Introduction to the Fact Sheets

1. Approach

The approach used for the social and cultural evaluation of the alternatives for the Middle Rio Grande (MRG) water planning region was as follows:

- Conducted a review of literature to determine social and cultural patterns of water-use along the middle Rio Grande.

- Developed a matrix to assess the feasibility and implications of various alternative water scenarios in the context of:

  - Social issues
  - Effects on the preservation of traditional values
  - Equity/justice implications
  - Special or unique aspects

Industrial and manufacturing applications are excluded in this analysis.

2. Assumptions

The following assumptions were made for these analyses:

- The unique hydrological riparian system of the Middle Rio Grande Basin is based on a water cycle model where surface water recharges the aquifer.

- The riparian watershed is integral in shaping a cultural landscape and cultural worldview.

- "Tradition" is not a static concept; dynamic cultures appropriate and adapt new technologies and innovate.

Also, as explained in the fact sheets, sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

2.1 Surface Use Characteristics

- Surface users comprise sociocultural groups that have their origin in subsistence activities. Among the most traditional are Hispanic acéquia villages, Pueblo Indians, and early Anglo homestead farmers and ranchers.

- Sociocultural water uses result in distinctive patterns of land tenure and land use.

- Public policy has been uneven in affirming the birthright of traditional water users, often dividing such policies along three general racial groups—Pueblo, Hispano, and Anglo.

- The basic infrastructure for the channeling and distribution of surface water is the *acéquia* or ditch system.

- With the advent of urbanization, the relationships that people maintain with surface water have become more diverse.

- Recreational and aesthetic usages have changed social norms. Maintenance of the riparian ecology for its amenity has become just as important as subsistence activities.

2.2 Groundwater Use Characteristics

- Groundwater users comprise sociocultural groups that use groundwater for domestic use.

- The appropriation of groundwater for indoor and outdoor household activities is sustained by advances in technology.

- Personal consumption drives the public and commercial market-demand of water use.

- The basic infrastructure for groundwater users has been wells, either individual or public.

3. Rationale

The human-ecological approach links human activity with the appropriation of natural resources. This model was first deployed for analyzing the impacts on a water region by Ian McHarg in his seminal text *Design With Nature* (1969). In this framework, the physiographic region and the river basin compose the primary organizing context for ecological planning. The analysis links past, present, and anticipated future actions through its physical evolution. The water regiment becomes comprehensible by deciphering the hydrological pattern of the river and aquifer and how human communities have appropriated surface water and groundwater for various uses. Accordingly, this analysis defers to special water-user groups as appropriate for explaining impacts on the riparian ecology.

4. Cultural Historical Background

The Middle Rio Grande Basin has been occupied by people since the end of the last Ice Age (15,000-11,000 BC). Since the time of the earliest human habitations, settlement patterns and the ecology have both undergone tremendous change (Crawford et al., 1993).

Such change can be attributed to two main factors. First is the role that the unique geology and ecology of the basin has had in shaping the human settlements along the Rio Grande. The natural water cycle depends on the annual renewal of surface water for recharging the surface flow of the river. This flow is hydrologically linked to the aquifer and serves to recharge it (Crawford et.al 1993: 61). Human interventions on the surface water affect the ability of the ecology to sustain life.

Second are the cultural advances made by both indigenous people and newcomers to the region. As human habitation spread, groups adapted or appropriated new technologies to sustain themselves. Social networks and collective cultural identities were established. Societies demarcated land necessary to sustain their populations.

4.1 Indigenous Traditions

The earliest inhabitants were nomadic and sedentary Tribes. Archeological evidence suggests that the earliest nomadic groups adjusted their patterns of subsistence to conform to the Rio

Grande's unique watershed. The watershed is characterized by seasonal moisture patterns that have sustained people and the riparian ecology for eons.

The earliest sedentary Tribes, such as the Anasazi (direct ancestors of today's Pueblo Indians), established proto-urbanized patterns of settlement that were based on subsistence agriculture. Although archeological evidence indicates that other sedentary groups (such as the Hohokam) in central Arizona practiced a form of irrigation that diverted flowing water through an extensive system of aqueducts, sedentary Tribes along the Rio Grande relied more on water harvesting (i.e., placing food crops along natural berms that were replenished by occasional surface flooding).

Early inhabits of the region understood this cyclical relationship very well. It was an integral part of their religious worldview and their cultural practices (Ortiz, 1969). Religious moieties and clans were organized around seasonal concepts. Ceremonial cycles were attuned to the physical and spiritual world for the purpose of sustaining a "durable community" (Stuart, 2000).

The post-contact Pueblos had a reverence for water. Because of their water harvesting practices, villages were not necessarily wedded to a flowing river. Domestic water for consumption at Acoma and other Pueblos was obtained by pooling rainwater into natural cavities or depressions. This allowed Pueblos to be built on mesas, a practice that later cultural groups never adopted.

4.2 Spanish Acéquia Culture

Water practices were modified with the migration of Spanish colonizers to New Mexico in 1598. Spanish colonizers in New Mexico adopted Old World urban traditions, including the *acéquia* system (Rivera 2001). The introduction of domestic animals, which requiring grazing lands and fodder, and irrigation-intensive crops impacted the riparian landscape as well.

For the colonial Spanish, the river essential became characterized as the *corazon* (life blood), alongside of which individual agricultural parcels and usufruct lands were allocated (Garcia 2002). Channeling water through ditch systems and supplying surface for both domestic use and agriculture was absolutely critical to their local subsistence.

Because the settlers had to survive in relative isolation from the governing authority of Spain (the *Audencia* in Mexico City), they had to develop self-reliant social orders. Fundamental to their social organization was the authoritative role of the *majordomo* (ditch boss), who regulated not only the allocation of water, but had jurisdiction over civil affairs.

4.3 Land Grant Culture

After the Pueblo Revolt of 1680, the Pueblo Indians and the Spanish townships developed a system of coexistence typified in the land grant. The "raiding culture" of nomadic Tribes, however, made it necessary to fortify and consolidate domiciles. This resulted in a unique farmstead called the casa-corral. Proximity of settlements along the river created a social climate of reciprocity, in which each community depended on others for its protection and survival (Jojola, 1998).

The most successful land grant communities were those that established themselves at the juncture of major tributaries, thereby assuring themselves of a continuous supply of surface water for domestic consumption, agriculture, and livestock. This resulted in the land grants being deeded in a manner that took contiguous lengthwise slices of riparian lands to assure that each township village had access to water. These slices extended essentially from the mountains to the lowest basin. As inheritance became a factor in the sustainability of the community, a distinctive pattern of land tenure called "long-lots," emerged (Carlson 1990). Such parcels require that all agricultural lands front directly onto a ditch.

4.4 Anglo-American Impact

When the American Territorial Government was established in New Mexico in 1849, the Spanish and the Pueblo Indian cultural identities, as typified by their water-centered settlements, were firmly established. Rather than accepting these settlements, however, the American Territorial government embarked on policy of cultural assimilation based on Anglo Euro-Western values.

The most fundamental of these values was the concept of private property. Under custom law, both Spanish and Pueblo families were allocated land parcels and afforded the right of inheritance. Land transfers, as such, were tempered by social morays and tended to stay within the extended family or clanships. The ability to severe water as a property right was absolutely alien to both cultures. However, Anglo-American dominance in the territorial courts and political

arena refashioned the landscape in a way that exploit land and water resources and made them commodities (Scurlock, 1998).

4.4.1 Private Property

Property rights also had another direct impact. The grid system and Euclidian zoning was applied both for the intent of measuring land holdings and to accommodate the transfer of land. This new grid system was no longer bounded by topographical or hydrological considerations. Eventually, the redistribution of the "public domain" led to 77 percent of land-grant acreage (about 9 million acres) being transferred to non-natives (Dunbar-Ortiz 1980). "Progress" that led to commercial gain squelched the traditional practices of community self-reliance. Anglo-Americans saw traditional culture as backward (Sunseri, 1973).

This was especially evident in Territorial policies intended to subjugate the local traditional communities under American rule. Laws like the 1854 Donation Act, the 1877 Desert Land Act as well as various Homestead Acts, paved the way for Anglo occupation of traditional Hispanic and Pueblo lands (Scurlock, 1998). Prior to 1880, the Anglo population comprised less than 3 percent of New Mexico's population; by 1880, Anglos made up 8.6 percent of the population (Kennison, 1978).

4.4.2 Industrial Revolution

By the latter half of the 19th century, Anglo Americans were poised to introduce the inventions of the industrial revolution. New farming techniques and mechanization increased pressure in the region to appropriate fallow lands and expand commercial agricultural production. New, more water intensive, crops were introduced. Farmsteads became larger. The demand for military foodstocks expanded ranching interests. The completion of the railhead into New Mexico in the 1880s guaranteed that migrants and their culture would continue to flourish.

