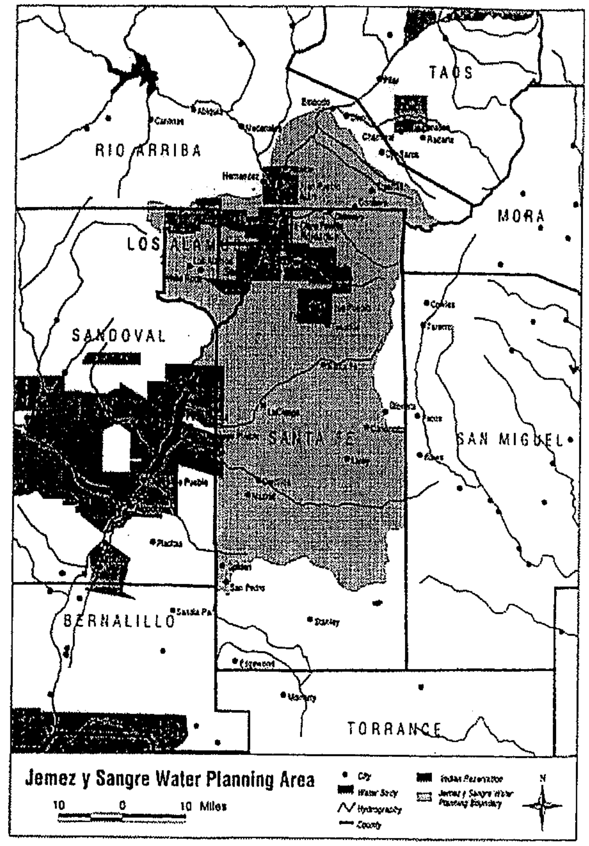
Appendix C3

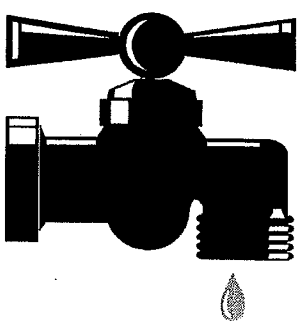
Fact Sheets

How can I learn more?
How can I get involved?

There are a number of ways to participate. Get on the mailing list to keep in touch with what's happening. Come to a special water planning meeting for your subregion. Or have a water planning participant come to speak and listen to your group. Fill out the form and tell us what you're interested in.

Early meetings will seek information and opinion before the plan is developed. Later meetings will ask for public response and advice on draft plans and, still later, on final plans.





JEMEZ Y SANGRE WATER PLANNING REGION

Water for the Future

Regional Water Planning: Why is it important?

Why should we care about the "Jemez y Sangre Regional Water Plan"?

We live in an arid environment. A plan can help us, as a community, to

- ❖ understand how we can balance our water use with our water resources and
- ❖ plan how we can balance our diverse water needs: municipal, agricultural, tribal, environmental.

How much water are we using? Do we have enough water for our future needs, and where is it coming from? How much growth could we expect and what will that mean for our water demand? What values will our plans reflect?

What kind of future do we want?

Regional water planning means getting together as a community and trying to answer those questions, based on technical data and information.

What is Regional Water Planning exactly?

There are 16 water planning regions in New Mexico, established by the Interstate Steam Commission (ISC). Each region can write its own water plan for the ISC to accept and integrate into a statewide water plan.

In this region, a committee oversees writing the plan -- hiring experts to collect information, making sure community concerns are considered, and evaluating different ways to meet our future water needs.

Our region is the watershed, or valley of the upper Rio Grande, between the Jemez and the Sangre de Cristo Mountain Ranges.

Who's involved?

In 1998, a wide range of governments, organizations and individuals signed a cooperative agreement to begin regional water planning for north central New Mexico. Those representatives formed the Jemez y Sangre Water Planning Council to lead the water planning process in our region. Members of the Council are:

Acequia Madre
US Bureau of Indian Affairs
US Bureau of Reclamation
City of Espanola
City of Santa Fe
Eldorado Area Water & Sanitation District
Garcia Ditch
Las Acequias de Chupedero
League of Women Voters
Los Alamos Co. Board of Public Utilities
Los Alamos National Laboratory
New Mexico Rural Water Association
North Central NM Economic Dev. District
Rio Arriba County
Rio Grande Restoration
Santa Fe Area Home Builders Assoc.
Santa Fe County
State Land Office
1000 Friends of New Mexico
To date, several Pueblos have been observing the process and participating informally.

The Council meets monthly and meetings are open to the public.

What's happening now?

Right now, the Council is gathering information on how much water we really have and how much we are using. The Council's Public Involvement Committee is beginning to seek out groups and leaders throughout the region to ask about their concerns, goals and priorities for water.

What happens to our region's plan?

The plan will be recommended for adoption and implementation by each affected city, county, pueblo, acequia, and others.

Some things for communities in our region to think about

Regional water planning means understanding the water resource limitations we face and what opportunities exist.

Among the questions we will be asking are:

What happens to our water supply in a drought year? If municipalities use renewable surface water during wet years, can that save ground water to supply need in drought years? If they carefully conserve will there be enough water for increased uses of water in the future?

How can we best reuse wastewater? Can we store water more efficiently? How can we protect water quality? Can we increase our local water supply by changing how we manage our watershed, limiting fire suppression, reducing forest density and the like?

I'm interested.
[ ] Put me on the mailing list so I can learn about developments in the regional planning process and what public meetings are scheduled to identify problems, issues, concerns and evaluate information and proposals for water management.
[ ] I'd like information on water planning for a meeting of my group.

NAME

____

____

ORGANIZATION AFFILIATION(S) IF ANY

____

ADDRESS

____

____

(Please include e-mail) address if there is one)

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TELEPHONE

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(Please include both home, work and fax, if there is one)

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PARTICULAR AREAS OF INTEREST

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My comment or question is:

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Planning also means understanding the trade-offs involved with different alternatives for meeting future water needs. It means setting goals so that we will have water for the uses we have determined are critical and then developing and evaluating alternatives for meeting those goals. Planning may mean proposing changes in water law and city or county land use codes.

Will water plans protect the region's traditional communities? Should we decide to limit use of water for landscaping or to limit where people can build? Is it acceptable to limit use of domestic wells? Do we need to or should we influence how much or how fast we grow?

Planning means developing a document that governmental organizations will be able to, and want to adopt. Plans won't work unless policy makers agree to implement the alternatives that have been selected.

Water planning will not determine who has water rights, and is completely separate from the legal process of water rights adjudication.

Water rights, however, are not the same as having real water to use.

Wise water planning and management can help make sure real water is available to water rights holders.

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Jemez Y Sangre Regional Water Planning Council
801 W. San Mateo
Santa Fe, NM 87501

Jemez y Sangre Water Planning Council

Fact Sheet

Regional Water Planning and Public Welfare

WHY MUST PUBLIC WELFARE BE ADDRESSED IN THE REGIONAL WATER PLANNING PROCESS?

In 1987, the New Mexico Legislature passed a law that established a process for regional water planning. That law required regional water plans to give an "adequate review of ... the effect on the public welfare."

WHY DID THE LEGISLATURE INCLUDE PUBLIC WELFARE IN THE LAWS ESTABLISHING REGIONAL WATER PLANNING?

In the early 1980's, El Paso applied to the New Mexico State Engineer Office to obtain a permit to appropriate water. The State Engineer, relying on a statute that barred exportation of New Mexico's water resources, denied the application. El Paso sued and a federal court ruled that our statute violated the interstate commerce clause of the U.S. Constitution. The court relied on a U.S. Supreme Court case that prohibited bans against exportation of water on economic grounds, but indicated that a state may prevent "uncontrolled" transfers of water out-of-state based on conservation and public welfare considerations.

In response to the El Paso ruling, the New Mexico legislature amended a number of water statutes to give the State Engineer authority to deny an application if it is contrary to conservation of water or detrimental to the public welfare of the state. Significantly, these criteria apply to all new appropriations and transfers, not just to interstate transactions. The legislature also enacted statutes that established a process for regional water planning. If we can prove that we need the water for our citizens, we can defend against attempts by other states to appropriate our water for use outside the state.

WHY IS PUBLIC WELFARE IMPORTANT?

Public welfare is important for two reasons.

First, when the U.S. Supreme Court provided a means for protecting our water from appropriations by other states, the court emphasized that state statutes must "regulate evenhandedly to effectuate a legitimate local public interest." Therefore, if we hope to retain our water in state to protect our communities, cultures and environment and to promote sustainable use of our water resources, we must apply those same concerns to applications for water to be used in-state. A regulation that clearly applies to all applications--interstate and intrastate--will accomplish the objective of keeping water in New Mexico more effectively.

