the region are established primarily by the ongoing adjudication suit (New Mexico vs. Aragon), along with the record of judicial precedent. The interrelationship of these rights, held largely by historic acequias, along with those held by mutual domestic water associations, tribes, and Pueblos, significantly affects our entitlement to use water within our planning region. This constraint, and other legal considerations, are examined in detail in the **LEGAL ISSUES** chapter of the Water Plan.

REGIONAL GEOGRAPHY



Rio Chama watershed map

The Rio Chama watershed covers 3,157 square miles, entirely within Rio Arriba County except for a sliver of Taos County near Tres Piedras and about 75 square miles in Colorado just north of the town of Chama, in the south San Juan Mountains. The western boundary includes the Continental Divide and the northeastern slopes of the Jemez Mountains above Abiquiu, while the eastern boundaries are along the Tusas Mountains and Black Mesa. The southern boundary of the watershed is defined by the north slopes of the Jemez mountains and the confluence of the Rio Chama with the Rio Grande, just north of Española.

The Santa Fe and Carson National Forests combined total almost 50 percent of the land in the watershed. Private land accounts for 28 percent; Indian tribes make up about 10 percent; and both the State of New Mexico and the Bureau of Land Management have about 6 percent.

Elevations in the planning region range from 11,410 feet atop Brazos Peak to 5,620 feet at the confluence of the Rio Chama and the Rio Grande. Most of the landscape within the Rio Chama watershed is rugged, mountainous, and wooded. Woodland types vary from sparse piñon-juniper at lower elevations, through ponderosa pine and Douglas fir at intermediate elevations, to alpine spruce-fir forest and montane grassland meadows with large stands of aspen at the higher elevations above Chama and Tierra Amarilla.

About 30,000 acres in the valley bottoms of the Rio Chama and its thirteen major tributaries are used for irrigated agriculture, where topography and water supplies have made it possible to construct acequias and irrigate land. The thirteen tributaries large enough to support appreciable irrigated agriculture are Cañones Creek, the Rio Brazos, Rito de Tierra Amarilla, Rio Nutrias, Rio Cebolla, Rio Gallina, Rito de Canjilon, Rio Puerco de Chama, a second Cañones Creek, El Rito, Rio del Oso, Abiquiu Creek, and the Rio Ojo Caliente, which itself is fed by the Rio Vallecitos and the Rio Tusas.

CALCULATING WATER SUPPLY AND DEMAND

Because of limited data, water supply was estimated using multiple techniques with cross-checked results. Water yield for the entire watershed was estimated from precipitation and evapotranspiration data and was independently calculated by adding the following components:

- streamflow leaving the region at the Chamita gage,
- surface water depletions within the region,
- evaporation from reservoirs, lakes, and the river itself,
- riparian water use,
- ground water flow out of the region, and ground water depletions.

The most reliable measurement relating to our water supply is, ironically, the amount of water that flows out of the region and down the Rio Grande just below the U.S. Geological Survey stream gage near Chamita. Other water yield components were calculated using information supplied by the Office of the State Engineer, the U.S. Geological Survey, the National Weather Service, and a variety of other published sources.

A flow duration analysis, calculating the streamflow available 10, 50, and 90 percent of the time, was performed by the U.S. Geological Survey specifically for the water plan. Flows were analyzed on the Rio Chama at the Chamita gage near the Rio Grande confluence, at the La Puente gage near Tierra Amarilla, and on the Rio Ojo Caliente at the La Madera gage.

In the absence of good stream-gage data, the water originating in each Rio Chama tributary watershed was estimated using an adaptation of the method developed by Hearne and Dewey of the U.S. Geological Survey for the Taos plateau in 1988. These estimates resulted in a range of predicted watershed yields that includes a substantial margin of uncertainty, but the sum of the predicted tributary yields correlates reasonably well with the overall Rio Chama watershed yield estimated independently.

Water available within the Rio Chama watershed was analyzed in terms of total water yield, rather than separating surface flows and ground water recharge. This was done because insufficient data exist to reliably separate the two yield components without double counting; or to quantify stream-aquifer interactions. In much of the region water probably cycles repeatedly between surface and subsurface flows before leaving the watershed, making it especially difficult to separate ground and surface water components. In many places aquifers are not deep and ground water is closely connected to surface water.

Little information is available on ground water hydrology in the region. However, ground water is critically important because the majority of the region's residents depend on it for their domestic water supplies and periodic shortages occur. Geologic information was found in published sources, and information on ground water use came mainly from estimates com-

piled by the Office of the State Engineer and from personal communications with supervisors of community water systems. Water quality information was obtained primarily from the New Mexico Environment Department, supplemented by results from water testing by the Rio de Chama Acequias Association.

Future population estimates were made from Census Bureau information, independent demographic research in the lower Chama valley, and projections made by the Rio Arriba County Planning Department.

A water budget calculating inflows and outflows for the region was prepared using long-term average values as well as drought-year estimates. Information on both supply of and demand for water in the region is summarized in the **WATER BUDGET** chapter of the water plan, while the details of the calculations and sources of information are discussed in the **WATER SUPPLY** and **WATER DEMAND** chapters of the plan.

