CHAPTER TWO

Regional & Environmental Context

In the Española Valley, the things that first attracted the Pueblo Indians, as well as Oñate and his original band of colonists, still exist — "the good soil, equable climate, irrigation water in abundance, and scenic majesty that makes one's heart stand still."

-Fitzgerald 1965

2.01 Regional Context
2.02 Seismicity & Volcanic
2.03 Topography
2.04 Soils & Geology
2.05 Watershed Sub-basins / Hydrology
2.06 Ecology
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2.01 Regional Context

Española region is a beautiful, diverse valley landscape located at the convergence of the Rio Grande, Rio Chama, and Rio Santa Cruz, between the spectacular Jemez and Sangre de Cristo mountain ranges. These mountains, the Indian Pueblos, Puye and other cliff dweller ruins, Bandelier National Monument, the Valle Grande, ancient ruins, intriguing hot springs, spectacular scenery and a variety of other features are an important part of this Northern New Mexican region. (Fitzpatrick and Sinclair 1965)

The City of Española lies within two county jurisdictions, Rio Arriba County and Santa Fe County, as well as two Indian Pueblos. San Juan Pueblo is located north of Española. Santa Clara is located to the south and west of the City. South of Española, there are three other pueblos—Pojoaque, San Ildefonso and Nambe. Two other pueblos—Picuris and Tesuque—lie within 25 miles of the City.

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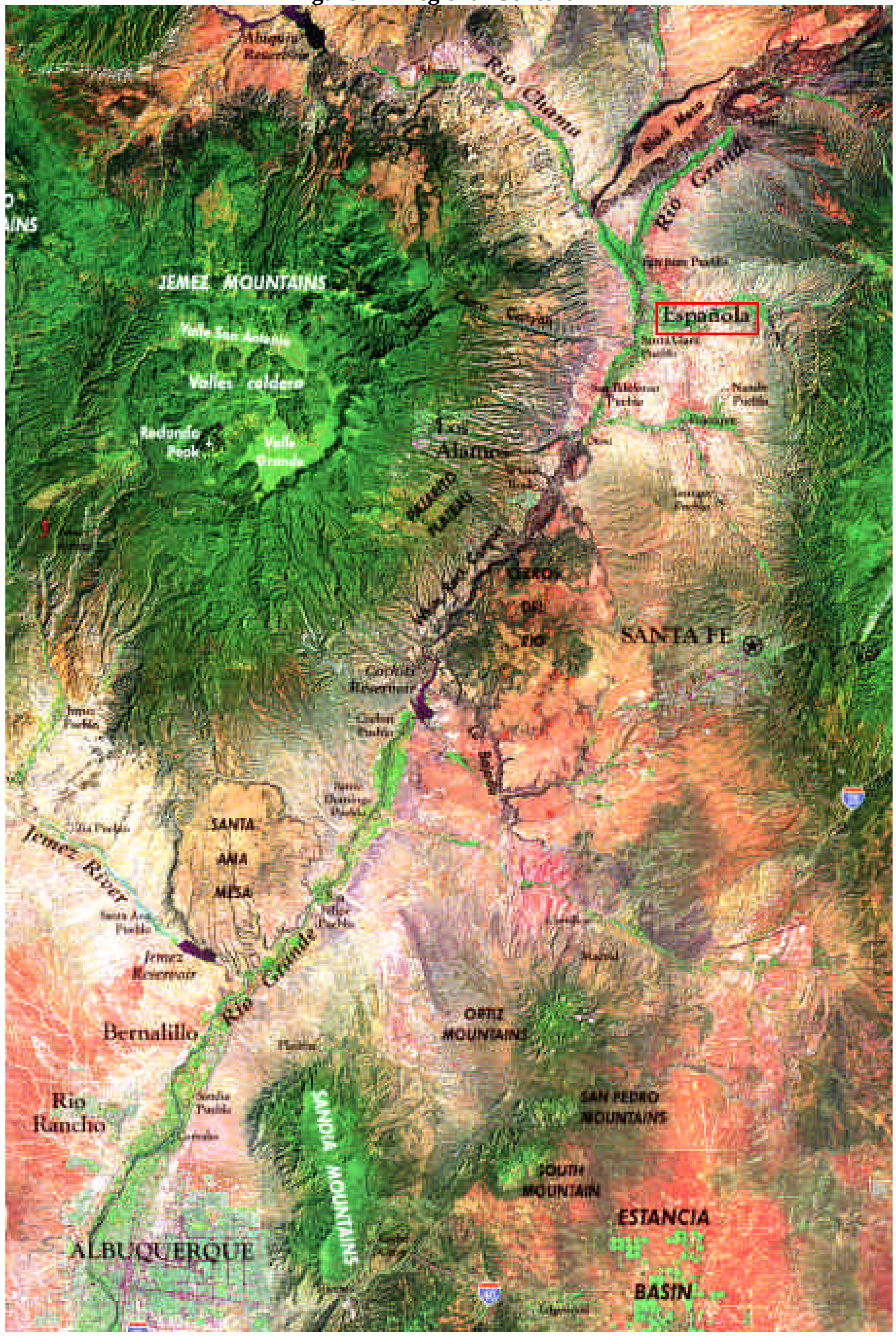
Figure 2-1 Regional Context