4.4.3 Technology and Water

Technology also had a significant impact on domestic water use. Tapping fresh groundwater through the use of windmills or handpumps solved many of the sanitary problems that had been prevalent when people had relied on irrigation ditches for their bathing, washing, and cooking needs (Scurlock, 1998). When electricity became available in the early 1880s, townships became staged for urban expansion. By 1883, Albuquerque had its first community water works (Simmons, 1982).

The repercussions of such innovations upon the ecology of the Rio Grande were immediate. By the 1890s, the groundwater level rose dramatically. Among the causes was sedimentation from by logging, overgrazing, and the increase of groundwater recharge caused by new valley irrigation ditches (Crawford et al., 1993). As the density of towns increased along the Rio Grande, flooding of houses and business became a recurrent problem. Severe floods struck Albuquerque in 1874, 1884, 1891, 1903, 1912 and 1920 (Kelly, 1969).

4.4.4 Public Water Works

Such problems prompted the development of public works designed for flood control and land reclamation. The Middle Rio Grande Conservancy District (MRGCD) was formed in 1925 to remedy both the flooding and the regulation of water for irrigation. MRGCD used the backbone of the traditional acéquia system to engineer a system of levies, drains, and ditches. The effort entailed consolidating 79 headgates to 4 headgates. Only the community of San Ysidro voted to continue its acéquia association (MRGCD, personal correspondence).

Similarly, in 1935, the U.S. Soil Conservation Service was established to promote soil rehabilitation. Along with the Work Projects Administration, many small retention diversion dams were constructed throughout rural areas. These small-scale projects helped to reduce the impacts of intermittent flooding that occurred during this time. They also gave a boost to agricultural pursuits that had waned as a result of negative impacts from logging, overgrazing, and natural catastrophes (Scurlock, 1998).

4.5 Urbanization and Water Usage

The MRG region was now beginning to be heavily impacted by successive waves of urban migrants. These new migrants appeared to be less interested in continuing the traditional patterns of agricultural subsistence and sought, instead, the amenities of the urban lifestyle. Perhaps the single most important factor in how these urban migrants reshaped the landscape were the new values they inadvertently introduced in their efforts to “civilize” the desert frontier.

Such civilizing patterns are most evident in the water-consumptive, foreign plant fauna that were introduced. The phenomena of introducing “exotic” species to supplant the ecology of the Rio Grande had become evident at the turn of the century. Saltcedar and Russian olives were deliberately transplanted into the riparian system for erosion control in the 1920s (Crawford, et.al., 1993). In the 1930s, the regime of Mayor Clyde Tingley, deliberately instituted a

campaign to propagate the water-thirsty, Siberian elm tree as a symbol of social attainment. Albuquerque was thus transformed from a "sleepy Mexican village" to an opulent town, replete with cultured grass lawns and shade trees.

Urbanization and its role in increasing the demand for groundwater consumption is principally a post-World War II (WWII) phenomenon. Prior to this, settlement patterns indicated most communities were still subject to the cyclical "feast and famine" nature of the riparian system. With the advent of new technologies that exploited the underground aquifer, much of that cycle was mitigated and the populations became use to the notion that water—at least for domestic usage—was readily attainable and plentiful.

4.6 Surburbanization and Water Usage

After WWII, the acceleration of suburban developments heightened the appropriation of water usage to sustain urban culture. In 1948, Congress passed the Flood Control Act. This resulted in the construction of a dam above Española (Chamita) and above Bernalillo (Jemez Canyon). Other dams quickly followed in succession. The Jemez Reservoir was constructed in 1950 and the Cochiti Dam in 1965. These reservoirs had the effect of retaining water for storage and discharge. They essentially "tamed" a wild riparian environment and transformed it from a braided meandering waterway into a single stream river (Crawford et al., 1993).

Today, 60 percent of the state population resides in an urban corridor centered in Bernalillo County. New surburban housing and commercial developments continue to push outwards into Sandoval and Valencia Counties in a pattern that is being characterized as "sprawl" (1000 Friends of New Mexico). Competition for real estate and water have typified the conflicts among stakeholders in managing development. In addition, quality of life factors including traffic congestion, density, crime, public safety and air, water, and noise pollution have come to the forefront (MRGCOG, 1989).

The result of urbanization and suburbanization is a complex land-use relationship with many layers of socioeconomic and historical community patterns. Although the paradigm for explaining these land-use patterns has traditionally been to distinguish these patterns as urban and rural, socioeconomic forces have blurred these distinctions.

As a consequence, the morphology of linking water-use and its cultural impacts is problematic at best. There are two usage "traditions," however, that can serve to capture the essence of water culture. These are cultural behaviors that can be attributed to groups that appropriate water from the surface and those that appropriate groundwater.

Most literature on the sociocultural aspects of water is dominated by historical water use patterns attributed to Pueblo and Spanish land grant acéquia communities. There is a smaller body of literature pertaining to early settlement Anglo usage, but it is confined largely to ranching and farming. By and large, all of these pattern relationships are tied to the use of surface water for irrigation and agriculture, the maintenance of livestock, and the symbolic importance of water in the maintenance of water for cultural identity.

What is missing from the literature are studies analyzing the sociocultural role of water in domestic consumption and, specifically, the impact of groundwater appropriation in the maintenance of the MRG region's distinctive cultures. This role becomes even more indistinct when the discussion is expanded to "social groups" because of the problematic crossover of behaviors in how groups appropriate both surface and groundwater to maintain a chosen lifestyle. The balance of the relationship between communities that rely on surface water for their subsistence and communities that rely on groundwater for domestic depends on the health and maintenance of the riparian system. Such relationships are often characterized as representing the competing interests between rural and urban groups. Although there are certain characteristics of each of these groups that can be attributed specific lifestyles, the final reality is that both groups share and depend on the same hydrologically renewed riparian system. As such, the effects of the water-use behavior of one group is inextricably tied to the other.

Our current cultural milieu has become a sociopolitical arena that consists of various interests locked in a contest that pits the economic development visions of contemporary urban groundwater water users against the struggle for the preservation of traditional irrigation practices among surface water users. Drought and water scarcity has renewed the same adverse effects that had challenged historic human populations. The continuing water crisis may yet require all social groups to rethink their existing culture and lifestyle.

References/Bibliography

Brown, F.L. and H.M. Ingram. 1987. *Water and poverty in the southwest*. University of Arizona Press.

Carlson, A.W. 1975. Long-lots in the Rio Arriba. p. 48-57 *In Annuals of the Association of American Geographers* V. 65.

Chandler, A.E. 1918. *Elements of western water law*. Technical Publishing Co.

Clark, R.E. 1964. *NM Water resources law: a survey of legislation and decisions, division of government research,* University of New Mexico.

Crawford, C.S., A.S. Culley, R. Leutheuser, M.S. Sifuentes, L.H. White, and J.P. Wilber. 1993. *Middle Rio Grande ecosystem: Bosque biological management plan*. Middle Rio Grande Biological Interagency Team, U.S. Fish and Wildlife Service.

Dunbar, R. G. 1983. *Forging new rights in western waters*, University of Nebraska Press.

Dunbar-Ortiz, R., 1980. *Roots of resistance: land tenure in New Mexico.* American Indian Studies Center, UCLA.

Garcia, P. 2002. Voices from the earth: community and culture vs. commodification: the survival of Acéquia acéquia and traditional communities in New Mexico. (Article reprinted by the SW Research and Information Center, Albuquerque) <http:www.sric.org>.

Harris, L.G. 1992. *New Mexico water rights*. Misc. Rept. 15, 2nd update, NM Water Resources Research Inst.

John Shomaker & Associates, Inc. and Pioneerwest. 2000. *Historic and current water use In the Middle Rio Grande region*. Prepared for the Middle Rio Grande Council of Governments and the Middle Rio Grande Water Assembly. June 2000.

Jojola, T.S. 1998. Pueblo Indians and Spanish town planning in New Mexico. pp. 171-185 *In* Morrow, B. and V.P. Price (eds.*), Anasazi architecture & American design*. UNM Press, Albuquerque.

Kelly, V.C. 1969. *Albuquerque: its mountains, valley, water, and volcanoes, scenic trips to the geologic past*, No. 9. State Bureau of Mines and Mineral Resources, NM Inst. of Mining and Technology.

Kenneson, S.R. 1987. *Through the looking glass: a history of Anglo-American attitudes towards the Spanish-Americans and Indians of New Mexico*. Unpublished Ph.D. Dissertation, Yale University, 1978.