Second, without public welfare, we have no mechanism for ensuring that the those things we value are not lost and those things that are needed for our future are protected. The public welfare criterion enables us to ask questions about our use of water. For example, do we want to promote sustainable uses of our water? Do we want to dry up our rural areas to supply municipalities? Do we want to encourage industries that need large amounts of water to move here?

WHAT IS PUBLIC WELFARE?

The legislature did not define public welfare, nor has the State Engineer Office or the Interstate Stream Commission. One question for both the state and the Jemez y Sangre region is whether or not we want to define public welfare broadly and, if so, what should be included. The following is a list of public welfare values, most of which are compiled from definitions of public welfare in other western states.

(1) health and safety;

(2) economic consequences, including impacts on the existing economy and area of origin of water rights, maintenance of traditional rural and agricultural economies, recreation, and external costs;

(3) encouragement of conservation and discouragement of waste or impractical or unreasonable uses of water;

(4) environmental and ecological consequences, including impacts on fish, wildlife and plants, ecologically critical areas, riparian ecosystems, wetlands, and watershed management;

(5) sustainability, sustained yield, groundwater recharge, and aquifer management;

(6) water quality;

(7) loss of alternative uses of water that might be made within a reasonable time if not precluded or hindered by the proposed application;

(8) opportunities for reuse of return flows;

(9) protection and enhancement of historic, cultural and natural resources, and aesthetic values;

(10) preservation of public and trust lands, water and open space;

(11) scientific study;

(12) whether high-quality water is being used when locally available low-quality water would suffice;

(13) public welfare as defined in the regional and state plans or by elected officials in land use planning;

(14) benefit and harm to the applicant and other persons;

(15) whether the applicant sets a precedent;

(16) cumulative impacts; and

(17) short and long-term consequences of application.

WHAT HAPPENS IF PUBLIC WELFARE IS DEFINED NARROWLY?

If public welfare is defined very narrowly, then it will not have much impact on the way water is managed. We will continue to base decisions only on whether:

- there is unappropriated water available;
- a new use or location will impair existing users; and
- whether the new use or location is contrary to conservation of water.

This fact sheet has been written by the Jemez y Sangre Regional Water Planning Council. For more information, contact Amy Lewis, Water Resources Planning Coordinator at 954-7123 or 801 W. San Mateo, Santa Fe, NM 87505. August, 2000

Jemez y Sangre Water Planning Council

Fact Sheet

A Brief Description Of Water Law In New Mexico

HOW NEW MEXICO MANAGES WATER

Since 1907, the New Mexico State Engineer has regulated water use. Initially the State Engineer only had authority over surface water. Since 1931, this authority has applied to all **declared groundwater basins** as well. The State Engineer is appointed by the Governor and confirmed by the New Mexico Senate. The State Engineer must act upon any application for new water uses or any application to change the point of diversion or the purpose or place of use of water (usually referred to as a **transfer**). The State Engineer must deny an application when he determines that the use would result in **impairment** (i.e., diminished supplies or water quality) to existing users or that the proposed use is contrary to the **public welfare** or conservation of water. After an application is filed with the State Engineer, existing users and others may file **protests** stating why the State Engineer should not approve the application. If a protest is filed, the protestant or applicant may request a hearing or the State Engineer may require a hearing. State Engineer decisions can be appealed to the district court.

An adjudication is a lawsuit filed to determine "all rights to the use" of water within a stream system. Water rights are never fully determined until there is an adjudication because a water right is measured under state law by the water put to actual beneficial use. For example, the State Engineer may permit Joe Smith to use 40 acre-feet of water per year. However, if Joe Smith only uses 20 acre-feet under the permit, a court will not automatically grant Smith a right to 40 acre-feet per year. For purposes of water planning, municipalities and counties are allowed to apply for a permit for sufficient water to meet need for the succeeding 40 years. However, if the water is not used within the time frame, there is no "water right" to the amount of the permit. Adjudications begin with a hydrographic survey of the stream system that maps all water uses, surface and groundwater. The priority date declared by the water user is deemed correct until the court determines the priority date. Many adjudications are on-going in the Jemez y Sangre Water Planning area, two of which are: State of New Mexico v. Aamodt (Pojoaque, Nambe and Tesuque basins) and State of New Mexico v. Anaya (Santa Fe River basin). These adjudications are not completed. In the future, there will likely be another adjudication in the region: the adjudication of the mainstem of the Rio Grande.

Water quality is generally controlled by the New Mexico Environment Department and the Water Quality Control Commission. The State Engineer, when ruling on applications, can take effects on water quality into consideration.

REGIONAL WATER PLANNING

The New Mexico legislature enacted a statute in 1987 enabling regions in the state to plan their water future. Pursuant to that statute, the Jemez y Sangre Water Planning area was established in 1998. Water planning was initiated at the regional level so that unique characteristics of each region of the state could be equally protected. Regional water plans determine future water demand and, based upon the available supply, determine how the region will balance demand and supply. Through this process, the region can significantly impact any evaluation of what uses of water are consistent with the public welfare.

THE PRIOR APPROPRIATION DOCTRINE

In water rich areas of Europe and the United States, water is acquired from natural watercourses on or adjacent to a person's land. If the use is reasonable, there is no limit on the quantity that can be put to use. This is called the riparian doctrine. Because of the scarcity of water in the West, a different doctrine developed to define rights to water. New Mexico and other western states use some version of the prior appropriation doctrine. In New Mexico, two clear principles govern establishment of water rights:

1. Priority of appropriation shall give the better right.
2. Water may be used only for beneficial purposes.

An appropriation means dedication of water for a beneficial purpose. Priority of appropriation is often summarized as first in time, first in right. This means that the person who first puts water to use has the senior priority and each additional user has a junior priority. The senior priority holder is entitled to receive the full quantity of water that the senior priority holder can apply to beneficial use or the maximum quantity permitted, whichever is less. Junior priority holders must satisfy their uses out of what remains in order of their relative seniority. Beneficial use has not been fully defined. Only waste and mine dewatering have been ruled to be a non-beneficial use of water.

ESTABLISHING WATER RIGHTS

As discussed previously, after 1907 or the date when the State Engineer declared authority over any groundwater basin (1956 for most of the Rio Grande basin), one must obtain a permit to use water from the State Engineer. These uses will have as a priority date the date the application for a permit was filed. If water use began before 1907 or the date when the State Engineer declared authority over any groundwater basin, then the date the use began, whether surface or ground water, determines the priority of the right. When these uses are transferred, the priority date is retained, but the amount of water that can be transferred may be significantly less.

Pursuant to New Mexico statute 72-12-1, the State Engineer "shall" approve applications for domestic wells. Domestic wells may use up to three acre-feet per year. However, when these rights are adjudicated, the adjudicated right will depend on what has actually been used. A water right may be declared forfeited, and it can be abandoned for non-use.

FEDERAL WATER RIGHTS

On federal lands (e.g., Forest Service, Park Service, Bureau of Land Management) water rights are reserved by the United States for use on those lands. The priority date of federal reserved water rights is the date the United States reserved the land for the particular use, not the date that the actual use began. In some cases, the United States may have state law rights under the prior appropriation system, if for instance, the United States acquires lands with existing water rights.

PUEBLO AND TRIBAL WATER RIGHTS

The Pueblos of New Mexico can have state law created rights in some instances where they acquire lands with appurtenant pre-existing state law water rights. They can have federal reserved water rights where lands outside Pueblo grants have been reserved for them by the United States. Pueblos also have a third type of water right, referred to as Mechem doctrine or aboriginal water rights. The Pueblos of New Mexico, unlike many other tribes, reside on lands that they have never left. While the United States recognized those prior holdings thereby giving Pueblo rights to land and water federal protection, these rights do not depend on any federal action for their existence. In Aamodt, Judge Mechem held that these rights have the senior priority right as the Pueblos were the first land holders. This right extends to historically irrigated acres, livestock watering, municipal and domestic uses. Historically irrigated acreage means all lands used for irrigation as of 1846 and any additional lands placed into irrigation from 1846 to 1924. In addition to senior priority, these rights cannot be lost through forfeiture, abandonment, or other forms of non-use.

Pueblos are governments, and pursuant to their inherent powers as confirmed by federal law, each Pueblo has authority to regulate water quality and water use by users within Pueblo boundaries.

INTERSTATE STREAM COMPACTS

Streams and rivers ignore political boundaries. Where a river runs through several states, those states form a compact to determine each state's share. The United State Congress must approve these compacts. New Mexico is a party to several compacts, including the Rio Grande, Pecos and Colorado compacts. The compacts obligate New Mexico to deliver water to other states. No matter how vested a water right might be, if using it violates a compact, it cannot be used. Compacts can place significant constraints on the water supply available for use.

This fact sheet was written by the Jemez y Sangre Water Planning Council. For more information, contact Amy Lewis, Water Resources Planning Coordinator at 954-7123 or 801 W. San Mateo, Santa Fe, NM 87505. November 2000

Jemez y Sangre Water Planning Council

Glossary

Acre-foot of water: The amount of water that would cover an acre to a depth of one foot or about 325,829 gallons.