WATER SUPPLY

Our water supply comes from precipitation. There are no ground water flows into the region, and there is no evidence of significant untapped ground water reserves in storage. Most ground water used in the region appears to be closely connected to surface water.

An annual average of more than 3 million acre-feet of water falls as precipitation over the 2 million acres of the Rio Chama watershed. However, only about 418,000 acre-feet per year appears as watershed yield, or the combination of streamflow and accessible ground water recharge. The San Juan-Chama Project has diverted an additional 92,700 acre-feet per year into the Rio Chama on average, since beginning operations in 1972. The chart on page six graphically illustrates the region's water supply.

While the San Juan-Chama Project has diverted an average of 92,700 acre-feet per year into the Rio Chama since 1972, essentially none of it is used within the region. The San Juan-Chama Project has provided little benefit to water users along the Rio Grande. Project water available for use within the region would be a great help in easing our chronic water shortages.

Total depletions within the region average about 42,200 acre-feet per year. Some 15,500 acre-feet of that evaporates from reservoirs, natural lakes, and the river itself; or is used by bosque vegetation along the river. Intentional human uses deplete about 26,700 acre-feet per year. Almost 375,900 acre-feet, or 90 percent of watershed yield, flows downstream into the Rio Grande for use outside the region.

Our total intentional human depletion of 26,700 acre-feet per year is only 6.4 percent of the total Rio Chama watershed yield. In practical terms this is a good approximation of the long-term sustainable water supply available within the region under current conditions. Available water supplies could be increased if storage were available – current reservoir storage is almost entirely for users outside the region – or if watersheds could be managed for some increase in watershed yield along with sound ecological, environmental, and flood-management practices.

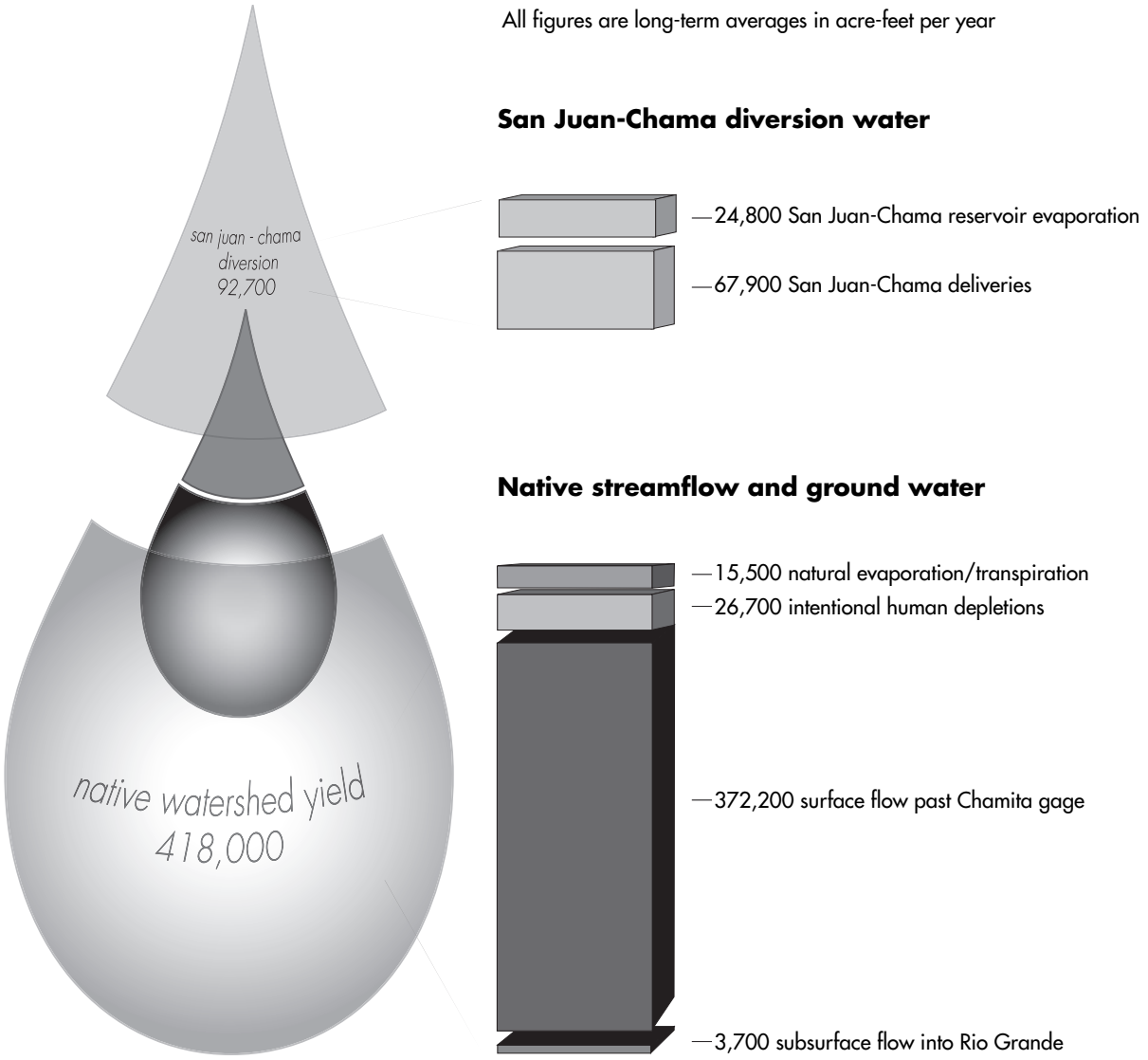
These figures are the best long-term averages available. Four considerations, however, make it impossible to precisely quantify the total water supply :