McHarg, I.L.1969. *Design with nature*. Natural History Press.

Middle Rio Grande Council of Governments (MRGCOG). 1989. *Survey of water resources issues in state planning and development: District 3.* Report SPR-225. July 1989.

Ortiz, A. 1969. The Tewa world: space, time, being, and becoming a Pueblo society. University of Chicago Press.

Rivera, J. A. 1998. *Acéquia culture: water, land and community in the southwest*. UNM Press..

Scurlock, D. 1998. *From the rio to the sierra: an environmental history of the Middle Rio Grande Basin.* General Technical Report RMRS-GTR-5, Forest Service, US Dept of Agriculture, May 1998.

Simmons, M. 1982. *Albuquerque: a narrative history*. UNM Press.

Stuart, D.E. 2000. *Anasazi America : seventeen centuries on the road from center place*. UNM Press.

Sunseri, A.R. 1973. New Mexico in the Aftermath of the Anglo-American Conquest, 1846-1861, unpublished PhD Dissertation, Louisiana State University & Agricultural & Mechanical College.

Wiel, S.C. 1911. *Water rights in the western states, Vol. 1*. Bancroft-Whitney Company.

Social and Cultural Feasibility Fact Sheet
Alternative 66: Watershed Plans

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1. Definition of Alternative

A-66: Implement local and regional watershed management plans through all land and water agencies in the planning area

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

The Rio Grande River and its tributaries have shaped the cultural landscape of the region for millennia. Whether early native settlements, Spanish colonial communities, or early Anglo homesteads, the human landscape has been determined by the connections of people to the watersheds that they inhabited.

Early inhabitants understood the relationship between water and land. Their very survival was dependent on the renewal of the riparian landscape through its seasonal cycles. The Pueblo and early Hispanic settlements, in particular, developed a deep abiding sense of stewardship to the land.

Many such communities depended on having access to usufruct or common lands within the watershed. When American territorial laws were applied to the region, many of these usufruct lands were transferred to the public domain. From such arrangements emerged myriad land entitlements including Spanish land grants, Indian lands, and public and private lands. In turn, these entitlements created a host of local, state, regional and Tribal agencies charged with managing or overseeing the natural resources found in these areas.

Historically, public policy has reflected national, regional, or community development goals. These goals have sometimes included the appropriation of natural resources and the establishment of "beneficiary" groups; as a result public policy has frequently treated various cultural and social groups differently than others. The public engagement of various social and cultural groups in the planning and use of historic usufruct lands has been checkered at best. In particular, many land grant communities continue to advocate that their traditional usufruct lands were wrongly taken from them.

The overall challenge for implementing this alternative is increasing the level of local participation and engagement in a watershed management plan.

3.1 Surface Use

The social and cultural impact of this alternative is substantial for surface users, since many historic communities are located within riparian watershed areas and have traditionally situated their settlements to take maximium advantage of the downstream flows for local subsistence.

3.2 Groundwater Use

Planning areas for urban and surburban development generally do not consider watershed regions in their planning and are driven by the availability of open or “cheap” land for development. Technological solutions via infrastructure projects aim to support continued growth without much regard to watershed areas. The concept of watershed is rarely applied in master planning.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

Negotiation of common goals will be necessary to balance the protection of the watershed, natural resources, and historical land uses in the face of urban development.

4.1.2 Groundwater Use

- May require the development and implementation of new ordinances to control the impact of development on various sensitive watershed and ecological zones.

- May inhibit the amount of land available for housing and development within protected sensitive and open-space areas.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

May result in uniform policies that will strengthen the ability of landholders to retain their land by taking into consideration and helping to preserve the way they have traditionally managed water as stewards of the land.

4.2.2 Groundwater Use

Urban and suburban developments typically import foreign plant species for landscaping. Landscape approaches that are tied to the unique ecologies of the local watershed would help reclaim natural environments.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

Will require the continued mobilization of special interest groups to ensure diverse representation at the policy table.

4.3.2 Groundwater Use

None.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

Traditional communities have had varying levels of local water control and public engagement in the past. Where traditional land-tenure patterns have been sustained, traditional forms of water management still exist at the community level. These traditions reflect values that are important to watershed management.

4.4.2 Groundwater Use

As urban and suburban developments move into open lands, it becomes more difficult to protect the watershed.

Social and Cultural Feasibility Fact Sheet
Alternative 1: Bosque Management

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1. Definition of Alternative

A-1: Restore Bosque habitat and manage vegetation in the Bosque to reduce evapotranspiration by selectively removing vegetation and promoting native plants.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Traditional cultures have used native plant species found in the bosque for food, medicinal, and ceremonial purposes. Of the 1,000 or so different species of wild plants that grow in New Mexico, nearly 300 are known to be used in some way by native people. Useful species like the broad-leaved cattail and Indian ricegrass are far less common today than in the past as a result of the disappearance of open wetlands.

Native plants have also served to provide habitats for unique and endangered animal species. The bosque shrub habitat is estimated to be the nesting places of 85 to 95 bird species. The total number of bird species observed in the bosque is 277, representing approximately 60 percent of all bird varieties in New Mexico. In addition, the unique bosque environment sustains a diverse variety of fish, amphibians, and mammals.

The bosque environment has been subjected to a wide variety of practices intended to introduce foreign species for erosion control. Although these human interventions have been well intended, many of these species have proved to be invasive and have displaced the native plants.

The lack of management of invasive species has created a dense covering amid the cottonwood groves. Dense foliage results in hazardous fire conditions, especially during periods of prolonged drought. Major fires have scarred the bosque, resulting in the destruction of fragile environments and endangering personal property. Forest fires tend to kill cottonwoods and become revegetated by undesirable plant species such as saltcedar, Siberian elms, and mulberries.

3.1 Surface Use

- The impact of selectively removing vegetation and promoting native plants is substantial for traditional surface users. Bosque areas have become overrun by foreign plants that are less useful for cultural practices than native species.
- Urban cultural practices have introduced many varieties of foreign species via domestic landscaping. Many of the plants have migrated to the bosque areas.
- The bosque is a recreational destination for many local residents.

3.2 Groundwater Use

Reducing evapotranspiration by selectively removing vegetation and promoting native plants does not have an immediate and discernable impact for urban users. However, the bosque is a very special landscape that adds to the beauty and identity of the region. The overall condition and health of the bosque is considered to be an important indicator on the sustainability of human interventions in the landscape.

4. Social and Cultural Feasibility

Social Issues and Implications

4.1 Surface Water Use

- This alternative would require communities to buy into the management of the restored areas.

- Increased access to ecologically sensitive areas may increase unintended human impacts (trash, degradation by overuse, etc.).

4.1.1 Groundwater Use

Would require educating the general public on the value of the bosque and its place in the riparian ecosystem in order to garner support for the implementation of this alternative.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Undergrowth caused by invasive species could be better managed, resulting in lowered forest fire danger and better protection of historic communities along the bosque.

- Better bosque management may enhance access to and multiuse of the bosque for foraging (e.g., firewood) and recreation (e.g., fishing, hunting, and picnicking). This would benefit local communities and recreational users.

- Native plants that have cultural value (for woodcrafts, medicinal, basketmaking, etc.) could be repropagated.

4.2.2 Groundwater Use

Restoring the bosque will add to the region's historic amenities of open space, the river ecology, and unique terrain.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

- Better access to previously overgrown, inaccessible areas would increase security needs.

- Local ordinances to control the planting of invasive plant species may need to be created or strengthened and special foraging permits may be necessary to protect reclaimed habitats.

4.3.2 Groundwater Use

Some forms of urban recreation, such as four-wheeling, may have to be prohibited to protect the fragile native environment.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

Indian Pueblos such as Santa Ana and Isleta have taken the lead in restoring the bosque to its original riparian condition.

4.4.2 Groundwater Use

The hard urban edge of Albuquerque is softened by the river that runs through it. Unlike many other major rivers throughout the nation, the Rio Grande is not an industrial river. The unique bosque environment contributes substantially to the identity and character of the city and the region. It is a unique ecological preserve in the middle of an urban corridor.

Social and Cultural Feasibility Fact Sheet
Alternative 45: Reservoir Management

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1. Definition of Alternative

A-45: Reduce open water evaporation in storage reservoirs by retaining water at higher elevations or latitudes, or by reducing surface areas.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Historically, the cultural landscape has been shaped by the seasonal downstream flow of the river. With the advent of reservoirs, the cyclical renewal of the riparian system was altered and what used to be a shifting, braided, wild river was channeled and tamed.