Adjudication: A legal proceeding in which a court determines the validity, priority, and amount of a water right.

Aquifer: A geologic formation that is saturated with water and sufficiently permeable to yield a usable quantity of water to wells or springs.

Appropriation: The right to use water for a beneficial use.

Compact: An agreement between two or more states that has been approved by the U.S. Congress and allocates the water in the rivers and streams flowing through those states.

Consumptive Use: Water that is evaporated or transpired and is lost from the water system.

Declared ground water basin: An area with reasonably ascertainable boundaries that has been designated by the State Engineer to prevent impairment of existing water rights. Once a basin has been declared, applicants must apply to the State Engineer to appropriate ground water from the basin.

Depletion: The net reduction in surface-water flow between two specified points in the flow system.

Domestic Wells: Domestic water rights are also known as "72-12-1" water rights after the section of the water code that requires the State Engineer to approve all applications for a well to supply a household for domestic uses, livestock and irrigation. A regulation adopted by the State Engineer allows domestic well users to use up to 3 acre-feet per year.

Evapotranspiration: The combined processes of simple evaporation and plant transpiration by which water is converted to vapor and lost to the system.

Forfeiture: If a water right is not used for a four-year period and for one additional year after notification, the right is forfeited. Water rights not used prior to 1965 do not require a one-year period of non-use after notification.

Impairment: When the supplies of an existing user are diminished in quantity or quality by a new use or change in an existing use.

Instream Flow: Water in a stream or river for fish, wildlife, recreation, watershed or other purposes.

Mining Water: Mining water usually refers to underground water resources that are being pumped out of the ground at a rate greater than water is replenished in the system by recharge.

Native Water: Water that naturally originates in streams or river. San Juan/Chama Project water which is pumped from the Colorado River basin into the Chama River basin is not native water.

Priority Date: The date indicating when the water right was first exercised. The priority date determines the seniority of the water right. Senior water rights holders are entitled to receive their full water right before junior water rights holders receives any water.

Recharge: Recharge is water that is added to groundwater storage from infiltration of rain, snow or stream flow.

Return Flow: Return flow generally refers to water that is returned to the hydrologic system. For example, when a field is irrigation, that water that flows off the field and back into the stream is considered return flow.

Riparian: Riparian refers to the habitat and life forms along streams, lakes and wetlands.

San Juan/Chama Project Water: San Juan/Chama Project water refers to water transported from the Colorado river basin into the Chama River basin. Several cities, counties and water companies have entered into leases with the Bureau of Reclamation for use of that water.

State Engineer: The New Mexico statutes give authority over water to the State Engineer who is appointed by the governor.

Transfer: The State Engineer must approve applications for the new use of water or the sale, change of use or location, or lease of a water right; this procedure is generally referred to as a water rights transfer.

This fact sheet was written by the Jemez y Sangre Water Planning Council. For more information, contact Amy Lewis, Water Resources Planning Coordinator at 954-7123 or 801 W. San Mateo, Santa Fe, NM 87505. July 2000

Jemez y Sangre Water Planning Council

Sub-Basin Water Supply and Demand Summary

Velarde Sub-Basin

OVERVIEW

The water budget for the Velarde sub-basin shows that for an average year there is currently an adequate supply of water. By 2060, the projected population change would increase water demand by approximately 325 afy. Domestic wells could be developed to meet demand, however, development of additional municipal water supplies will require acquisition of existing water rights. Water quality issues must be addressed in the sub-basin as groundwater resources are developed. Surface waters below the Velarde sub-basin and Otowi gauge are fully appropriated and include Rio Grande Compact deliveries.

SUB-BASIN CHARACTERISTICS

The Velarde sub-basin lies entirely within Rio Arriba County. The sub-basin includes Alcalde, Estaca, Velarde, and small portions of Espanola and San Juan Pueblo.

The Velarde sub-basin, covering an area of 167 square miles, mostly drains the Sangre de Cristo Range in the vicinity of the Truchas Peaks. A small portion of the sub-basin west of the Rio Grande, which drains slopes on the east side of Black Mesa, does not contribute measurable volumes to the local surface water supply.

The Velarde sub-basin extends from an altitude of 12,300 feet above mean sea level at its highest point to 5,572 feet at its outlet on the Rio Grande, encompassing some 6,730 feet of elevation relief. The average elevation of the watershed is 6,847-feet.

The main streams draining the mountain slope are Rio de Truchas and Cañada de Las Entrañas. Arroyos that drain lower elevations include Arroyo del Pueblo, Arroyo Ocote, Cañada Ancha, Arroyo del Palacio, Arroyo de Los Chavez, Arroyo de Ranchitos and Arroyo de Los Borregos.

PRECIPITATION

The Velarde sub-basin receives an average annual precipitation of 12.2 inches.

SURFACE WATER SUPPLY AND DEMAND

Surface water inflow to the Velarde sub-basin consists primarily of Rio Grande flow at Embudo, and runoff from the Sangre de Cristo Mountains east of the river. Runoff from the west side of the river in the vicinity of Black Mesa is imperceptible within the total sub-basin budget.

The average annual flows at the Embudo gauge during the years 1963 to 1986 (816 cfs) were used to compute part of the area's surface water inflow, while tributary inflow (2,420 afy) was derived using the elevation-area-yield approach, which accounts for evapotranspiration losses.

Irrigated acreage is concentrated along the Rio Grande and along reaches of the Rio de Truchas. Reported 1995 irrigated acreage in the area was used to estimate irrigation diversions, depletions, and return flows. Free water surface evaporation losses from the Rio Grande channel were estimated assuming a river distance of 16 miles from Embudo to the watershed outlet and a river width of 100 feet.

Evapotranspiration losses near the Rio Grande and Rio de Truchas areas were computed using an estimated riparian acreage of about 1,000 acres, as measured from the 1992 Landsat map.

Inflow from groundwater to surface water along the Rio Grande has been estimated at about 0.5 to 1.0 cfs per river mile. For the 16 miles between Embudo and the San Juan Pueblo, the Rio Grande was assumed to gain in flow from groundwater discharge at a rate of 0.5 cfs per mile, which resulted in a total annual river gain of 5,800 afy.

The remaining budget component, loss of surface water to groundwater, was estimated at 1,800 afy by comparing all components. The outflows are assumed to occur in areas of the sub-basin lying at higher elevations than the Rio Grande.

Assessment of the surface water budget indicates that surface water is considered fully appropriated in the Velarde sub-basin. However, Pueblo water rights remain to be determined. There appears to be sufficient flow in the main stem of the Rio Grande for agricultural purposes during 10 year drought and minimum flow conditions. Surface water use off the main stem at higher elevations in the sub-basin would likely be impacted during periods of drought.

GROUNDWATER SUPPLY AND DEMAND

Assessment of the groundwater budget indicates that groundwater resource is extensive and largely not utilized in the Velarde sub-basin. The estimated groundwater storage in the aquifer is 9.6 million acre-feet. However, because surface waters are fully appropriated, stream-connected groundwater appropriations or transfers will be conditioned to require retirement of surface water rights to offset any depletions caused by groundwater pumping.

EXISTING USES

Water is used for agricultural and domestic purposes in the Velarde sub-basin. Domestic supplies are provided through mutual and individual domestic water supply wells. Approximately 26,400 afy of surface water and 46 afy of groundwater are used for irrigation purposes. Approximately 667 afy of groundwater is pumped for municipal/domestic purposes. Water is also used for livestock purposes.

WATER QUALITY

In general, the water supplies meet applicable water quality standards. However, water quality concerns exist due to septic tank discharges. For example, there is an area of high nitrate in excess of drinking water standards in Alcalde.

POPULATION AND DEMAND PROJECTIONS

Under the most likely growth scenario, the Velarde sub-basin population will increase from its current population of about 4,500 to about 6,600 in the next 60 years. The population change would increase water demand by approximately 325 afy. Domestic wells could be developed to meet demand, however, development of additional municipal water supplies will require acquisition of existing water rights. Water quality issues must be addressed in the sub-basin as groundwater resources are developed.

SPECIAL CONSIDERATIONS

Surface waters below the Velarde sub-basin and Otowi gauge are fully appropriated and include Rio Grande Compact deliveries. Per the Rio Grande Compact, New Mexico must maintain flow conditions that existed in 1929 to meet Compact requirements. Additionally, Pueblo water rights remain to be determined.

Summary water quantity and quality data taken from "Water Supply Study Jemez y Sangre Water Planning Region, New Mexico," Duke Engineering, & Services, Albuquerque, New Mexico, (August 2000) or as referenced. Population data taken from "Population Projections for the Jemez y Sangre Water Planning Region, Bureau of Business and Economic Research, University of New Mexico, July 2000.