1. Effective water supply often depends more on water rights than on the total amount of water available. Because water rights have not been adjudicated in much of the area, the amount of water to which right holders are entitled is uncertain.

2. Surface flows are highly variable from year to year and from one tributary to another, so that even if rights were fully adjudicated, "wet water" available in any given year cannot be precisely predicted.

3. No tributaries are gaged except the Rio Ojo Caliente, so all water supply information for those watersheds has to be estimated from very limited data.

4. Few data exist for ground water, but we do know that aquifer characteristics in much of the region severely limit ground water availability.



Water supply components

Surface water

Our water supply cannot be rigidly separated into surface and ground water components because both are closely connected geologically throughout most of the region. Still, we deplete over 24,250 acre-feet per year for acequia irrigation, and all of this – the great majority of our water supply – comes from surface water. The water really available to users within the region is subject to many constraints other than total watershed yield or annual streamflow. Irrigation water is limited by streamflows during peak mid-summer demand, and these are often inadequate to provide enough water for land that has irrigation rights. The real water supply is also constrained by lack of available water storage and by water rights that are based on native flows in the Rio Chama – the water that would be in the river without San Juan-Chama diversions or the operation of Heron, El Vado, and Abiquiu reservoirs.

It is important to distinguish between the aggregate total of water rights held within the region and reported average water

use. As our region was settled, acequias were dug and land brought under irrigation in a way that permitted flexible use of the highly variable runoff. Our field and acequia system evolved to allow farmers to take advantage of relatively high runoff to grow more food on more land, but still permit the system to work on a smaller total acreage in dry years. Accordingly, the total acreage irrigated and total water use varies with the weather and available streamflow.

Acequias and parciantes hold valid water rights to irrigate the land that can be irrigated when there is adequate streamflow, even though not all that land is irrigated every year. This is an inherent and valuable characteristic of the acequia system. Water rights to land that can only be irrigated in times of abundant streamflow are entirely valid. Irrigation rights must not be subject to forfeiture for non-use simply because they pertain to land that is only irrigated when there is enough water. Reported average water use figures attempt to take the diminished water use during dry years (historical shortage) into account, and therefore understate the quantity of water needed and used in periods of higher streamflow. In other words, even if reported average irrigation use within the region is 24,250 acre-feet per year, irrigators have a right to use significantly more water than that and water planning must recognize the larger need and use during wetter years.

Ground water

While surface water provides most of the water available in the Rio Chama watershed, ground water is crucial for domestic and community water supplies: approximately 90 percent of domestic water supplies in the region come from ground water. Availability of ground water is highly variable within the region, depending on the capacity of local aquifer systems to store water and allow it to flow through permeable soil, sediment, or rock.

The Rio Chama watershed consists of three different geologic provinces, each containing distinct aquifer systems:

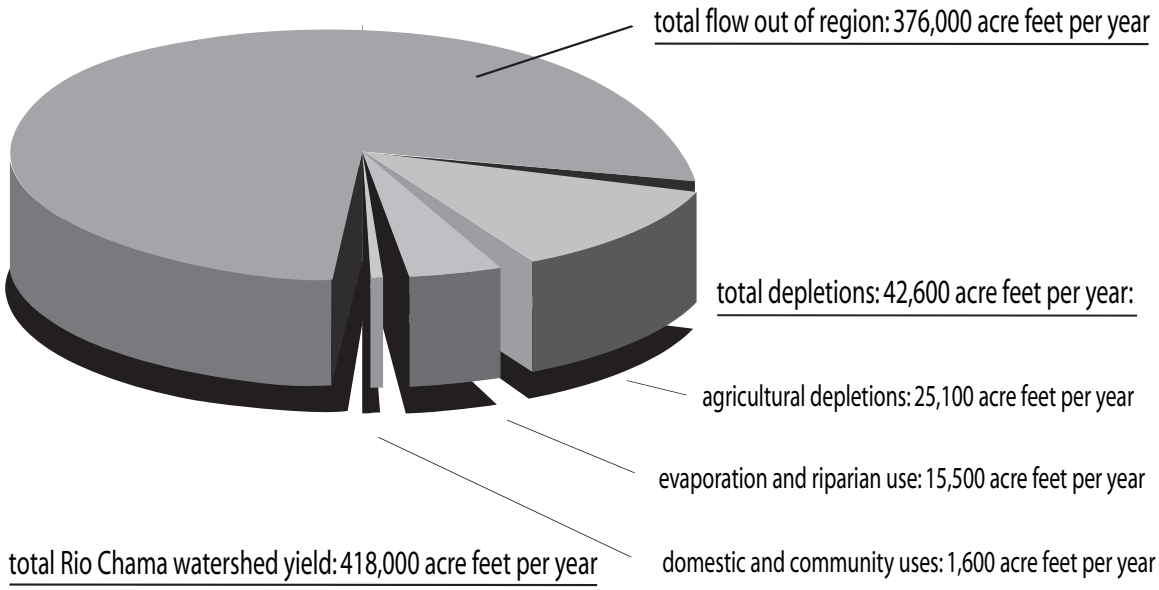
The Española Basin province, in the southern part of the watershed, consists of Tertiary Period sediments, primarily the Santa Fe Group. These deposits are moderately permeable, contain large amounts of sand and gravel, transmit a fair amount of water, and have a relatively large recharge potential, meaning that the ground water is easily renewed by surface water percolating down. Española Basin aquifers usually yield relatively ample supplies of good quality water.