At the turn of the 20th century, dams were constructed to store irrigation water for large-scale agriculture. These were followed soon after by flood control dams that were designed to protect the low-lying areas. With the onset of urbanization, municipalities began using dams as reservoirs for domestic water

Downstream communities benefited from this in several ways. The containment of water provided a steady and continuous flow of river water. The destruction of property caused by seasonal floods was alleviated. Stored water became available for agriculture and domestic use. The large waterbodies created by these dams became a haven for recreationalists. The reservoirs, of themselves, created new eco-zones sustaining a diversity of animals and plants.

New settlements along the river and alongside reservoirs were established to take advantage of both the agricultural and recreation potential. Over time, these settlements became an integral part of New Mexico's social and cultural landscape.

3.1 Surface Use

Elephant Butte is a mecca for year-around recreation (vacationing, boating and fishing). Upstream reservoirs also serve the same function, but are smaller and tend to have much more restricted public access. Retaining water at higher elevations will potentially result in the increase the size of the upstream reservoirs while decreasing the size of Elephant Butte.

3.2 Groundwater Use

Reservoirs will continue to be used by municipalities to store water for domestic use.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- Storing water upstream would reduce surface areas and have negative recreational impact on boaters and properties located next to the shores of Elephant Butte.

- Reducing surface areas would result in vacation property frontage shifting. Existing lakeside property would no longer front the shore.

- The use of surfactants to further reduce surface areas may have negative effects on how both farmers and recreations users perceive the quality of water.

4.1.2 Groundwater Use

Competition between municipalities, environmentalists, and recreationalists over the use of reservoirs at higher elevations may be a major source of contention.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Competing social values pitting water supply management versus recreational use may arise.

- Flows from larger upstream reservoirs may become greater, resulting in increased safety and hazard conditions along the banks of downstream settlements.

- Rising water may endanger sacred and historic low-lying sites located close to reservoirs or on the banks of the river.

4.2.2 Groundwater Use

None.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

- Municipalities that store their domestic water in upstream reservoirs would be more reluctant to allow public recreational use.

- The impact of increased downstream flows or larger upstream reservoirs may adversely affect historic communities located nearby.

- Property owners displaced by the reduction or increase in the size of reservoirs may seek compensation.

- Damage to irrigated lands from rising water tables may affect farmers.

- Impoverished historic communities are the least likely to pursue legal remedy for adverse damage.

4.3.2 Groundwater Use

Conflicts between municipalities that store water and recreational users may arise.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

Due to the hydrological relationship of surface water and groundwater, the water table of areas adjacent to and downstream of expanded reservoirs may rise significantly.

4.4.2 Groundwater Use

If municipalities such as Albuquerque choose to divert water away from the aquifer directly into domestic usage, the hydrological balance between surface water and groundwater could be changed. The resultant impact on the surface ecology would be substantial.

Social and Cultural Feasibility Fact Sheet
Alternative 24: Reuse Greywater

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-24: Promote, through incentives, on-site residential and commercial greywater reuse and recycling.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Households in traditional communities practiced water-saving measures. Water that had to be carried from a distance was a cumbersome and difficult daily task. Domestic water that had been used for bathing, washing, and laundry was recycled to gain additional useful benefits.

Greywater from domestic chores was used for watering a variety of garden plants. Single plots of creeping plants like squash and melons, as well as climbing vines like grapes and gourds, were the most common varieties. Greywater was also used to water shade trees.

Today, households may need to use of biodegradable soaps/cleansers and refrain from using harsh chemicals before they can recycle greywater for watering. The immediate benefit of using greywater for a household is to augment the supply of water available for outside landscaping.

Similarly, the recycling of greywater from commercial sources that use large quantities of water can have significant benefits to surrounding neighborhoods. Commercial greywater, assuming it meets a specified level of water quality, can be used to sustain grassy areas and parks. Large open grassy parks are especially sought after for organized games like soccer, football and baseball. Shady parks are used by individuals, families and groups for outdoor events such as picnics.

3.1 Surface Use

Because the point source of greywater is the individual household, the immediate outdoor landscaped area benefits from watering. Properties such as apartments or townhouses with larger open lots can use greywater to irrigate of small community gardens or ponds.

3.2 Groundwater Use

Watered surface vegetation provides a lush, green environment which is highly valued among high-desert dwellers living in Albuquerque. Greywater used for surface watering is generally lost to evapotranspiration, and thus does not recharge the aquifer. However, it may lower the demand for fresh water to water the landscape and thus offset any losses to the aquifer.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- This alternative may not be feasible in densely settled communities.

- Rural households that use septic systems may benefit by recycling their own greywater and using it for their yards.

- Could help to promote sustainable values by reducing the amount of fresh domestic water that is used for landscaping.

4.1.2 Groundwater Use

Would require fitting existing houses with new plumbing systems. New construction is better adapted to installing greywater systems.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Could help rejuvenate local farming traditions through the encouragement of small family backyard plots.

- Could serve to supplement water needed to irrigate oriental plants and yard landscaping.

4.2.2 Groundwater Use

- Would strengthen the self-reliance of households that use this option.

- Could help maintain domestic supply wells, since less water will be pumped. This is especially favorable for rural users who maintain their own wells.

4.3 Equity and Justice Implications

- Poorer rural households that can benefit the most from using greywater are the least likely to afford the additional costs of retrofitting their existing plumbing.

- Poorer urban households that can benefit the most from using greywater are the least likely to afford the additional costs of retrofitting their existing plumbing.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

The South Valley area of Albuquerque has several ongoing successful demonstration projects (Paul Lusk farm and Los Padillas Elementary School) that show the benefits of greywater usage in maintaining bosque habitat within unincorporated, mixed land-use areas.

4.4.2 Groundwater Use

Changing the overall social values for the acceptance of greywater use will require a concerted educational campaign. This might be accomplished through demonstration projects that show the economic and environmental benefits of recycling water

Social and Cultural Feasibility Fact Sheet
Alternative 27: Reuse Treated Effluent

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-27: Reuse treated wastewater for non-potable uses.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Wastewater treatment facilities are mainly confined to the larger urban and surburban developments in the region. Due to the large quantity and steady volume of discharge from such facilities, treated water discharge occasionally becomes the only source of water flowing in the river bed. Historically, this has been both beneficial and problematic in the maintenance of the downstream bosque environment.

The reuse of nonpotable water for metropolitan usage may constrict the amount of water that is added to the river. This will become evident during times when the upstream river flow is insufficient to supply both the main river and diversion channels.

Some smaller communities, like Pueblo villages, also may have waste treatment facilities. For the Tribes, wastewater facilities were constructed and maintained by the Indian Health Service. As a result of new changes in federal/Indian policies, many Tribes have taken over the management of these systems. However, wastewater systems for non-Indian, small historic communities are the exception and not the rule.

Especially among rural households, the only solution to managing wastewater is the use of individual septic tank systems. This alternative is not feasible for such situations.

3.1 Surface Use

Currently, treated wastewater supplements the natural flow of surface water. Diverting non-potable water for municipal usage will benefit urban users but may have a negative effect on downstream communities.

3.2 Groundwater Use

Reuse of wastewater reduces the need to pump as much groundwater to meet demand. It also decreases the need to use potable water for maintaining water-intensive recreational land-uses.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- Reuse of wastewater for nonpotable uses could benefit recreation by sustaining landscaping for parks and parkways.

- Reuse of wastewater could offset the domestic water usage of water-intensive land-uses (e.g., golf courses).

4.1.2 Groundwater Use

Groundwater would be preserved for domestic potable uses, which would benefit all social groups.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Small communities with wastewater treatment facilities may also benefit from reuse of wastewater for nonpotable uses. Small communities are the least likely to have grassy parks that support outdoor recreational activities. Recycling greywater may provide incentives to create such places.

- Reuse of wastewater would result in less effluent being discharged into the river. The depleted surface flow will affect aquatic and plant life. The greatest environmental concerns are associated with the protection of endangered species such as the silvery minnow and the willow flycatcher.

4.2.2 Groundwater Use

Would produce visible benefits among urban residents who use recreational areas that could be watered with reuse water.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

- Reduced downstream flows may adversely affect the ability of smaller communities to irrigate and farm.

- Reusing wastewater for nonpotable uses benefits urban more than rural residents, as reuse will occur primarily in urban locations.

4.3.2 Groundwater Use

None.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

The ecosystem of the bosque environment is already stressed. Treated wastewater discharged to the river has helped mitigate some of the impacts of low surface water flow, especially during extremely dry conditions. Decreased discharge of effluent may adversely affect the bosque ecology; however, this social concern may have to be weighed against the benefits that urban residents will gain from the use of nonpotable wastewater.