Jemez y Sangre Water Planning Council

Sub-Basin Water Supply and Demand Summary

Santa Clara Sub-Basin

OVERVIEW

The water budget for the Santa Clara sub-basin shows that for an average year there is sufficient water to meet current demands. The quality of surface water and groundwater is quite good (although surface water quality will be degraded for a few years following the Cerro Grande fire). Domestic water demand is projected to increase from 720 acre feet per year (afy) today to 1077 afy in year 2060. Current projections indicate that there will be sufficient groundwater to meet population-based needs for the next sixty years. As with other areas in the region, care will be needed to assure that shallow groundwater is not contaminated by additional septic systems as the population grows.

SUB-BASIN CHARACTERISTICS

The Santa Clara sub-basin encompasses 84 square miles on the eastern slopes of the Jemez Mountains north of Los Alamos and southwest of Espanola. The sub-basin is bounded on the west by the crest of the Jemez Mountains, on the south by the Los Alamos sub-basin, on the east by the Rio Grande, and on the north by the drainage divide located north of Santa Clara Canyon. The majority of land in this sub-basin is within the Santa Clara Pueblo reservation boundary in Rio Arriba County.

Santa Clara Creek is the only perennial stream in this sub-basin, but it has several ephemeral tributaries along its reach. The headwaters of Santa Clara Creek are at an elevation of 11,525 feet and its discharge at the Rio Grande is at an elevation of 5,523 feet, for a total relief of about 6,000 feet.

PRECIPITATION

The Santa Clara sub-basin receives an average of 18.2 inches of precipitation annually, mainly from mountain snow and summer monsoon rains. Evaporation and evapotranspiration is higher in the lower and more heavily vegetated reaches of the Santa Clara Sub-Basin, and accounts for a significant decrease in total available water.

SURFACE WATER INFLOW AND OUTFLOW

Inflow from rain and snow melt runoff for the sub-basin was calculated as 5,570 afy using the elevation-area-yield approach of Reiland (1975). Outflow occurs as stream loss to groundwater (510 afy), evaporation/evapotranspiration (550 afy), and diversions for irrigation (1,620 afy). The diverted irrigation water is estimated to yield a return flow of about 890 afy.

Surface water flow into the Rio Grande is estimated to be 3,780 afy using flow measurements on Santa Clara Creek near Espanola and yields for ephemeral tributaries estimated by the elevation-area-yield method (Reiland 1975).

GROUNDWATER INFLOW AND OUTFLOW

Groundwater inflow is estimated to be 3,760 afy from mountain front recharge, 510 afy from stream channel recharge, and 850 afy return flow, mostly from irrigation, for a total of 5,120 afy.

Groundwater outflow is estimated to be 1,120 afy to municipal/industrial and domestic uses, 1,250 afy to evapotranspiration (to a depth of 20 ft) and 2,740 afy to groundwater moving slowly (underground) out of Santa Clara sub-basin into adjacent sub-basins, for a total of 5110 afy.

WATER QUALITY

Water quality information for Santa Clara Creek is limited; however, it is probable that it is similar to Rito de los Frijoles in Bandelier National Monument to the south. Both Rito de los Frijoles and Santa Clara Creek drain Tertiary volcanic tuff composing the eastern flank of the Jemez Mountains, and both watercourses are subject to some recreational and cattle grazing land use.

It should be noted that the Cerro Grande fire in May 2000, burned through the headwater area of Santa Clara Creek so that runoff and water quality are certain to be altered for a number of years. It is also worth noting that in the Espanola area high density rural housing (with septic systems) is commonly associated with local groundwater contamination problems.

EXISTING USES

Surface water is used predominantly for agriculture. Approximately 699 acres are irrigated. Livestock also graze in the mountains during mild weather periods. Santa Clara Canyon has been developed into a recreational area with three retention ponds for fishing, numerous picnic sites, and south of the canyon is Santa Clara ruins visited by many tourists each year.

Santa Clara Pueblo and adjacent communities south of Espanola currently use 1120 afy of groundwater for domestic and municipal/industrial purposes.

PROJECTED DEMAND

The population in the Santa Clara sub-basin is estimated at 4,800 in 1999, and is projected to grow to 7,180 in the next 60 years (BBER). Most people reside either in Santa Clara Pueblo south of Espanola or in southwestern Espanola, west of the Rio Grande River. Future growth will likely take place in these same general areas of the sub-basin. Groundwater used only for domestic purposes, based on population, is projected to grow from 720 afy to 1077 afy by the year 2060. Municipal/industrial demand (mainly in Espanola) will likely grow over the next 60 years, but future growth will be constrained by limited availability of water rights. Surface water usage for irrigation is projected to remain essentially constant during this period.

Summary water quantity and quality data taken from "Water Supply Study Jemez y Sangre Water Planning Region, New Mexico," Duke Engineering, & Services, Albuquerque, New Mexico, (August 2000) or as referenced. Population data taken from "Population Projections for the Jemez y Sangre Water Planning Region, Bureau of Business and Economic Research, University of New Mexico, July 2000.

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Sub-Basin Water Supply and Demand Summary

Santa Cruz Sub-Basin

OVERVIEW

The Santa Cruz sub-basin encompasses an area of about 200 square miles to the east of Espanola. It includes the Rio Quemado, Rio Medio and Rio Frijoles stream drainages and numerous associated arroyos. It is projected that the population in this sub-basin will double in the next 60 years from 20,000 to 40,000, and that the demand for groundwater for domestic use will also double from 3,000 acre feet per year (afy) to 6,000 afy. Surface water demand, principally for irrigation, is projected to remain constant to 2060. While surface and groundwater quantities appear sufficient to meet future population demands as projected through the year 2060, water appropriations and water quality issues will likely grow as the population increases. Surface and groundwater quality is generally quite good, except in some local communities where septic tanks and leach fields have raised nitrate levels in groundwater.

SUB-REGION CHARACTERISTICS

The Santa Cruz sub-basin is east of Espanola, bounded on the west by the Rio Grande, on the north by the Velarde sub-basin, on the east by the crest of the Sangre de Cristo Mountains, and on the south by the Pojoaque - Nambe sub-basin. Most of the Santa Cruz sub-basin is in extreme northeast Santa Fe County and southeast Rio Arriba County.

The Santa Cruz sub-basin encompasses just over 200 square miles draining the western flanks of the Sangre de Cristo range between Pecos Baldy on the south and Truchas Peaks on the north.

The elevation ranges from 12,980 feet in the Sangre de Cristo range to 5,490 feet at the Rio Grande, a relief of 7,490 feet from east to west. The main stream draining the sub-basin is the Santa Cruz River and its principal tributaries are the Rio Quemado, Rio Medio, and Rio Frijoles. Other significant drainages within the lower elevation areas of the sub-basin flow only after major storm events and include Arroyo Seco, Arroyo Madrid, and Arroyo de la Mesilla

PRECIPITATION

The average annual precipitation within the sub-basin is 16.3 inches, with the higher elevations getting substantially more than the lower elevations. The combined surface water evaporation and evapotranspiration through vegetation accounts for a significant decrease in available water supply each year.

SURFACE WATER INFLOW AND OUTFLOW

Surface water inflow from the combined drainage areas of the Rio Medio, Rio Frijoles (using gauging station data) and Rio Quemado (using the elevation-area-yield approach) at the mountain front is estimated to be 26,280 afy.

Inflow from groundwater (springs and seeps) is assumed to be negligible because a net stream loss is computed for the Santa Cruz sub-basin. Return flow from irrigation is estimated to be 10,760 afy.
Surface water outflow includes stream loss (to groundwater) of 5,190 afy for all streams in the sub-basin; diversions for irrigation (19,700 afy), and water losses to evaporation and evapotranspiration of 3,680 afy combined. Surface water outflow to the Rio Grande averages 8,470 afy, which includes the Santa Cruz watershed as measured at a gauging station near Riverside and estimated yields (using the Reiland method) from Arroyo Seco and Arroyo Madrid.

GROUNDWATER INFLOW AND OUTFLOW

The total inflow to groundwater is estimated to be 10,650afy. Inflow is estimated to be 3,080 afy from mountain front recharge, 5,190 afy from surface water infiltration along stream courses, 1,760 afy from adjacent sub-basins, and 620 afy from return flow of irrigation and municipal/industrial sources.

Groundwater outflow is estimated to be 3,000 afy for domestic and municipal use, 2,400 afy to evaporation and 7,130 afy to outflow from the sub-basin.

EXISTING USES

Surface water is utilized primarily for agricultural purposes with an estimated 9890 irrigated acres (using the method of Wilson and Lucero 1997, but also noting considerable uncertainty) in the sub-basin.

Groundwater is tapped primarily for rural domestic use and by the City of Espanola for municipal uses.

WATER QUALITY

Surface water quality is generally good within the sub-basin with only iron and manganese levels noted as being somewhat elevated when sampled in the late 1980s. The groundwater quality is generally very good except in the more congested areas, where septic tanks and drain fields have locally raised nitrate levels.