The Chama Basin province, in the north-central and northwestern parts of the watershed, consists primarily of the Mancos, Dakota, Morrison, and Chinle aquifer systems. Generally, only the coarser-grained strata in these formations yield water. These aquifer systems produce small amounts of water in some locations and are dry in other locations. There can be problems with taste, odor, or other chemical contamination of water from these aquifers.

The Crystalline and Volcanic province, in the mountainous eastern parts of the watershed and in the Jemez mountains to the southwest is characterized by Tertiary deposits over Precambrian bedrock. The Tertiary deposits are similar to those of the Española Basin, but most deposits are shallow. Where there are Tertiary deposits, the ground water is of sufficient quantity and quality, but the Precambrian bedrock is seldom a useful aquifer because little or no water can be obtained unless open fractures are penetrated.

Shallow alluvial aquifers are found throughout the watershed, in all three geologic provinces, and many wells in the region draw water from these aquifers. Alluvial aquifers, composed largely of gravel and sand, can be a good source of water if the deposits are deep and extensive. However, in the Rio Chama region, the alluvial deposits are shallow and generally not extensive. Wells drawing water from these aquifers often run short of water in dry years.

Total ground water depletions now average about 2,150 acre-feet per year, or 8 percent of intentional depletions. Additional ground water production may be possible on a limited scale in certain areas. However, taking the Rio Chama watershed as a whole, there do not appear to be significant untapped ground water resources that could replace any large fraction of surface water use, or provide major new water supplies within or outside the region.