4.4.2 Groundwater Use

It may be difficult to convince urban users to conserve water if they perceive that the reuse of wastewater for nonpotable has solved the City's demand for water. Given current lifestyle patterns among urban users, present practices would likely be continued if they are convinced reuse is an effective solution. An educational campaign to change these perceptions may be important.

Social and Cultural Feasibility Fact Sheet
Alternative 18: Urban Conservation

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-18: Adopt and implement local water conservation plans and programs in all municipal and county jurisdictions, including drought contingency plans.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Periodic droughts are a naturally recurring event in New Mexico. It is estimated that at least 52 droughts, lasting one or more years, have occurred in the last 500 years. Historically, the adverse effects of a prolonged drought have been the cause of major social upheaval.

Drought results in the loss of water sources for irrigation and a consequent decrease in food. The lack of moisture affects grazing and animal life. During Spanish colonial times, droughts were the cause of abandoned settlements, widespread raiding, and civil strife. The Pueblo Indian Revolt of 1680 is one of the best historical examples of a major social upheaval that occurred during a drought.

Even during relatively recent modern times, drought has been a major social and cultural factor. From 1951 to 1956, the effects of La Niña forced communities in northern New Mexico to sell thousands of cattle and abandon crops. Mountain streams dried up and water rationing was instituted in Santa Fe. Some of the effects of drought, however, were mitigated by increasing the number of domestic and irrigation wells.

Shorter recurring droughts occurred in 1971 and again in 1980. Today, the region is once again experiencing drought conditions, which are forcing water conservation measures. For example, northern communities such as Española have been forced to suspend the approval of construction permits for new housing due to a lack of domestic water.

Drought conditions may affect the entire watershed or only specific areas. Normal or above average snowfall in higher elevations can help to alleviate drought conditions downstream during the summer season.

3.1 Surface Use

The impact of drought is substantial for rural communities. Rural communities often depend on the surface flows to both irrigate and for domestic needs. As water sources become less reliable, residents are forced to look for new sources. Federal, state, county, and Tribal agencies are critical in coordinating relief.

3.2 Groundwater Use

During drought conditions, many communities have relied on pumping groundwater to continue their normal lifestyle. This practice has resulted in a nonchalant attitude among urban populations regarding the necessity of water conservation.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

Conservation plans require coordination across counties.

4.1.2 Groundwater Use

The introduction of conservation programs among domestic ground users will require a major educational effort.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Traditional water organizations, such as acéquia associations, can assist in implementing contingency plans.

- Pueblo Indian communities have or are developing their own water contingency plans.

4.2.2 Groundwater Use

Conservation of groundwater requires a great deal of voluntary compliance from domestic water users who are not accustomed to conserving water.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

The concept of prior appropriation often results in conflict among water users who are competing for the same scarce resource.

4.3.2 Groundwater Use

- Urban domestic water may need to share the burden of water scarcity during severe droughts.

- Extreme drought conditions will require increased enforcement for mandatory compliance.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

The role of historic communities in managing water has diminished. County jurisdictions have assumed the oversight of rural communities. Municipal and county jurisdictions, however, may not represent the vested interest of all rural users.

4.4.2 Groundwater Use

Lifestyle and water-use habits take a long time to change. Educational programs on water conservation should begin with small children and be continued throughout their primary schooling.

Social and Cultural Feasibility Fact Sheet
Alternative 21: Urban Water Pricing

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-21: Examine a variety of water pricing mechanisms and adopt those that are most effective at conserving water. The mechanisms to be examined include: a) price water to reflect the true value; b) institute a moderately increasing block price schedule; c) institute a steeply increasing block price schedule; and d) other feasible incentives and subsidies for conserving water.

2. Assumptions

The effects of this alternative are borne by urban residents, who currently use groundwater, almost exclusively, as their water source. Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Domestic urban and suburban water users incur various pricing schedules and rates depending on the municipality or area where they reside. Many families in rural areas maintain their own domestic wells and are not tied into municipal systems.

The burden of water use varies according to the socioeconomic characteristics of the household and is not evenly distributed across the region. Major factors include household income and the size of a family in a given household. Assuming that each individual in a household consumes

the same amount of water per day, the impact of pricing mechanisms would be greatest for those families that are large and have a small household income.

A large family with a small household income does not have the same ability to conserve water as a small family with a large income. Large families use more water out of necessity, while smaller families with high incomes may not conserve water simply because they can continue to afford steeply increasing block prices.

Based on U.S. Census 2000 results, household income varies for the Bernalillo, Sandoval, and Valencia Counties. The median household income for Bernalillo is $38,788, while Sandoval and Valencia Counties have median incomes of $44,949 and $34,099, respectively. Household size does not vary as greatly, ranging from 2.47 people per household in Bernalillo County to 2.84 in Sandoval and 2.86 in Valencia.

One major indicator of the unequal burden of water pricing is the poverty rate for each county. Bernalillo has the lowest rate (10.9 percent), followed by Sandoval (12.2 percent) and Valencia (15.6 percent). For families with a female head of household, the poverty rate is even more dramatic, ranging from 30.1 percent in Bernalillo County to 33 percent in Sandoval County and 41.4 percent in Valencia County. These families also tend to have younger children. Unless measures are taken to consider the impact of block pricing on poorer, socially disadvantaged households, social inequities may be realized.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

- Water pricing is feasible where domestic users are tied into municipal systems and water use is metered.

- Water pricing is essentially an urban phenomenon. Rural areas that use individual wells would not be affected unless their wells are metered as well.

4.2 Effects on Preservation of Traditional Values

- Urban users would not change their water-use behavior until costs impact them directly and substantially.

- Households with high income would be willing to pay higher costs to preserve lifestyle.

- Pricing mechanisms may be an effective means for conservation among middle-income families.

4.3 Equity and Justice Implications

- Smaller municipalities may bear a higher burden for managing water pricing because costs to administer such a system cannot be distributed over a large population.

- Lower income households with large families would be more impacted by higher water prices and would not have same options as higher income households.

4.4 Special or Unique Aspects

A more socially egalitarian pricing mechanism would consider the amount of water that is necessary to meet the basic needs of a specified household size.

Social and Cultural Feasibility Fact Sheet
Alternative 10: Irrigation Efficiency

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-10: Develop and employ alternatives to maximize irrigation efficiency on all irrigated land in the region.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

For the colonial Spanish, the river was considered the *corazon* (life blood). Early settlements constructed and maintained acéquias (ditches) from which individual agricultural parcels were cultivated. The irrigation system became the lifeline of many traditional settlements.

The impact of irrigation upon these historical settlements was enormous. The management of water created a political and social organization that was centered on the authoritative role of the *majordomo* (ditch boss). The *majordomo* not only regulated the allocation of water, but presided over the jurisdiction of civil affairs.

The number of ditch systems peaked in 1880., when it was estimated that there were 82 systems with 124,800 acres of irrigated land under cultivation. This was in spite of the fact that the population of New Mexico was only 119,565 people according to the census. Although the territory continued to grow, environmental degradation due to the impacts of overgrazing, timber harvesting, and water diversion led to a rising water table, waterlogging, and a resultant loss of irrigated lands.

In addition to providing needed irrigation water, irrigation practices shaped the distinctive land tenure of the region. Even with the advent of growth and development after World War II, the use of ditch systems persisted in urban areas. Places like Albuquerque simply enveloped historic irrigated communities.

Irrigation systems also created a distinct ecology. Consequently, the efficiency of irrigation is not the only consideration. Earthen ditches allowed water to percolate and sustain a diversity of wild plant and animal life. Ditch water readily distributed the seeds of plant species and replenished the topsoil with silt. Community work centered on ditchwork created unique and irreplaceable cultural traditions. Open flooding of fields has been a traditional practice in the region and the cultural landscape it has created is a hallmark of New Mexican culture.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- Drip irrigation systems are an expensive alternative to traditional flooding methods and are maintenance intensive.

- Lining ditches in urban areas creates safety hazards for animals and humans alike.

4.1.2 Groundwater Use

Drip systems may lower groundwater recharge, resulting in lower water tables and deeper domestic wells. This may affect rural households that rely on domestic wells.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Traditional small farmers may resist new alternatives.

- Certain crops may be more suited to drip irrigation.

4.2.2 Groundwater Use

Rural domestic well systems may be adversely affected.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

- Cultural impacts from irrigation alternatives are greater for historic agricultural communities.

- Large commercial farms are more likely to accept and benefit from new irrigation technologies.

- More efficient irrigation that results in smaller diversions may benefit downstream users (increased surface flows).

4.3.2 Groundwater Use

Localized effects on hydrogeography may impact rural areas more than urbanized ones.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

- Cash crops like alfalfa are not particularly labor intensive and are well-suited suited to weekend farming. The introduction of new, more labor intensive crops may not be feasible for small farms.