PROJECTED DEMAND

Most residents in the sub-basin reside in Espanola or in communities to the east along state road 76, including Santa Cruz, Chimayo, Portrero, Cordova and Truchas, or south, including La Mesilla and Arroyo Seco near US 285. The Santa Cruz sub-basin population is estimated to be about 20,000 in 2000.

Under the most likely population growth scenario, the population will grow to about 40,000 by the year 2060 (BBER, Draft, July 2000). Most of the future population growth will be in the same general areas as the present population centers. The Santa Fe County portion of the sub-basin, southeast of Espanola/Riverside, is expected to see the greatest growth over the next 60 years (BBER, Draft, July 2000). The increased population will result in a greater demand for groundwater for domestic use, from 3,000 afy in year 2000 to 6,000 afy in 2060. Little change in surface water demand (mainly for agriculture) is projected during this period.

Summary water quantity and quality data taken from "Water Supply Study Jemez y Sangre Water Planning Region, New Mexico," Duke Engineering, & Services, Albuquerque, New Mexico, (August 2000) or as referenced. Population data taken from "Population Projections for the Jemez y Sangre Water Planning Region, Bureau of Business and Economic Research, University of New Mexico, July 2000.

Jemez y Sangre Water Planning Council

Sub-Basin Water Supply and Demand Summary

Los Alamos Sub-Basin

OVERVIEW

The Los Alamos sub-basin meets current water demand through use of ground water. By 2060, the population change could increase water demand by approximately 660 afy. It appears the State Engineer's recognized water right of 5,541 afy could meet the demand. The primary concern for the sub-basin is the sustainability of groundwater pumping. Additionally, naturally occurring constituents, such as arsenic, and historic releases of hazardous substances from Los Alamos National Laboratory, such as radionuclides, are a concern. The Cerro Grande fire heightened these concerns.

SUB-BASIN CHARACTERISTICS

The Los Alamos sub-basin encompasses Los Alamos County with small portions extending into Rio Arriba and Santa Fe counties. The sub-basin is in the Jemez Mountains with the landscape consisting of relatively high mountains and plateaus cut by deep canyons.

Portions of Santa Clara Pueblo and San Ildefonso Pueblo occupy the eastern part of the sub-basin with the Rio Grande forming the eastern boundary. Most sub-basin residents live in Los Alamos or White Rock. Landholdings are largely federal, including Los Alamos National Laboratory.

The watersheds within the sub-basin encompass a total area of approximately 173 square miles. The sub-basin extends from a high elevation of 10,423-feet above mean sea level in the Jemez Mountains to about 5,360-feet at the Rio Grande where the southernmost tributary (Rito de los Frijoles) joins the main stem river; thus the total elevation relief is about 5,060 feet.

Rather than comprising a single, main watershed with a distinct outlet, the Los Alamos sub-basin actually contains several canyons that flow southeastward to eastward and are directly tributary to the Rio Grande. They include Guaje Canyon, Los Alamos Canyon, Pajarito Canyon, Water Canyon, Ancho Canyon, and Canyon de los Frijoles. Several other smaller canyons are tributary to these major canyons. When considering full stream lengths within each watershed, almost all streams are considered ephemeral/intermittent.

PRECIPITATION

The sub-basin receives an average annual precipitation of about 17.7 inches.

SURFACE WATER SUPPLY AND DEMAND

Surface water inflow at the mountain-front in the Los Alamos sub-basin was estimated at 2,790 afy using the elevation-area-yield approach, which accounts for terrestrial ecosystem ET losses. Runoff, spring discharge from perched aquifers, and sanitary wastewater discharges enhance surface water flows. Using estimates of flat free water surface areas and riparian areas, total ET was estimated to consume 1,990 afy of surface water.

Stream losses on the plateau are significantly greater than can be explained by ET and thus represent a source of recharge for the groundwater system. This mechanism, however, probably produces far less water than does recharge from the Sierra de los Valles and possibly from Valles Caldera. Assessment of the surface water budget indicates that no human use is made of surface waters, thus the system is in a natural state.

GROUNDWATER SUPPLY AND DEMAND

The regional aquifer beneath the Pajarito Plateau occurs in rocks of the Puye Formation, Cerros del Rio Basalts, and Tesuque Formation. The aquifer is unconfined in the west and confined in its eastern portion near the Rio Grande. The flow of groundwater is east or southeast, towards the Rio Grande.

The Rio Grande is the main discharge area for the regional aquifer. The aquifer primarily is recharged by underflow of groundwater from the Sierra de los Valles. However, there is leakage from alluvial groundwater in canyon bottoms on the Pajarito Plateau, and from intermediate perched groundwater.

Assessment of the groundwater budget indicates net depletion of groundwater due to pumping could be as little as zero or as large as 2,000-3,000 afy, depending on assumptions about recharge rates. It is unclear whether municipal pumping has reduced discharge to the Rio Grande. Ongoing studies indicate water levels in the aquifer may be stabilizing and current-pumping rates may be sustainable. Estimated groundwater storage is 11 million acre-feet. However, because surface waters are fully appropriated, stream-connected groundwater appropriations or transfers will be conditioned to require retirement of surface water rights to offset any depletions caused by groundwater pumping. The Long Range Water Supply Plan for Los Alamos County indicates annual water level declines between 1 and 2 feet per year compared with the 500- to 1,500-foot-thick saturation zone of the aquifer.

Los Alamos County administers the New Mexico State Engineer recognized water right of 5,541.3 afy. Approximately 80 percent of the right have been used over the past 10 years. The County holds the 1,200 acre-foot San Juan/Chama contract, which could potentially allow diversion of up to 1,550 afy to fully consume the water. According to Los Alamos County Long Range Plan, present County development plans could result in an 11 percent increase in water usage. Additional Laboratory water use is more difficult to forecast, but likely to remain stable because of aggressive water conservation efforts.

WATER QUALITY

The Los Alamos County public water supply meets drinking water quality standards. In addition to the public water supply, there are a few individual domestic water supply wells. Concerns exist relative to residual contamination associated with historic operations of Los Alamos National Laboratory. The Laboratory is taking corrective action under its Environmental Restoration Project to address these concerns. The Laboratory has an ongoing surveillance and monitoring program to assess the quality of surface water and groundwater. In addition, the public water supply is monitored to ensure it meets applicable water quality standards.

EXISTING USES

The Los Alamos groundwater supply is used for municipal, domestic, and industrial purposes (approximately 4000 afy). Groundwater and surface water are also used for livestock purposes (minimal).

POPULATION AND DEMAND PROJECTIONS

Under the most likely growth scenario, the Los Alamos sub-basin population will increase from its current population of about 20,000 to 23,000 in the next 60 years. The population change would increase water demand by approximately 660 afy, which is consistent with the Los Alamos County Long Range Plan. It appears the New Mexico State Engineer recognized water right of 5,541.3 afy could meet this demand.

SPECIAL CONSIDERATIONS

The primary concern for the Los Alamos sub-basin is if the current pumping rate is sustainable. Additionally, naturally occurring constituents (for example, arsenic) and historic releases of hazardous substances (for example, radionuclides) are a concern in groundwater. Per the Rio Grande Compact, New Mexico must maintain flow conditions that existed in 1929 to meet compact requirements. Additionally, Pueblo water rights remain to be determined.

Summary water quantity and quality data taken from "Water Supply Study Jemez y Sangre Water Planning Region, New Mexico," Duke Engineering, & Services, Albuquerque, New Mexico, (August 2000) or as referenced. Population data taken from "Population Projections for the Jemez y Sangre Water Planning Region, Bureau of Business and Economic Research, University of New Mexico, July 2000.

Jemez y Sangre Water Planning Council

Sub-Basin Water Supply and Demand Summary

Pojoaque-Nambe Sub-Basin

OVERVIEW

The Pojoaque-Nambe watershed is the focus of the Aamodt lawsuit, first filed in 1966 in an attempt to adjudicate the waters of the sub-basin. Little is known about much of the sub-basin's water resources due to a lack of measuring capacity for inflows, diversions and domestic wells. The population of the region, due to its proximity to the population center of the region in Santa Fe, is projected to grow at a faster rate than other sub-basins farther from Santa Fe.

SUB-BASIN CHARACTERISTICS

The Pojoaque-Nambe sub-basin drains an area of 123 square miles. The elevation ranges from 12,621 feet at the peaks of the Sangre de Cristo Range, to 5,494 at the Rio Grande. The main streams in the watershed are the Nambe River, the Rio En Medio, Chupadero and the Tesuque, all of which combine to form the Pojoaque River. The average slope of the river is 182 feet per mile.

The Nambe River is the principal stream in the watershed and has the only surface water reservoir in the watershed. The normal reservoir storage capacity is 2,023 acre feet.