Source: Johnson 2001

Much of the land surrounding Española is owned by the federal government. (In the region as a whole, approximately 70 percent of the land is federally owned.) This land is managed by a number of agencies including the Bureau of Land Management, National Park Service, U.S. Forest Service, and Bureau of Reclamation. (CUED 2001)

The important environmental conditions of Española and the surrounding region are affected by land-use management decisions. Forest management policies and fire suppression, agricultural practices and other land-use measures, the diversions of natural water supplies, and urban growth patterns all influence Española's regional environment. (Scholle 2001) To maintain the quality of the features that attracted Oñate to the Española region now and into the future, it is critical to understand past and present environmental conditions of the region, as well as environmental implications of the City's land-use management plans and policies.

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2.02 Seismicity & Volcanic

Two parallel fault zones crossing New Mexico from north to south create the Rio Grande Rift upon which the City of Española lies. The Rio Grande rift came into being about 30 million years ago. During its formation, volcanoes bordering the rift spewed dark basalt from the Earth's mantle. The major pulling apart of the crust that is responsible for the rift may be due to upward "boiling" of mantle material like that along mid-ocean ridges. Geologists believe that this pulling apart is the beginning of a new narrow seaway similar to the Red Sea or the Gulf of California. "The Rio Grande Rift may eventually—millions of years from now—widen to form a new ocean basin comparable in its size and origin to the Atlantic Ocean." (Chronic, 1987)

A. **Seismicity.** The Rio Grande Rift starts as a narrow sliver in central Colorado, and slowly broadens southward through New Mexico. Movement along these fault lines is still going on today. Portions of the rift see frequent minor earthquakes, and young alluvial fans occur in places of new cliff formation created by relatively recent movement of the rift. No damaging event has occurred on faults of the Rio Grande over the past 400 years. Geological evidence indicates that large earthquakes (of magnitudes greater than 6.7) have occurred in the past in the Rio Grande rift, and will undoubtedly occur in the future. Although large earthquakes may be infrequent, the high number of faults in the rift indicates that the probability of a large earthquake occurring in the valley is far from insignificant.

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In addition, ground motions from a large earthquake in or around Española would likely be quite severe due to the nature of the alluvial sediments in the Valley. These alluvial soils tend to amplify ground shaking, and can cause very damaging events. In addition, a large earthquake today in the Española Valley could result in significant damages and casualties because of the existence of older structures as well as the extensive use of unreinforced masonry. Geologists believe a large earthquake will strike New Mexico in the future and increased efforts should be made to prepare Española, and other communities throughout the state for such an event. A risk assessment of critical buildings (such as hospitals, police and fire stations, and schools) is a logical and cost-effective first step for the City of Española to reduce future earthquake hazards. (Wong and Love, 2001)

Figure 2-2 Jemez Mountain Range

Source: Johnson 2001

B. **Volcanoes.** Volcanoes are abundant in New Mexico. Volcanic formations—black, barren lunar-like landscapes and flat-topped mesas ranging from as young as 3,000 years to as old as 1.7 billion years—are found throughout the state. Near Española, the Jemez Mountain Range forms most of the topography from north to west of the region. This range is one of the largest volcanic complexes of the world. It is believed that the Jemez range began forming about 16.5 million years ago. Although there have not been any major eruptions from the Jemez Mountains volcanic fields for the last million years, there have been a number of smaller eruptions, the most recent occurring about 600,000 years ago. Geophysical

measurements and measured periodicities of eruptions lead scientists to believe the Jemez Mountain volcanic field may be entering a new phase of volcanic activity. Currently, however, there is no evidence of any unusual activity in the Jemez Mountains. (Dunbar 2001)
If there were to be a volcanic eruption in or around Española in the next 100 to 1000 years, it would most likely form either a lava flow or a cinder cone (or both), and would not involve extensive explosive activity. Depending on where the event were to occur, the eruption would be unlikely to cause major loss of life or property, although the initial stages of the eruption could be dangerous to nearby inhabitants. There is roughly a 1% chance that some type of volcanic eruption could occur somewhere in New Mexico in the next 100 years, and a 10% chance that an eruption will occur in the next 1,000 years. Widespread seismic monitoring and continued study around the Jemez Mountain area would help to predict where an eruptive event might take place and provide forewarning of an event to the City of Española. (Dunbar 2001)