- Weekend farming may not be possible unless the water deliveries are managed in a way that supports weekend farmers.

4.4.2 Groundwater Use

The Middle Rio Grande Conservancy District (MRGCD) maintains ditches, riverside drains, and wasteway laterals that channel groundwater out of high water table areas. The open space that has been created by these systems is considered one of the main recreational amenities of the city among bikers, horse riders, and walkers.

Social and Cultural Feasibility Fact Sheet
Alternative 7: Agricultural Metering

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-7: Meter and manage surface water distribution flows through all irrigation systems to conserve water.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historic relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

This alternative applies almost exclusively to surface water use; only a small percentage of irrigation water in the Middle Rio Grande planning area comes from groundwater. Irrigators with established water-rights are self-regulated. Diversions are determined by availability and need. Traditionally, the main role of *mayordomos* was to regulate water in a manner that provided for equitable distribution. This was accomplished by opening headgates to regulate the flow and timing of water releases.

Smaller ditches that divert water from the main ditch may supply a single parcel or numerous ones. These ditches, often used by one family or shared among neighbors, are typically earthen and may or may not have locking gates that can support meters. In many instances, farmers simply dig trenches to release water into their fields.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

- Individual irrigators take turns accessing the ditches to water their fields when water is available. There is a deeply ingrained tradition of self-regulation. Metering is counter to accepted cultural conventions.

- Meters are susceptible to vandalism.

- Meters may be effective in monitoring the amount of water used by monocrops. Reports from the data could help traditional farmers adjust their irrigation patterns to be more efficient.

4.2 Effects on Preservation of Traditional Values

- The consequences of shutting off irrigation systems when allocation is exceeded may cause social turmoil.

- Pueblo and acéquia users are opposed to any mechanisms that may be eventually be used to monitor the amount of their water usage and to quantify their water rights.

4.3 Equity and Justice Implications

- Many rural irrigators use cash crops to augment their income. Charging farmers for either administrative or maintaining meters would be an additional financial burden.

- Poor farmers may not be able to afford water if the cost of metering is passed onto them

4.4 Special or Unique Aspects

This alternative seems best suited for larger scale agricultural operations that factor efficiency into their commercial operations. Metering and monitoring surface water distribution flows would increase yields and cost savings would be passed onto consumers. Such measures are perceived as beneficial to the economy and contributing to social goals.

Social and Cultural Feasibility Fact Sheet
Alternative 9: Agricultural Conveyance

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-9: Develop conveyance alternatives for water transportation in agricultural irrigation systems.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historic relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Conveyance alternatives pose major cultural concerns to traditional water users. The unique hydrological relationship between surface water and groundwater is the basis of cultural systems that place a high value on stewardship and sustainability. The natural ecosystems that are supported along ditches contribute to the identity of the bosque environment. The bosque provides a diversity of animal and plant life that is valued by traditional cultures as well as by individuals seeking the open space created for leisure activities.

3.1 Surface Use

The ecology of the riparian area is maintained by surface flow.

3.2 Groundwater Use

Although lined ditches or piping delivers water more efficiently, neither option allows water to seep and recharge the surrounding groundwater.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- Concrete lining of ditches could adversely affect the ecology of vegetation and animal life along ditchbanks. The bosque environment is valued for its scenic beauty and diverse ecology. Traditional cultures still depend on harvesting useful plants that grow near ditchbanks.

- Concrete lining of ditches creates additional public safety hazards, especially for children and domestic pets, as it is more difficult to climb out of lined ditches.

- Underground piping eliminates safety hazards, but associated costs may be prohibitive.

- Recreational users who use the ditchbanks for hiking and horseback riding may lose these pathways if ditches are channeled underground.

- Conveyance systems may be a socially acceptable solution for large farms.

- Some urban residents consider ditches to be a public nuisance and hazard.

4.1.2 Groundwater Use

Conveyance systems would not allow groundwater recharge.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Cyclical cultural practices of historic communities are tied into the maintenance of ditches.

- Community activities such as ditch work are adversely affected by concrete lining.

- Lining ditches affects the communal cycle of ditchwork and water ceremonies.

4.2.2 Groundwater Use

A lower water table may impact rural farmers who depend on wells for domestic water.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

Changes to local ecology will affect cultural land-use practices within traditional communities.

4.3.2 Groundwater Use

None.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

- Federal initiatives on Indian reservation lands have already lined many ditches for water conservation purposes. The impact on the ecology has affected some ceremonial practices.

- Urban underground convenience systems have been proposed and have been met by stiff opposition by environmental groups.

- Because Albuquerque has grown around historical, irrigated communities, open ditches have persisted in urban areas even though they may no longer be used for local irrigation. There is an urban public perception that open ditches in densely settled neighborhoods are more of a nuisance and danger to public safety than they are a benefit. Developing convenient alternatives may inadvertently create contention between groups interested in eliminating open ditches in urban areas versus those interested in preserving them.

4.4.2 Groundwater Use

None.

Social and Cultural Feasibility Fact Sheet
Alternative 11: Low-Water Crops

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-11: Develop markets for locally-grown produce, and low-water alternative crops.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historic relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Early indigenous Tribal and Hispanic settlements practiced subsistence farming and produced a wide variety of products. Anglo-American farmers introduced larger scale commercial farming. As urbanization has overtaken agricultural lands and wage-earners come to rely on jobs in the city, remaining open parcels have shifted to monocrops like alfalfa and corn.

The traditional agricultural land-use systems are in danger of being lost to residential development. Traditional long-lots that front ditch systems are easily parceled crosswise to accommodate the demand for local housing. Even within the most traditional, compact communities such as the Pueblos, residents are moving outside of the traditional village, building houses in the middle of agricultural fields.

Such changes are the result of complex shifts in social and economic behavior over time. According to a special U.S. Census supplement report for New Mexico, in 1910 14.5 percent of all land in Bernalillo County was farmland (112,744 acres), while Sandoval County had 14.1 percent farmland (349,299 acres), and Valencia County 5.8 percent (208,385 acres). In each of these counties, respectively, the average size of an individual farm was 129.9 acres, 282.4 acres, and 161.3 acres. By 1987, estimates of irrigated acres served by acéquias had dropped considerably: Valencia County had the highest amount (10,975 acres), followed by Bernalillo County (22,110 acres), and Sandoval County (8,170 acres).

Although this alternative will help to preserve historical agricultural values by encouraging residents to reap the benefits of small-scale farming, it cannot replace agricultural lands lost to urban development.

3.1 Surface Use

The push-pull forces of urbanization have resulted in the parceling of agricultural lands for housing subdivisions. Historic agricultural subsistence communities have been overtaken by development and a pattern of mixed land-uses have emerged along ditches and old acéquia systems. Traditional irrigation practices are still found in open parcels. The loss of agricultural lands will have significant impacts on traditional settlements through the erosion of subsistence values that have become the core of their cultural identity.

3.2 Groundwater Use

Urbanized communities that are not served by surface irrigation may practice some gardening by drawing on domestic wells or water systems. Some public and alternative schools use groundwater to irrigate small demonstration plots to teach agricultural principles to schoolchildren.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- Subsistence farming is still practiced by landowners along acéquia systems.
- Traditional varieties of crops can still be found in small family plots.
- Some varieties of crops, such as alfalfa, are used to augment household income.
- Large farms may benefit more from low-water alternative crops.

4.1.2 Groundwater Use

Low water use alternative crops, grown on a personal scale, can help teach the values of farming.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Acéquia communities still have a high cultural value in practicing farming.
- Traditional Hispano long-lot lands are becoming less suitable for agriculture and are increasingly subdivided to augment household income.
- Pueblo Indian communities practice both subsistence farming and monocropping.
- Newcomer Anglos have revived farming practices in areas where lands had been fallow.

4.2.2 Groundwater Use

Traditional families who have been displaced from their farms seek low-cost housing and sometimes continue to practice gardening using groundwater.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

- Urbanization has eroded the traditional family values placed on subsistence farming.

- Gentrification has displaced traditional families from their farmsteads.

4.3.2 Groundwater Use

Pricing controls on domestic water may affect small family gardens.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

Small farmers markets already allow urban users to buy locally grown goods. New cultural trends in organic farming may entice urban buyers to seek local produce. Marketing of local produce may assist small farmers to compete effectively with large grocers.

4.4.2 Groundwater Use

Indigenous and Hispanic families who live in the city still tend to maintain ties with their rural origins. As they reach retirement age, they are inclined to move back to their rural hometown communities.