PRECIPITATION

The closest long-term precipitation station to the sub-basin is Santa Fe. The average precipitation is 13.84 inches but has varied from 5.03 inches to 21.75 inches.

SURFACE WATER SUPPLY

Reiland has estimated that the average surface water inflow to the sub-basin from the four major streams is 12,820 afy. However, the surface flow of the Rio en Medio and the Rio Chupadero have not been monitored. Excluding the Tesuque runoff, the estimated runoff is about 10,000 afy. Diversions in the sub-basin total 4,870 afy. The surface water outflow is 5,500 afy.

Because of a projected increase in population, much of it relying on wells on irrigated land, there is expected to be an unquantified concomitant decrease in surface water in those areas.

GROUNDWATER SUPPLY

Koopman (1975) estimated that the groundwater in storage in the Pojoaque-Nambe and Tesuque sub-basins is 55 million acre-feet. The estimated inflow to the groundwater is 4,500 afy from mountain front recharge, 5,000 from seepage of streams and rivers and other factors, for a total inflow of an estimated 13,730. Groundwater diversions are estimated at 940 afy, and springs contribute about 4,000 afy to rivers and streams.

WATER QUALITY

In general the quality of the groundwater in the sub-basin is good. However, in local areas water quality problems exist. Some areas have naturally occurring high levels of fluoride and uranium. Areas of higher population density have increasing levels of nitrate associated with the use of septic tanks

EXISTING USES

The hydrographic survey found 3,538 acres of irrigation (including the Tesuque sub-basin) based on 1959 aerial photos. In a 1995 report (Wilson and Lucero) the irrigated acreage was estimated to be 2,255 acres, a 36 percent decrease over 36 years.

The use of groundwater is mainly for domestic use and is currently a relatively small amount of 943 afy.

PROJECTED DEMAND

Population in the sub-basin is estimated to grow substantially from the estimated 2000 population of 6,280 to 9,580 in 2020, then to 14,799 in 2040, and to 22,383 by the end of the planning period in 2060. The use of groundwater is projected to increase, up to an estimated 3,357 afy.

SPECIAL CONSIDERATIONS

The irrigated acreage in the watershed is involved in an adjudication lawsuit that began in 1966. The U.S. District Court has recently increased the pueblos' irrigated acres of 1,094 by 407 acres. In drought years, the surface water supply is not sufficient and, as senior water right holders, the pueblos have exercised their priority to curtail the use of water by junior users. With the increased senior rights of the pueblos, shortages will increase as the additional new acreage is put into production.

The Pojoaque-Nambe Sub-Basin lacks sufficient data for precise understanding of water inflow and outflow. Duke Engineering suggests that much more data should be collected about irrigation diversions, depletions and return flows to arrive at a more accurate calculation of surface flows.

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Sub-Basin Water Supply and Demand Summary

Tesuque Sub-Basin

OVERVIEW

The Tesuque sub-basin is located north and east of Santa Fe and is drained by the Tesuque and Little Tesuque creeks. . The projected six-fold population growth in the Tesuque sub-basin over the next 60 years will put a strain on water demand, and particularly for domestic use groundwater. Groundwater demand is projected to increase from about 730 acre feet per year (afy) to 4500 afy in 2060, while surface water demand remains constant. While current supply/demand analyses indicates that there will be sufficient water to meet domestic demand to 2050, after that date new sources of supply may need to be secured. Surface and groundwater quality is generally good in the Tesuque sub-basin, although there are signs that minor contamination may be entering surface water from upstream development. As demand for water grows, the potential for contamination will increase, especially in localities with higher population densities.

SUB-BASIN CHARACTERISTICS

The Tesuque sub-basin is located north of Santa Fe with headwaters in the Sangre de Cristo Range south of Lake Peak. The Tesuque sub-basin watershed encompasses 77 square miles and ranges from 11,850 feet on the east to 5,750 feet at the confluence of the Rio Tesuque and Pojoaque Creek, for a total relief of 6,100 ft. across the sub-basin.

The Tesuque and Little Tesuque creeks flow generally west from the Sangre de Cristo Range until they converge to form the Rio Tesuque. The Rio Tesuque then flows north-northwest until it joins Pojoaque Creek to form the Pojoaque River, which in turn flows west to the Rio Grande.

PRECIPITATION

Precipitation averages 15.3 inches per year, most of which results from winter snow, and brief but intense summer thunderstorms. Higher elevations receive significantly more precipitation than the lower areas along the Rio Tesuque. Evaporation and evapotranspiration, especially along the heavily vegetated stream drainages, results in a significant decrease in the total available water within the Tesuque sub-basin.

SURFACE WATER INFLOW AND OUTFLOW

The surface water budget includes an estimated 3,500 afy inflow for the combined drainage area of Tesuque and Little Tesuque Creeks and their ephemeral tributaries.

Inflow from groundwater adds 1,815 afy and return flow from irrigation and municipal/industrial sources another 1,115 afy, for a total estimated inflow of 6,430 afy. Outflows include 2,110 afy to irrigation and municipal/industrial uses, 2,500afy as stream losses to groundwater, 1,280 afy to evapotranspiration, and 540 afy as flow into the Pojoaque River, for a total outflow of 6,430 afy.

GROUNDWATER INFLOW AND OUTFLOW

Groundwater budgets for the Tesuque sub-basin include inflow from mountain front recharge of 2,460 afy, stream channel recharge of 2,500 afy, flow from adjacent sub-basins of 3,500 afy, and return flow from irrigation and municipal/industrial use of 155 afy for a total estimated inflow of 8,615 afy.

Outflow estimates include 729 afy to domestic use (based on per person average), 2,400 afy to evaporation, 1,815 afy groundwater discharging to surface water, and 4,000 afy flow out of the sub-basin, for a total of 8,944 afy.

WATER QUALITY

Surface water quality in the Tesuque sub-basin is characterized as very good overall with iron, lead and aluminum being the three inorganic constituents that occasionally are found to be elevated. The source of the increase is unknown, but might be natural weathering of the granitic core rock in the Sangre de Cristo Range or from runoff over roads, building sites or the Santa Fe Ski area, or some combination of events.

Groundwater is also of high quality in most of the Tesuque sub-basin with only a few localized areas having elevated nitrate levels due to agricultural fertilizers or more concentrated septic leach fields. Except in local areas where nitrate levels are high, the calcium-bicarbonate groundwater is potable and contains relatively low levels of total dissolved solids.

EXISTING USES

It is estimated that about 475 acres are currently under irrigation within the Tesuque sub-basin, and approximately 2,110 afy of surface water will be used for agricultural purposes in year 2000. In addition, current domestic/industrial users in the sub-basin consume about 310 afy of groundwater. Total surface and groundwater usage in year 2000 is estimated to be 2,420 afy.

PROJECTED POULATION GROWTH AND WATER DEMAND

The population of the Tesuque sub-basin was 4,670 in 1999, and is projected to grow to 30,422 by the year 2060 (BBER). A majority of the current population is located in or near the village of Tesuque along the Rio Tesuque, or in the Pueblo of Tesuque, also along the stream but a few miles to the northwest. As the population grows in the coming decades, it is projected that agriculture use of surface water will increase only moderately from 1,210 afy now to 1,740 afy in 2060; however, it is also possible that agricultural usage will decrease as projected domestic demand increases from 729 afy to 4,563 afy by year 2060. Collectively, the projected growth in population will significantly increase the demand for water in the Tesuque sub-basin over the next 60 years.

Summary water quantity and quality data taken from "Water Supply Study Jemez y Sangre Water Planning Region, New Mexico," Duke Engineering, & Services, Albuquerque, New Mexico, (August 2000) or as referenced. Population data taken from "Population Projections for the Jemez y Sangre Water Planning Region, Bureau of Business and Economic Research, University of New Mexico, July 2000.

Jemez y Sangre Water Planning Council

Sub-Basin Water Supply and Demand Summary

Caja del Rio Sub-Basin

OVERVIEW

The water budget for the Caja del Rio sub-basin shows there is an adequate supply of water for users in the sub-basin. However, the Buckman wells will continue to supply water to the Santa Fe sub-basin. By 2060, the population change could increase water demand by approximately 290 afy. Domestic wells could be developed to meet demand, however development of municipal supplies would require acquisition of existing water rights.

SUB-BASIN CHARACTERISTICS

The Caja del Rio sub-basin is situated in the western part of Santa Fe County and includes a portion of San Ildefonso Pueblo. The Rio Grande forms the western boundary of the sub-basin. The Caja del Rio sub-basin, located between the combined Tesuque and Pojoaque-Nambe watershed on the north and the Santa Fe River sub-basin on the south, has a combined drainage area of about 158 square miles.

Elevations in this sub-basin vary from 7,400 feet at the highest point to about 5,150 feet at the Rio Grande near the sub-basin's south boundary. The largest stream is Canada Ancha, which drains the northern portion of the sub-basin and flows from southeast to northwest. The slope of its channel is 80 feet per mile.