Current Water Uses

WATER DEMAND

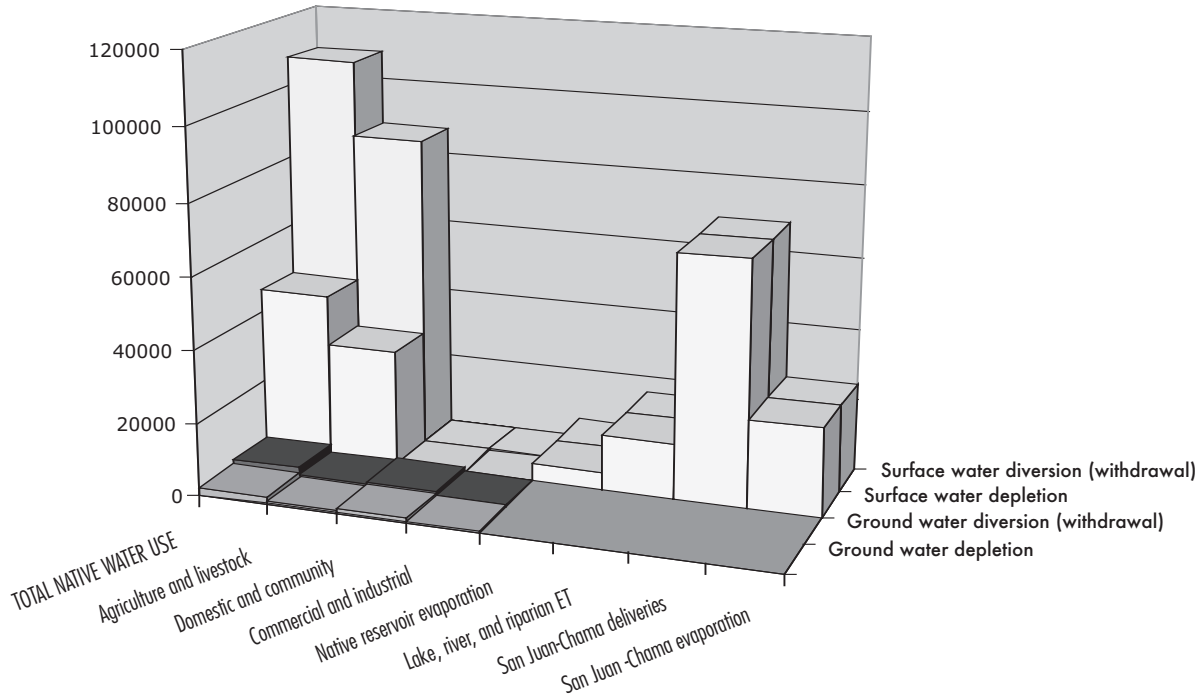
Current water uses

As shown in the graph above, about 90 percent of all the 418,000 acre-feet per year that originates in the Rio Chama watershed flows out of the region, as surface flow in the Rio Chama and subsurface flow of ground water. Only 10 percent of the total average watershed yield, 42,200 acre-feet, is depleted within the region. Agriculture uses about 25,100 acre-feet, or 60 percent of total depletions but only 6 percent of watershed yield. Reservoir, lake, and river evaporation (including riparian evapo-transpiration) account for 15,500 acre-feet per year, 37 percent of depletions and 3.7 percent of total yield. We use about 1,600 acre-feet per year for all domestic, community, and commercial water uses, 3.7 percent of depletions or 0.37 percent of the total watershed yield. However, even though domestic or community water use makes up a very small part of the total, most of that domestic water supply comes from ground water sources that are barely adequate to meet current demand, and probably inadequate for growing future demand.

It is important to distinguish between **diversions** (sometimes called withdrawals) and **depletions** in discussing water demand. To get water where we need it, more water has to be **diverted** from a stream or pumped from an aquifer than is **depleted**, or permanently removed from the local hydrologic system. In acequia irrigation, usually three or four times as much water needs to be diverted from a river into the entire acequia system as is actually evaporated or taken up by plant roots from the fields. The rest of the water becomes return flow and stays in the system, soaking into ground water aquifers or returning to its original stream as irrigation tailwater. The terms "water use" or "water demand" in this water plan refer to depletions – water permanently removed from the local system – and not to diversions, unless specifically stated.

The chart on the next page shows the relative magnitude of both diversions and depletions within the Rio Chama watershed. San Juan-Chama diversions and depletions are shown separately, and neither surface nor subsurface outflows are shown on the chart.

Evaporation from reservoirs is a significant "use" of water in the Rio Chama watershed. A total of about 30,000 acre-feet a year evaporates from the three



Diversions and depletions–categories of water use

reservoirs in the region, although the majority of the evaporation – almost 25,000 acre-feet – is from San Juan-Chama Project water diverted into the region. The remaining 5,000 acre-feet of evaporation mainly results from storage of Middle Rio Grande Conservancy District irrigation water at El Vado Reservoir.

Future demand

The water planning goal most frequently and strongly voiced during public meetings was the preservation of agriculture and the acequia system in the region. Future agricultural demand is expected to remain constant; in fact, we need additional irrigation water.

Domestic water demand is increasing. According to the 2000 census, approximately 12,500 people live in the watershed, a population increase of 22 percent since 1990. Previous predictions have significantly underestimated population growth, especially along the lower Rio Chama from Abiquiu to Española. Low, medium, and high projections of future regional population were made for the water plan. The low estimate assumed population loss from the entire region apart from the lower Chama Valley, while the mid-range estimate assumed a continuation of 1990-2000 population growth rates. The high estimate was based on population growth rates projected by the Rio Arriba County Planning Department. The low population estimate for the region in 2040 is essentially the same as the current population. The mid-range projection is for double the current population, while the high estimate suggests a population of over 32,000, or 2.6 times the current level.

Water systems are aging throughout the region and many wells tap relatively unproductive aquifers. The majority (68 percent) of the Mutual Domestic Water Users Association wells have sporadic and sometimes chronic water shortages. An increase in domestic demand will not have a large impact on overall water supplies in the region, since domestic use makes up less than 6 percent of the total demand. The region as a whole could supply additional domestic water, but that does not mean that any individual community will be able to provide additional water. There are few institutions or large commercial users in the region at present, but consideration must be given to water availability for them in the future.

All these considerations – increasing population as well as the need to upgrade existing water supply systems and provide water for economic growth – suggest that demand for domestic and commercial water will increase substantially over the next 40 years, probably at least doubling from the existing 1,600 acre-feet per year. Depending on precisely what level of increased population and commercial uses we experience, we should plan to provide 3,000 to 5,000 acre-feet of domestic and commercial water per year for the region as a whole.

There are both practical and water rights issues involved in providing more water for domestic or commercial uses. The practical issues involve providing additional water where aquifers and/or wells are incapable of increased production, or there are other local problems like inadequate storage tanks or poor water quality. Water rights issues involve finding adequate domestic water supplies without forcing communities to choose between acequia water supplies and drinking water. The region as a whole has plenty of water for its future domestic and community needs, but many communities within the region face limited water supplies and significant technical or economic hurdles in providing additional water. Local water banking may offer creative solutions to some community water supply needs.