Social and Cultural Feasibility Fact Sheet
Alternative 30: Land Use

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-30: Adopt policies to integrate land use and transportation planning and water resource management in all government jurisdictions in the Middle Rio Grande water planning region.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Forty percent of the entire state population is located in and around Albuquerque. The City is surrounded by Indian land, U.S. Forest Service land, and military bases; however, new or improved highway systems have allowed development to leapfrog beyond these reservations. Urbanization now extends into the more rural areas of Valencia, Sandoval, and Torrance Counties.

The urban corridors located along Interstates 25 and 40 traverse lands managed by myriad public and Tribal agencies. Most of these agencies operate in relative autonomy with no uniform standards for regulating growth or mitigating the impacts of urban development on traditional farming and ranching communities. A comprehensive regional approach involving all principle agencies and setting common water-use polices is needed.

3.1 Surface Use

Commuters seeking the amenities of rural life encroach on historic towns and villages. Self-contained suburban developments that have sprouted at crossroads tend to be less integrated into the social and political life of smaller communities. The values associated with suburban water use and rural water use are often in conflict.

In particular, the north-south I-25 urban corridor parallels a special irrigation district of the Middle Rio Grande Conservancy District (MRGCD). The MRGCD is bounded on each side by highline ditches. Along the length of this district are located the majority of historic settlements and communities that remain actively engaged in traditional irrigation practices. The protection of riparian bosque and historic ditch systems and irrigated lands within the MRGCD has been difficult in the face of urbanization. As roads into these areas are improved, outside development and competition for housing has begun to alter the traditional farming and agricultural character of these environs.

3.2 Groundwater Use

Urban and suburban development is almost completely dependent on pumping groundwater. The infrastructure for distributing domestic water and returning it through sewer systems tends

to parallel highway systems. This results in a grid, Euclidian land-use pattern that makes residents dependent on the automobile for basic transportation.

As development continues along the urban corridors, the need for land-use controls is necessary to protect the ecology of sensitive riparian zones and plan for sustainable communities.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- Agricultural lands are being lost to suburban development.
- Special land use policies that apply to lands within the riparian irrigation zone are weak or non-existent.
- Urbanization has stressed the riparian ecosystem through overuse or misuse.
- Lack of coordination among agencies has resulted in competing and inconsistent policies over public access to waterways.

4.1.2 Groundwater Use

Unregulated suburban development puts a strain on the capacity of municipal services to provide domestic water. Domestic water management is tied into the ability of a municipality to forecast demand. Many historic communities are not prepared to meet the water demand placed on them by nearby housing developments and population growth; this can create social tensions that divide long term residents against newcomers.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Irrigable lands are also the most desirable for new housing development. The fact that irrigated lands are flat and level, the lands tend to have good drainage, and that the soil is compact and suitable for good footings and foundations all contribute to their desirability. As such, open fields are easily transformed by building or moving houses onto the parcel.

- As a result of gentrification, high-end "trophy" houses have encroached onto or displaced traditional family farmlands.

- Pueblo Indian communities have generally opted out of interacting with local municipal and state agencies.

4.2.2 Groundwater Use

Water conservation values could be reintroduced as a collective urban vision.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

Families from traditional communities are being displaced by the purchase and development of traditional lands.

4.3.2 Groundwater Use

Preservation values compete with development values.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

Newcomers to the region are unaware of the cultural and social significance of the bosque and its historic role in irrigation. As a result, they are more inclined to change the landscape to conform to outside value systems.

4.4.2 Groundwater Use

- New development may have to assume more costs to acquire groundwater.

- Land-use practices and suburban development is being linked to major public health problems such as water quality, sanitation, and disease control.

Social and Cultural Feasibility Fact Sheet
Alternative 144: Conjunctive Management

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-144: Address groundwater/surface water interactions in the statutes for administering water rights

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Hydrologically, water knows no boundaries. This is especially the case when it comes to balancing the rights of senior and junior users in the Middle Rio Grande Basin. The political geography of municipalities, Indian Tribes, historic acéquia communities, public agencies, and private landholders is varied and complex. The application of conjunctive management and priority administration among water users is socially and culturally replete with issues and controversy. Although this alternative is technically possible, the politics are far from being resolved.

There is a long history of how water rights came be established. When the American Territorial Government in New Mexico was emplaced in 1849, the Spanish colonial and the Pueblo Indian cultural identities, as typified by their water-borne settlements, were firmly established. Rather than accepting these settlements, however, the American Territorial government embarked on policy of cultural assimilation based on Anglo Euro-Western values.

The most fundamental of these values was the concept of private property. Under customary law, both Hispano and Pueblo families were allocated land parcels and afforded the right of inheritance. Land transfers, as such, were tempered by social morays and tended to stay within the extended family or clanships. The ability to severe water as a property right was absolutely alien. Anglo-American dominance in the territorial courts and political arena refashioned the rights of traditional land holders so as to weaken their hold on the natural resources found within their territories.

In 1851, the New Mexico territorial government enabled water laws that preserved acéquia water-sharing customs and management practices. These rights were upheld once again in 1891under the Court of Private Land Claims, and in 1898 and 1907 under the Territorial Water Commission. In 1908, reserved water rights were upheld and accorded to Indian Tribes under the Winter's Doctrine. The concept of prior appropriation allowed other early settlers to secure their water rights.

Today, how water rights are applied is still a matter of adjudication. The court challenge appears less to be an issue of who has rights, but how they are quantified. As seen in the pending Aadmont water suit, Indian Tribes are opposed to quantification. It is because of the

adjudication environment that Indian Tribes in the Middle Rio Grande Basin are reluctant to participate in any public forum on water or to work outside of the U.S. federal arena to reach an accord.

3.1 Surface Use

Pueblo and historic acéquia communities established their rights to surface water very early. Anglo homesteaders were the next to obtain rights. The unique culture of the historic communities that were established along the riparian system is exemplified by the relationship that these communities have to the land. Diverting surface water for beneficial use to support an agrarian lifestyle is integral to New Mexico culture.

3.2 Groundwater Use

Due to the unique hydrology of the Middle Rio Grande Basin, groundwater has been relatively easy to find. The use of technology to pump groundwater has helped to sustain the patterns of rural and urban settlements throughout the middle basin. Urbanization demands on the groundwater available for domestic use, especially during periods of drought, have impacted the natural system.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- Historic communities that hold superior water rights would have to be assured that they will be the first under the application of priority administration to be considered.

- If surface water is diverted to recharge the aquifer, junior rights irrigators may be adversely affected due the unavailability of water for agriculture.

4.1.2 Groundwater Use

Municipal governments tend to have more leverage with it comes to appropriating their share of groundwater through state statutes. Much of that leverage simply occurs because of the size of their communities and the resources they may have to acquire additional water rights.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

Conjunctive management may benefit historic communities because of their superior water rights as established in time and beneficial use.

4.2.2 Groundwater Use

The social cost of buying the superior rights from historic communities is very high. This has been the practice of urban governments to meet the demand of their populations. Assuming that urban governments were able to purchase a large share of superior water rights, the application of priority administration would favor them.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

- The priority enforcement of senior rights over junior rights, especially during periods of drought, can cause social and political turmoil.

- The permit application required under priority administration may incur more time and costs for smaller water holders, especially those in rural communities.

4.3.2 Groundwater Use

The demands of urbanization for groundwater will continue to outpace the needs of smaller communities. Smaller communities that surrounding urban areas are more sensitive to changes in the hydrology of the area. Shallow wells and the lack of resources to drill deeper may impede their ability to sustain themselves if subjected to conjunctive management practices that change the natural balance of surface and groundwater.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

It is unlikely that the Pueblo Tribes would be willing to allow their surface water use to be regulated through conjunctive management.

4.4.2 Groundwater Use

It is unlikely that the Pueblo Tribes would be willing to allow their groundwater use to be regulated through conjunctive management

Social and Cultural Feasibility Fact Sheet
Alternative 26: Domestic Wastewater

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-26: Expand use of centralized wastewater collection and treatment systems into all areas of urban and suburban development within the water planning region.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

The historic pattern of settlement in the middle Rio Grande was characterized by small villages that practiced subsistence agriculture and were self-sufficient in their domestic water needs. Metropolitan Albuquerque grew from such settlements. Although infill development has occurred, many of the original settlements have not been tied into the City's municipal water and sewer systems and continue to use domestic wells and septic systems. This is also the situation with outlying rural communities. Self-sufficiency is considered to be an important cultural value that has sustained historic communities through time.

3.1 Surface Use

During certain times of the year when the river runs dry, treated wastewater comprises the largest or only source of surface flow.

3.2 Groundwater Use

Urban growth increases the volume of wastewater discharge. Suburban development may require water and sewer services to be more self-contained, resulting in a decentralized system.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- Increased flows will benefit the riparian bosque ecology.