The Caja del Rio sub-basin does not actually contain a single main stream that defines its area. Instead several watercourses and arroyos originating within it are directly tributary to the Rio Grande.

Two additional drainages occurring in the northern half of the sub-basin are defined respectively by Thirtyone Draw and Arroyo Eighteen. Drainages in the southern half include Santa Cruz Arroyo, Arroyo Tetilla, and Arroyo Colorado, the latter two of which combine to form Canada de Cochiti, a tributary to the Rio Grande.

PRECIPITATION

The Caja del Rio sub-basin receives an annual average precipitation of 12 inches.

SURFACE WATER SUPPLY AND DEMAND

The only surface water flow records that are apparently available for the Caja del Rio sub-basin are a few measurements of spring flows close to the Rio Grande. Because all watercourses in the sub-basin are ephemeral and currently ungauged, surface inflow to the watershed (1,350 afy) was estimated using the elevation-area-yield approach. The estimate of the groundwater discharged to surface water is zero.

Total evapotranspiration was estimated at 200 afy. Comparison of all aforementioned budget components resulted in an estimated stream loss to groundwater of 1,150 afy.

Assessment of the sub-basins' surface water budget indicates that surface waters are in a natural state and utilized in small amounts by livestock.

GROUNDWATER SUPPLY AND DEMAND

Assessment of sub-basin's groundwater budget indicates that groundwater is used for domestic and livestock purposes. However, the Buckman wells, which supply the City of Santa Fe, pump 4,911 afy, have caused a water level decline of 500 feet over 30 years.

The groundwater supply is believed to be extensive with an estimated storage of 20.3 million acre feet, under certain assumptions. However, because surface waters are fully appropriated, stream-connected groundwater appropriations or transfers will be conditioned to require retirement of surface water rights to offset any depletions caused by groundwater pumping.

WATER QUALITY

Assessment of water quality in the sub-basin indicates localized impacts to surface waters associated with cattle use. Additionally, the Buckman wells experience elevated levels of natural radionuclides of concern.

EXISTING USES

Groundwater is used for domestic (approximately 88afy) and livestock (minimal) purposes in the sub-basin. Surface water is also used for livestock purposes (minimal).

POPULATION AND DEMAND PROJECTIONS

Most of the sub-basins residents reside in the Las Dos area in the eastern region of the sub-basin. Under the most likely growth scenario, the Caja del Rio sub-basin population will increase from its current population of about 550 to about 2,500 in the next 60 years. The population change would increase water demand by approximately 290 afy. Domestic wells could be developed to meet demand, however, development of municipal supplies would require acquisition of existing water rights.

SPECIAL CONSIDERATIONS

The Buckman wells will continue to supply water the Santa Fe sub-basin. Per the Rio Grande Compact, New Mexico must maintain flow conditions that existed in 1929 to meet Compact requirements. Additionally, Pueblo water rights remain to be determined.

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Jemez y Sangre Water Planning Council

Sub-Basin Water Supply and Demand Summary

Santa Fe River Sub-Basin

OVERVIEW

The Santa Fe River Sub-Basin is meting present demand through the use of groundwater pumped from various wells within the city and runoff from the Santa Fe River watershed, totaling about 9,100 afy. Additional water totaling about 4,900 afy is transferred into the sub-basin from the Buckman wellfield near the Rio Grande, in the Caja del Rio sub-basin. Population in the sub-basin is projected to reach 157,092 by the year 2060, which would require additional water supplies of about 13,200 afy. The wastewater treatment plant discharges about 6,500 afy to the Santa Fe River, contributing to recharge of the groundwater aquifers downstream.

SUB-BASIN CHARACTERISTICS

The Santa Fe River watershed, which drains the southern extent of the Sangre de Cristo Range and covers a total area of 284 square miles, is the location of the City of Santa Fe, the municipality with the largest population within the region. Major tributaries to the river include Arroyo Hondo, Arroyo Calabasas, Cienega Creek, and Alamo Creek. The Santa Fe River is perennial from Santa Fe Lake at 11,700 feet amsl to Nichols Reservoir and from the city wastewater treatment plant to Cochiti Lake. The natural outlet for the Santa Fe River is at the Rio Grande about 2 miles south of Cochiti Lake, but the river's discharges are diverted northward to the lake about 3 miles upstream of the natural outlet. The elevation at the lake outlet is approximately 5,250 feet, which results in a total elevation relief for the watershed of 6,900 feet.

PRECIPITATION

The average annual precipitation on the watershed is 12.4 inches. The minimum recorded precipitation is 5.03 inches and the maximum is 21.75 inches for the period 1868-1996.

SURFACE WATER SUPPLY AND DEMAND

The amount of inflow from precipitation into the Santa Fe River is estimated at 7,850 afy, which includes estimated inflow from Arroyo Hondo. The Santa Fe River watercourse loses a significant amount of its flow to groundwater. The losses appear to occur within and near the City of Santa Fe, and downstream of the Santa Fe wastewater treatment plant, which discharges its effluent to the river. The amount of seepage to the groundwater amounts to 3,770 acre-feet per year on average above La Cienega and 4800 afy below La Bajada. The Santa Fe River gains in the reach below La Cienega Springs and above La Bajada at an average rate of 2,170 afy.

Estimated return flow in this sub-basin represents the combination of average waste water treatment plant discharge of 6,500 afy to the Santa Fe River during the years 1993-1997, and estimated irrigation return flow of 1,560 afy. Water is diverted from the Santa Fe River for both irrigation and municipal uses, the total of which is estimated at 7,290 afy. The irrigation diversion is computed at 2,665 afy. The estimated municipal diversion is about 4,625 afy, which is the average diversion for the period 1990 to 1999.

The total amount of evapotransporation is estimated at 1,180 afy based on an estimated 80 acres of free water surface area subject to 45 inches per year evaporation and 440 acres of riparian land subject to and evapotransporation rate of 24 inches per year. The surface water outflow of 1,110 afy is calculated as the residual from combining all other budget components. The outflow value is reasonable considering the large losses downstream of the gauging station (Santa Fe River above Cochiti Lake). The average flow is 8,450 afy measured at the gauging station during the years 1970-1997 and seepage losses could be as high as 8700 afy.

GROUNDWATER SUPPLY AND DEMAND

Recharge to the groundwater occurs from the 3,770 afy of stream losses discussed above. A total of 5,050 afy is estimated to recharge the groundwater at the mountain front. Another 1,000 afy recharges the groundwater as inflow from the North Galisteo sub-basin, and 285 afy recharges the groundwater from irrigation and domestic well use.

An average of 4,574 afy is diverted from the aquifer in the Santa Fe sub-basin from the City of Santa Fe wells and domestic wells. Evapotransporation from shallow groundwater is estimated to be 1,200 afy and discharge through springs is estimated at 2,170 afy. The total flow out of the Santa Fe sub-basin to other sub-basins is 4,120 afy, 1,050 afy of which moves toward the Caja de Rio sub-basin, 500 afy to the North Galisteo sub-basin and another 2,570 afy to the Rio Grande.

WATER QUALITY

The water quality of the Santa Fe Sub-Basin is naturally very good, but hard due to the concentrations of calcium and magnesium. The total dissolved solids concentrations is generally less than 350 milligrams per liter (mg/L). Nitrate, from an unknown source, has been detected in many of the city wells at concentrations slightly above the 10 mg/L standard. Downstream of the City's wastewater treatment plant, nitrate concentration in the groundwater range from 4 to 6 mg/L. Within the City limits, leaking underground storage tanks have contaminated the groundwater in several locations. chlorinated solvents have contaminated one city well and PCE from a dry cleaners has been detected beneath the Railyard property. This site is being developed as a Brownfields Superfund Site.

EXISTING USES

Groundwater and surface water are used for municipal and irrigation purposes.

POPULATION PROJECTIONS

Under the most likely growth scenario, the Santa Fe sub-basin population will increase from its current population of about 87,700 to 157,100 in the next 60 years. The population change would increase water demand by approximately 13,200 afy.

SPECIAL CONSIDERATIONS

The City and County of Santa Fe have rights to San Juan-Chama water, that when imported and combined with return flow credits, could meet the growing demand for water until 2040.

Summary water quantity and quality data taken from "Water Supply Study Jemez y Sangre Water Planning Region, New Mexico," Duke Engineering, & Services, Albuquerque, New Mexico, (August 2000) or as referenced. Population data taken from "Population Projections for the Jemez y Sangre Water Planning Region, Bureau of Business and Economic Research, University of New Mexico, July 2000.