PLANNING ALTERNATIVES

Water planning concerns and priorities have been expressed in discussions with residents and stakeholders in the region in many venues over nine years. Participants have said over and over that there is one main objective we need to achieve before any other goals will matter: **We need to keep the water (and water rights) we have within our communities and our region.**

If we can't keep water rights within the region our other water planning goals will serve little purpose. We need water to provide for growing communities, to make local economic development possible, and to preserve and enhance the agricultural opportunities in the Rio Chama watershed. Already 90 percent of the water produced in our watershed is available for use elsewhere, so we need to keep what we have.

To help do this and make sure water is available when and where we need it, there are seven principal goals that the water plan seeks to address:

- ***Preserve the acequia system and strengthen its role in community life***
- ***Enhance growing season streamflows (by increasing storage or other means) so that agriculture is less limited by low peak-season flows***
- ***Develop local agriculture with information, marketing, and financial support***
- ***Provide reliable water supplies to community water systems***
- ***Protect water quality***
- ***Conserve and reuse water resources where appropriate***
- ***Protect and restore upper watershed areas***

Perhaps the best ways to keep water within the region are to preserve and strengthen the acequia system and to support local agriculture. These goals are closely related: acequias need water and secure water rights as well as physical participation and upkeep; and water rights without the acequia system would be largely unusable. At the same time, unless local farmers can make a living, the long-term survival of the acequias will be uncertain.

Within the framework of these goals, water use and management within the Rio Chama watershed may offer some opportunities for win-win situations that could benefit users in other areas—but only if there are genuine benefits to communities within the region.

A number of alternative actions or scenarios were considered as a means to move towards achieving the goals mentioned above. The principal alternatives recommended by the water plan are summarized briefly below, in relation to the relevant planning goal.

* *GOAL: PRESERVE THE ACEQUIA SYSTEM*

Strategies

1. **Insulate acequias from commodity-value economic pressures.**

- Continue preventing the transfer of water uses across the Otowi gage.
- Consider establishing a community-accountable entity to administer any transfers of acequia water rights and/or to administer financial proceeds from water transfers.
- Make sure the State Engineer considers the public welfare of acequias and communities when considering water rights transfer applications involving acequias.

2. **Implement appropriate-scale water banking.**
   - Take advantage of the ability of acequia parciantes to bank water among themselves.
   - Oppose an unconstrained state-wide water banking system.
   - Work with the State Engineer to expand water banking into a larger (but carefully limited) area than just one acequia: for instance, within a single tributary watershed, or within an association of acequias.
   - Explore options for storing water in existing reservoirs or in new local reservoirs.
3. **Maintain and repair acequia systems—but don't set them in cement!**
   - Look for targeted assistance for intractable acequia maintenance problems—for instance, headgates that can withstand flood flows but still allow for natural stream geomorphology; or reinforcing areas of chronic washouts.
   - Acequias are not interested in wholesale ditch lining or piping because the water "leaked" from unlined acequias returns rather quickly to stream systems, helps recharge ground water and maintain water levels, and expands riparian environment and wildlife habitat.
4. **Modify the adjudication process.**
   - The State Engineer should collaborate with acequias to modify the adjudication process to be more cooperative and less adversarial, while placing fewer burdens on holders of small water rights. This would serve our region better and complete the adjudication process sooner.
   - Recognize the unique legal status of acequias. Acequias are legal subdivisions of government, local political systems, instruments of community cohesion, and historic monuments, as well as water conveyance systems. Acequia rights are recognized under the Treaty of Guadalupe Hidalgo and are usually quite senior water rights.
   - Recognize that acequia irrigation is by nature variable with available runoff, and parciantes have valid water rights to use more water in wet years than they use on average.

* *GOAL: ENHANCE GROWING SEASON FLOWS*

Strategies

1. **Implement improved high-altitude forest and grassland management.**
   - Explore the potential for carefully thinning dense, relatively young forests in some parts of the watershed that may result in increased water yield.
   - Augment vegetation management with small check dams, swales or impoundments in areas with a potential for recharge enhancement (encouraging or re-introducing beavers and muskrats may have a similar effect).
2. **Enhance grass cover and infiltration in lower-altitude areas.**
   - Restore damaged lower-altitude watersheds by reseeding and otherwise enhancing native grass cover. It may be necessary to build many small swales, check dams, and similar structures to slow runoff, reduce erosion, increase infiltration and ground water recharge, and jump-start revegetation.

Note: Watershed restoration such as this could help restore more perennial flow patterns to some tributaries – making more water available for midsummer irrigation – as well as reducing erosion and sediment problems. Good ground cover vegetation is the best way to prevent massive erosion and flash flooding, as well as enhance overall water supplies and improve the timing of streamflows.

3. **Explore options for new reservoir storage.**
   - Seek storage rights for region acequias in existing reservoirs.
   - Explore the options for constructing a number of relatively small reservoirs along existing acequias.
   - Explore the possibility of locating relatively small reservoirs in the upper reaches of the Rio Chama and its tributaries.

Note: New reservoirs could provide additional effective water supply within and perhaps even outside the region.