- Expanded centralized wastewater facilities meet stiff opposition from adjoining neighborhoods.

- Water quality of treated wastewater.

4.1.2 Groundwater Use

- Opportunities to recycle treated wastewater.

- Reuse of treated wastewater that formerly went to septic systems would decrease recharge of the aquifer.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Independent communities that regard self-sufficiency as a cultural value may resist municipal incorporation.

- Pueblo Indian communities already have centralized wastewater systems.

4.2.2 Groundwater Use

Groundwater contamination from septic tanks would be curbed.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

Wastewater treatment plants tend to be located adjacent to socioeconomically disadvantaged communities.

4.3.2 Groundwater Use

Costs for centralized treatment systems may be passed onto users. Poorer residents who were used to domestic wells and septic tanks would feel the immediate impact of municipal costs on their household income.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

Concerns have been raised by downstream users that treated wastewater is harmful to the ecology and is inferior to naturally occurring water.

4.4.2 Groundwater Use

Major public policy decisions, such as the City of Albuquerque's proposal to inject treated wastewater into the aquifer, have had little or no public engagement with communities adjacent and downstream of the City, despite the impact such a change will make on downstream surface water.

Social and Cultural Feasibility Fact Sheet
Alternative 52: Growth Management

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-52: Develop a sustainable and coordinated growth management plan for adoption and implementation by local governments in the middle Rio Grande region in order to: 1) reduce water consumption; 2) minimize impact on water resources; 3) encourage conservation-oriented economic development and 4) ensure adequate water supplies for any proposed development.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs

encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Growth in both urban and rural areas can result from migration, increase in birth rates, and/or decline in mortality. Urban populations tend to grow more as the result of migration than rural areas. The economic vitality of an area is the best predictor of growth. When the economy of the city is good, migration to the area tends to increase. In such areas, family size tends to be smaller, especially in households where both parents work.

Rural populations are more affected by natural increase and a decline in mortality. Traditionally, the demand for manual labor on a farmstead encouraged rural families to have more children. As public health advanced in rural areas, individuals lived longer. At the same time, however, there are few employment opportunities in rural areas. The more educated and skilled the rural children become, the less inclined they are to pursue farming and ranching occupations. This results in the outmigration of family members to urban areas. As the number of young children decreases, the overall median age of rural communities increases substantially.

3.1 Surface Use

A coordinated growth management plan would help to minimize impacts on the riparian system including historic irrigated lands by controlling the location of economic development.

3.2 Groundwater Use

Growth management that is tied to the source and availability of groundwater can affect how communities are planned and settled and may affect groundwater depletion. Increasing the density of population centers will allow more open space in adjacent areas. New Urbanism practices as proposed in future developments such as Mesa del Sol, for example, are premised on protecting open spaces by creating densely settled, village-style nodes. The use of conservation measures to promote more efficient uses of domestic water in such denser settlements are an integral aspect of the lifestyle it is intended to promote. Growth management can be applied at two levels. It can be used to control where development occurs and it can be used to regulate the type of land-uses that occur in a specified area. New development tends to

bring more people into an area, oftentimes overwhelming the population of surrounding smaller traditional settlements. The placement of new developments and the scale of development have a direct bearing on how their groundwater use will impact neighboring communities. Rural communities adjacent to such large-scale developments are more impacted by urbanization.

At the same time, urbanization has changed the lifestyle of rural communities. The economic capture region of urban areas has changed the cultural behavior of how people relate to the land. Commuting has become a way of life. Traditional concepts such as sustainability no longer appear to be relevant to encouraging water conservation. Public education will be critical to public acceptance of the lifestyle changes necessary to develop water conservation habits among domestic water users.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- This alternative could protect sensitive riparian areas from advancing development.

- Growth management could be used to protect specially zoned agricultural areas from certain types of development.

4.1.2 Groundwater Use

Conservation of domestic water will decrease demand for groundwater.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Special protective zoning may keep property owners from subdividing or developing protected lands.

- Pueblo Indian communities are reluctant to participate in outside growth management planning initiatives.

4.2.2 Groundwater Use

Limits to growth based on availability of domestic water will impact the cost of development.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

The lack of developable land in historic communities would force growth to occur in other areas.

4.3.2 Groundwater Use

Affordable housing for low-income households may be unattainable.

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

Conservation-oriented development could influence the style of development in growth areas and make future residents more likely to accept these values.

4.4.2 Groundwater Use

Smaller local governments may not have the ability to enforce new growth control policies.

Social and Cultural Feasibility Fact Sheet
Alternative 59: Severance Tax

Acknowledgements: These social and cultural feasibility fact sheets were written by Ted Jojola, Ph.D. of the University of New Mexico as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format of the fact sheets and the definitions of the alternatives were developed by the Water Assembly.

1. Definition of Alternative

A-59: Establish a State-based water severance tax for water projects, planning, and conservation.

2. Assumptions

Sociocultural groups are divided into two distinct subgroups for purposes of this assessment: surface water users and groundwater users.

Surface users comprise sociocultural groups that have shaped their relationship to the land through the use of surface water. Much of that historical relationship can be characterized through subsistence activities involving irrigation and the extensive use of riparian habitats for foraging. Among the most traditional settlements in the Middle Rio Grande (MRG) planning region are Hispanic acéquia villages, Pueblo Indians, and turn-of-the-century Anglo homestead farmers and ranchers.

Less traditional, but just as vital, are surface users who use waterbodies and waterways for recreation. These include fishermen, boaters, bird watchers, and hikers who seek the amenity of the water landscape for leisure activities.

Groundwater users are comprised primarily of sociocultural groups that use groundwater for domestic use. They include populations in urban and suburban communities as well as less populated towns and villages that use groundwater for their domestic needs. Basic needs encompass cooking, personal hygiene, and washing. Secondary needs include such activities as watering indoor houseplants, outdoor landscaping, and washing automobiles.

3. Summary of the Alternative

Water-use behavior is determined in great part by lifestyle. In the Middle Rio Grande planning area, water is used primarily for domestic purposes in urban areas, and most of the water comes from groundwater. In addition to domestic use, rural and agricultural settlements use water for irrigating crops and watering livestock.

3.1 Surface Use

The impact of a severance tax may be substantial for surface users. Subsistence farmers and commercial farmers use both groundwater and surface water. Depending on how the tax is applied, users may be levied taxes for water used for irrigation or livestock and water used for domestic use. This would not be the case for those who do not use water for subsistence activities.

On the other hand, large infrastructure projects may benefit everyone in the region

3.2 Groundwater Use

Water-use by urban residents is tied directly to lifestyle. Taxes would make the cost of domestic water more expensive, and would result in changes in household behavior. Using less water would become a cost-saving measure.

4. Social and Cultural Feasibility

4.1 Social Issues and Implications

4.1.1 Surface Water Use

- The base unit for determining a tax would be critical. If agricultural acreage owned versus actual water used determines the amount of taxes owed, social inequities could result.

- Many urban-rural, mixed land-use communities appropriate water only as they need it, not because they are forced to use it. A severance tax would raise public expectations about the immediate benefit gained from using or not using water. This will require a public education campaign.

- In times of drought or scarcity, taxation of non-existent water surface water may place heavy burdens on rural users.

- Commercial farmers may be able to pass tax costs to consumers.

- Residents in the Middle Rio Grande Conservancy District (MRGCD) irrigation district are already taxed for managing surface water. Some of the revenues are applied to maintaining the irrigation systems and some are applied to reclamation efforts.

4.1.2 Groundwater Use

- Would be easy to implement in urbanized areas where municipal services is provided.

- Would be difficult to implement for households that are not tied into a water system.

4.2 Effects on Preservation of Traditional Values

4.2.1 Surface Water Use

- Taxation in traditional communities may be counterproductive, as it may induce residents to abandon small farming.

- Pueblo Indian communities will resist the imposition of state taxes on Indian land.

- Small farm owners may chose to rezone to housing to avoid additional taxation on surface water.

4.2.2 Groundwater Use

- Redistribution of funds from taxation may help preserve the riparian bosque and small restoration projects.

- The tendency for urban areas to receive more funds for water development may induce more unbalanced growth.

4.3 Equity and Justice Implications

4.3.1 Surface Water Use

- The taxation of both domestic water consumption and surface water consumption would place a double burden on rural users.

- Local produce may get more expensive.

4.3.2 Groundwater Use

Would place an extra financial burden on low-income households

4.4 Special or Unique Aspects

4.4.1 Surface Water Use

The doctrine of “use it or lose it” is difficult to enforce. Singling out users who are delinquent in paying taxes may jeopardize their water rights.

4.4.2 Groundwater Use

If applied to water planning, tax revenues could achieve a more comprehensive approach to water management.