Jemez y Sangre Water Planning Council

Sub-Basin Water Supply and Demand Summary

North Galisteo Creek Sub-Basin

OVERVIEW

The North Galisteo Creek Sub-Basin is the drainage area that, at the lowest points of its major arroyos, feeds into the Galisteo Creek near Cerrillos. The dominant activity in the sub-basin is the community of Eldorado and its suburbs, which are one of the fastest-growing areas in the entire Jemez y Sangre region. In 1970, the North Galisteo Creek Sub-Basin was ranked eighth out of the 10 sub-basins in the region in population, with fewer than 900 inhabitants. By the turn of the century, the population had grown by more than 1,000 percent to more than 10,000 people. The region relies heavily on groundwater to serve the growing population, and taps the only flowing stream in the adjoining South Galisteo Basin for the majority of its present water needs.

SUB-BASIN CHARACTERISTICS

The North Galisteo Creek watershed lies immediately south of the Santa Fe River watershed. The sub-basin has a drainage area of 93 square miles and an elevation relief of 2,510 feet, with land elevations varying from 8,230 to 5,720 ft. Despite its name, Galisteo Creek does not actually flow within the sub-basin. Galisteo Creek is the defining watercourse for the South Galisteo Creek watershed, however the drainages in North Galisteo Creek watershed eventually empty into Galisteo Creek. The main stream within it is the southwestward-trending Gallina Arroyo, which is formed by the merger of Cañada de las Minas and Cañada Ancha in the foothills near the southern extent of the Sangre de Cristo Range. San Marcus Arroyo joins Gallina Arroyo about two miles upstream of the watershed's outlet at Galisteo Creek.

PRECIPITATION

The watershed receives an average annual precipitation of about 13 inches.

SURFACE WATER SUPPLY AND DEMAND

Surface water inflow in the North Galisteo Creek sub-basin was calculated at 900 afy. Evapotransporation from an estimated riparian area of 65 acres near stream channels that are typically dry was estimated at 130 afy. The remaining budget balance of 770 afy was assumed to recharge the groundwater system through stream losses.

GROUNDWATER SUPPLY AND DEMAND

The North Galisteo Creek receives little mountain front recharge. A total of 1,550 afy of recharge occurs as inflow from adjacent sub-basins and another 260 afy recharges from return flow through septic tanks. With the 770 afy of stream losses estimated to recharge the aquifer, the total recharge to this sub-basin is estimated to be 2,580 afy.

Groundwater diversions occur through municipal (403) and domestic (112) pumping for a total of 515 afy. Another 500 afy is estimated to occur through evaporation of shallow groundwater and 2050 afy are estimated to leave the sub-basin to adjacent sub-basins. The total discharges from groundwater amount to 3065 afy, or 485 afy more than the estimated recharges. Because little to no data exist to support the estimated budget values for the North Galisteo Creek sub-basin, all of its estimated components are considered very uncertain.

WATER QUALITY

Water quality is generally very good, but hard due to concentrations of naturally occurring calcium and magnesium. Given the few potential sources for contamination in this sub-basin, very little groundwater contamination problems exist. Nitrate is found in wells along the mountain front in concentrations commonly ranging from 3-5 mg/L as N. Pesticides were detected in Canoncito wells.

EXISTING USES

Groundwater is used for domestic and minor commercial uses only.

POPULATION PROJECTIONS

Under the most likely growth scenario, the North Galisteo sub-basin population will increase from its current population of about 11,100 to 49,500 in the next 60 years. The population change would increase water demand by approximately 5,750 afy. The sub-basin is one of the fastest growing in the region. In 1970, the U.S. Census measured its population at 898 people. By 1990 it had grown to about 5,800 and by 2000 to 11,100. It has climbed from eighth most populated sub-basin in 1970 to the fourth largest. By 2020 it is projected to be home to more than 18,000 people. By 2040, the Eldorado and surrounding communities will surpass Los Alamos in size with an estimated 30,326 people. By 2060 it will be nearly as large as the population of the three sub-basins that comprise greater Espanola.

SPECIAL CONSIDERATIONS

Summary water quantity and quality data taken from "Water Supply Study Jemez y Sangre Water Planning Region, New Mexico," Duke Engineering, & Services, Albuquerque, New Mexico, (August 2000) or as referenced. Population data taken from "Population Projections for the Jemez y Sangre Water Planning Region, Bureau of Business and Economic Research, University of New Mexico, July 2000.

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Sub-Basin Water Supply and Demand Summary

South Galisteo Creek Sub-Basin

OVERVIEW

The South Galisteo Creek Sub-Basin includes the upper villages of Galisteo and Lamy, the lower villages of Cerrillos, Madrid and Golden, and the sparsely populated areas in between. As a sub-basin, its population will grow, but will not at the rates of its neighbor to the north, which includes the fast-growing community of Eldorado. The South Galisteo Sub-Basin will grow from about 1 percent of the region's total population in 2000 to 2 percent of the total by 2060.

The region relies almost entirely on groundwater for its domestic uses, primarily through individual water wells. The sub-basin is presently able to meet demand, however the supply to meet the projected demand beginning at the present time is undetermined.

SUB-BASIN CHARACTERISTICS

The South Galisteo Creek watershed is comprised of a sub-basin whose borders do not everywhere coincide with natural drainage boundaries. Part of the eastern boundary of the defined sub-basin is formed by the eastern boundary of Santa Fe County. The entire western boundary of the sub-basin coincides with the border between Santa Fe County and Sandoval County.

The South Galisteo Creek watershed is the largest of the study sub-basins, encompassing an area of about 527 square miles. The Ortiz Mountains form part of the watershed's south boundary. In upper portions of the watershed, Apache Canyon River and Galisteo Creek combine to drain about 32 square miles of the southern end of the Sangre de Cristo Mountains. For the initial 15 miles below the confluence of these two streams, Galisteo Creek flows toward the southwest. West of Galisteo, the creek flowing west-northwest and continues until it joins the Rio Grande about 5 miles west of the Santa Fe County/Sandoval County line.

Tributaries to Galisteo Creek include Cañada Estacada, Arroyo de la Jara, Gavisco Arroyo, Cunningham Creek, and Arroyo Charro. The South Galisteo Creek watershed varies in elevation from 10,500 feet in the Sangre de Cristo Mountains to about 5,400 feet at the western Santa Fe County line.

The hydrologic system is structurally complex and most of the rock formations are not considered aquifers. Most of the rocks have low permeability and storage capacity. Some of the geologic units that do form an aquifer, but generally they are thin, entirely bounded laterally by low permeability rocks that receive little recharge. Thus, on a regional scale, they are not considered to be significant water bearing units.

PRECIPITATION

The sub-basin receives an annual average precipitation of 14 inches.

SURFACE WATER SUPPLY AND DEMAND

About 6,240 afy of surface-water inflow was calculated for this sub-basin. Irrigation return flow of 170 afy also was computed. Groundwater discharge to surface water of 890 afy was estimated by balancing all other budget components. Irrigation diversions of 290 afy were estimated for 88 acres of land. Water losses to ET were calculated at 2,570 afy, assuming 1,050 acres of riparian vegetation experiencing an evapotranspiration rate of 26 inches per year, and 125 acres of free water surface area undergoing an evaporation rate of 45 inches per year. Surface outflow from the watershed, estimated at 4,440 afy, was based on the annual average measured flow at Galisteo Creek below Galisteo Reservoir during the period 1970-1997.

GROUNDWATER SUPPLY AND DEMAND

Mountain front recharge to the groundwater system in the South Galisteo Creek area is estimated to be 5,500 afy. Inflow from adjacent basins is estimated at 1,050 afy and recharge from domestic use is estimated at 105 afy. The total recharge rate to groundwater is estimated at 6,655 afy. Diversions from the groundwater system include 210 afy from domestic wells, 1,300 afy from evapotranspiration from shallow groundwater and 890 afy of spring flow. A total of 4,600 afy of groundwater is discharged from the basin to the north and to the west (Rio Grande). Discharges exceed recharge by 345 afy.

WATER QUALITY

Water quality is naturally quite variable in the South Galisteo sub-basin. Total dissolved solids can reach as high as 3,500 milligrams per liter (mg/L), much higher than the drinking water standard of 1,000 mg/L. The cyanide heap leach operation in the Ortiz Mountains resulted in cyanide and metals contamination in the groundwater and surface water near the mine. The pesticide Atrazine has been detected in wells in Lamy, Girls Ranch and in Glorieta, and a leaking underground storage tank has resulted in gasoline contamination of groundwater near Galisteo.

EXISTING USES

A relatively small amount of surface water is used for irrigation and groundwater is diverted for domestic use. Historically, water was used for the heap leaching operation and dewatering the gold mine in the Ortiz Mountains. This operation has ceased, although efforts have been made within the past decade to resume mining.

POPULATION PROJECTIONS

Under the most likely growth scenario, the South Galisteo sub-basin population will increase from its current population of about 2,900 to 15,300 in the next 60 years. The population change would increase water demand by approximately 1,856 afy.

SPECIAL CONSIDERATIONS

The water budgets are very poorly understood in this sub-basin.

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