* *GOAL: SUPPORT LOCAL AGRICULTURE*

Strategies

1. **Enhance marketing opportunities.**
   - Coordinate existing services and resources that help local growers find good markets.
   - Make sure local farmers know about services and opportunities for better production and-marketing.
   - Work with potential institutional buyers like school districts, LANL, and NNMCC.
   - Pursue appropriate-scale food-processing industry that could be located in the region, including meat-processing facilities.
   - Support and help expand farmers' markets and other direct marketing opportunities.
   - Work with State government to expand marketing opportunities outside the local area.
2. **Help finance local agriculture.**
   - Evaluate capital needs among local farmers.
   - Work with local financial institutions, Rio Arriba County, and perhaps private foundations to see that capital needs can be met, either through existing markets or by creating new opportunities.
   - Consider setting up a mechanism to re-invest proceeds from any future water transfers in local agriculture or community infrastructure.
3. **Help with information sharing and technical assistance.**
   - Rio Arriba County (or another region-wide entity) should keep track of information sources and local farmers' needs to help make connections as easy as possible.
   - Help make sure success stories and relevant technical information are widely shared.
   - Provide information and assistance with grant applications or similar opportunities.
   - Help find ways to involve young people in agricultural activities and vocations.
4. **Collaborate widely.**
   - Implementing these strategies will not be easy. Rio Arriba County should perhaps be the spearhead to organize help for local farmers, but many other entities will need to be involved. A great many services are potentially available, and coordinating among them and making the right connections is perhaps the crucial job to be done.

* *GOAL: ENSURE RELIABLE COMMUNITY WATER SUPPLIES*

Strategies

1. **Consolidate community water systems where appropriate.**
   - Evaluate where existing systems may be close enough that consolidation or other forms of collaboration could help cope with drought or technical difficulties.
   - Help find potential funding sources for system enhancement.
2. **Develop alternatives for providing additional water rights where needed.**
   - Identify water systems where additional water could be physically supplied if water rights were available.
   - Explore alternative methods to provide adequate rights for community needs from willing provider(s).
   - Consider local water banking possibilities where water rights are a limiting factor.
   - Enable transfer of water rights from private wells to community systems.
3. **Optimize location and depth of community wells.**
   - Identify systems most constrained by lack of production from existing wells and evaluate the available hydrologic information to assess the likelihood of improving performance by re-drilling or modifying the well(s).
4. **Protect existing communities from unsustainable new water demands.**
   - Make sure proposed new developments are carefully and conservatively analyzed for water-demands and long-term availability before they are approved. Rio Arriba County should

employ a staff or contract hydrologist of its own to evaluate the water supply impacts of proposed developments or water transfers.

5. **Gather basic data to permit informed decision-making.**
   - Collect data on ground water depth, community well production, and other hydrogeological information on ground water level trends and long-term water supplies.
   - Perform water system audits to find leaks and inefficiencies.
6. **Understand surface water – ground water interactions along the Rio Chama.**
   - Request help to define and quantify the interaction between surface water flowing in the Rio Chama and the shallow aquifer system in connection with the river.

* *GOAL: PROTECT WATER QUALITY*

Strategies

1. **Consider and encourage community wastewater treatment.**
   - Explore suitable locations for small-scale package wastewater treatment plants and the economics of providing community treatment.
   - Explore the possibility of providing community treatment for septic tank effluent from existing systems (rather than leaching directly into the ground).
2. **Encourage or require better individual wastewater treatment.**
   - Rio Arriba County and the state Environment Department should enforce existing liquidwaste disposal regulations more effectively.
   - Provide incentives, including educational resources, for individual alternatives to leach fields (such as subsurface flow wetlands, aerobic decomposition, composting toilets, etc.).
3. **Mitigate non-point source and agricultural water pollution.**
   - Encourage organic or chemical-free agriculture, since permeable soil and shallow water tables in agricultural areas make the entire region highly vulnerable to potential agri-chemical pollution.
   - Provide incentives and regulatory requirements for road construction to minimize runoff and erosion.
   - Encourage and seek funding or assistance for watershed restoration activities that enhance ground cover (primarily grass) in poorly vegetated areas. These include constructing swales, check dams, and detention structures, and reseeding with appropriate native grasses.
   - Protect stream banks and riparian areas from inappropriate grazing or other degradation.
4. **Regulate development in upper watersheds.**
   - Prohibit or severely limit residential or other development in upper watershed areas.
   - Establish stringent standards for road con-struction that prevent damaging runoff, erosion, and sediment transport.
   - Establish stringent standards for erosion prevention and revegetation following any disturbance in upper watershed areas (for instance, utility construction or logging activities).

* *GOAL: CONSERVE WATER*

There are many ways to use water more efficiently, and perhaps to make some available for alternative uses. However, New Mexico water law as it currently affects our region provides little incentive for such savings and water conservation will not be widely practiced. The first priority for water conservation is to provide some incentive, or at least remove the disincentives, for efficient water use.

Strategies

1. **Provide incentives for conservation.**
   - Complete adjudication in a reasonably efficient and non-adversarial way.
   - Ensure that right holders or acequias that invest in efficiency benefit from the investment.
2. **Store conserved water.**
   - The value of conserved water (whether used later or elsewhere) is much greater if it can be stored – but this involves tradeoffs with evaporation from reservoirs, or provision of alternative means of storage, such as aquifer storage and recovery. Some water could be stored in

existing reservoirs, and there may be other alternatives for storing water.

3. **Foster practical ways to conserve.**
   - Provide technical and financial help with field leveling and other on-farm water management .
   - Repair chronic or excessive leakage from certain acequia sections.
   - Encourage more active water management, including soil moisture testing and additional flow measurement.
   - Implement water banking so unneeded water can be used elsewhere without loss of rights.
   - Encourage agricultural research and extension services to help grow and market more water-efficient crops.
   - Support re-use alternatives, such as gray water systems, water harvesting, cisterns, constructed wetlands for waste treatment, or re-use of effluent from community wastewater treatment.

* *GOAL: PROTECT & RESTORE OUR WATERSHEDS*

We can manage watersheds to enhance both ecological health and hydrological functioning. This will help achieve all our water planning goals. Good watershed management can help with acequia water supplies, make both community and individual water supplies more secure, protect water quality, make acequia maintenance easier, and even contribute to the long-term viability of the entire acequia system.

There are opportunities for better watershed management throughout the region. Higher altitude areas may benefit from improved fire management, forest thinning, beaver re-introduction, better grazing management, and development restrictions in critical areas. At lower altitudes erosion control and grass cover enhancement are needed almost everywhere, along with managing the timing and intensity of grazing so that livestock can enhance rather than degrade soil cover. Better road construction and runoff management offer advantages everywhere. Better watershed management will need to be achieved in close collaboration with federal land management agencies, particularly the Forest Service, the Bureau of Land Management, and the Fish and Wildlife Service.

For our region, one of the most important issues is ensuring that local residents benefit from watershed restoration or other water management alternatives, with sustainable land-based employment, more stable water supplies, and protected environmental quality. These benefits may be shared outside the region, but proposed actions need to genuinely involve and benefit local residents and communities.

MOVING FORWARD

Bold leadership and creative thinking are needed to implement both this regional water plan and the State Water Plan. Vision and leadership are needed by commissioners of acequias, county officials, state water managers, the Governor, and legislative leaders to protect and defend traditional water use, while allowing planned growth. Traditional uses of water, by Native Americans, parciantes of acequias, and community water systems, should in general be "off the table" for the commercial water market. The environmental and cultural values embodied in traditional water uses, and our future agricultural possibilities, are worth far more than quick profits for a few generated by sprawling, uncontrolled population growth.

To implement this Water Plan, Rio Arriba County critically needs at least two people within the Planning Department with specific skills: a hydrologist and one or more agricultural and natural resource specialist(s). Hydrological expertise is needed to evaluate the effects of proposed development of all kinds and to represent the interests of the County and the planning region with the Office of the State Engineer and other agencies. The region and the county also need a locally accountable staff member with a vision for agriculture and natural resources in northern New Mexico. For local agricultural producers, the County needs to help coordinate existing sources of assistance, find additional funding, and work with state and federal agencies, private enterprises, the State Legislature, and the U.S. Congress to expand agricultural opportunities and success in our region.

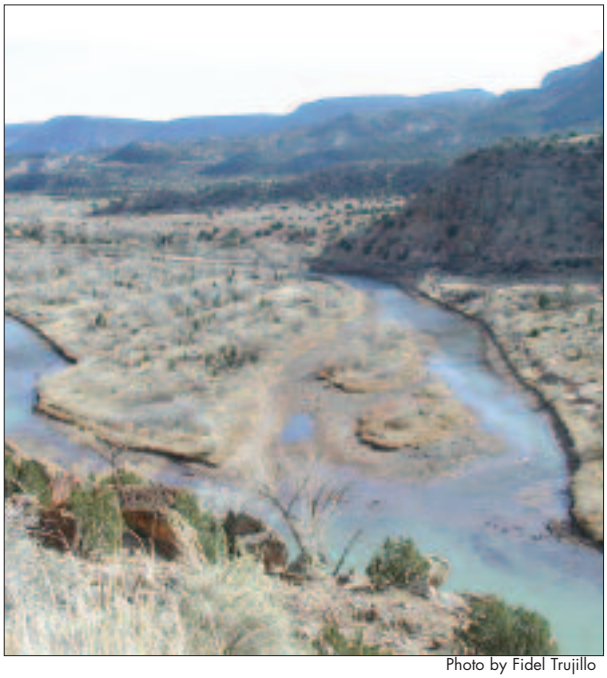


Photo by Fidel Trujillo

Coordination and advocacy are also needed at the county level in sustainable watershed management, both in upland forest areas that may need thinning or controlled burning; and in lower-altitude areas that may need erosion control and revegetation.

New Mexico has a unique water history, including international and interstate treaties and growing, thirsty urban areas. We do not have to become a battleground or a statewide water auction. With creative leadership and active cooperation, New Mexico can be an exporter of innovative ways of dealing with a growing worldwide problem.

Water Supply and Uses in the Rio Chama Watershed