2.03 Topography

The Española Valley, as part of the larger Rio Grande Valley, is not a valley in the true sense of the term 'valley.' Unlike a true valley, the Rio Grande Valley was not first created by river action. In addition, the Rio Grande Valley does not branch upstream the way most river valleys do. Instead, the Valley was formed along the already existing rift trough between the Sangre de Cristo and the Jemez ranges. The development of these mountains was intimately tied to the development of the rift and, subsequently, the development of the broad, flat landscape characteristic of the Rio Grande and Española Valley. (Chronic, 1987) The elevation of the eastern Española Valley region ranges from 12,980 feet in the Sangre de Cristo range to 5,490 feet at the Rio Grande—a relief of 7,490 feet. West of the Valley the elevation ranges from 11,525 feet at the headwaters of Santa Clara Creek in the Jemez Mountains to 5,523 feet at the Rio Grande—a total relief of about 6,000 feet. The City of Española is at an elevation of 5,595. (Jemez y Sangre Water Planning Council 2001)

Broad, flat landforms resulting from river deposition along Valley bottoms are common. In the Española region, wind and water has played, and continues to play, a large role in the shaping the topography. Alongside the slightly sloping topography of the Valley bottom lie canyons and cliffs, sharpened peaks and ridges, caverns and sinkholes. These unique features are found in and around the Española Valley (e.g., Camel Rock and the Black Mesa). In many cases, these forms have been developed by wind action that scours away fine sand, deepens basins, and moves soil particles far from their original sites. In the Española Valley, cultivated land is susceptible to wind erosion, particularly during drought conditions. (Chronic 1987)

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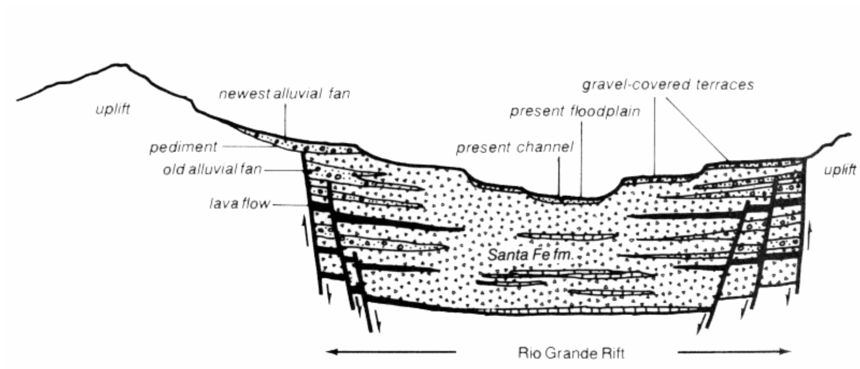
2.04 Soils & Geology

Since the Tertiary period, the Rio Grande has filled the fault edge trough with sand and gravel brought in from upstream and the adjacent Jemez and Sangre de Cristo mountains. During times of low discharge the Rio Grande deposits gravel bars and sand bars; with high river flows, it cuts into the established floodplain, and washes the sand and gravel deposits away. This natural cycle of deposition and downcutting began nearly 30 million ago (during the mid-Tertiary period) and, in many areas along the Rio, still occurs today. (Chronic 1987)

A. **Santa Fe Soil Group.** These Tertiary terrace sand and gravel deposits are classified in the Santa Fe soil group. Generally, the Santa Fe group is comprised of sand, gravel, clay, lava and volcanic ash. Santa Fe soil sediments are soft and easily eroded. Due to the differing sources of sediment and different kinds and amounts of lava flows and volcanic ash that once flowed or blew into it, the Santa Fe soil group varies considerably in soil composition from region to region, and place to place. (Chronic 1987)

Figure 2-3 Rio Grande Trough



Source: Chronic 1995

In and around Española, the Santa Fe soil group contains large amounts of volcanic ash and, as such, is highly erosive. These erosive soils have been identified as the Española Barrancas or Badlands—and characterize the sparsely vegetated landscape north and south of the Española. The volcanic ash within the Barrancas has, over time, derived clay, which, through erosion, has contributed to the badland formations. Plants have difficulty growing in these soils, especially in the arid climate, and wind and rain easily erode loosened clay and silt. The Española Barrancas contain fossils of extinct animals—ancestral horses, deer, camels and bear—that thrived in Española and the surrounding region more than 30 million years ago. (Chronic 1987)

The City of Española is located along the bottom lands of the Rio Grande Valley. Here, water transforms the Española Barrancas into fertile low-land soils. In contrast to the dry, arid, and sparsely vegetated nature of the Barrancas, the fertile soils of the Española Valley has historically hosted richly vegetated riparian corridors, alongside a variety of agricultural crops. Agricultural fields are irrigated directly from the river, or from tributary streams coming from the mountains through a complex system of acequias that were established in New Mexico over 400 years ago. (Chronic 1987)

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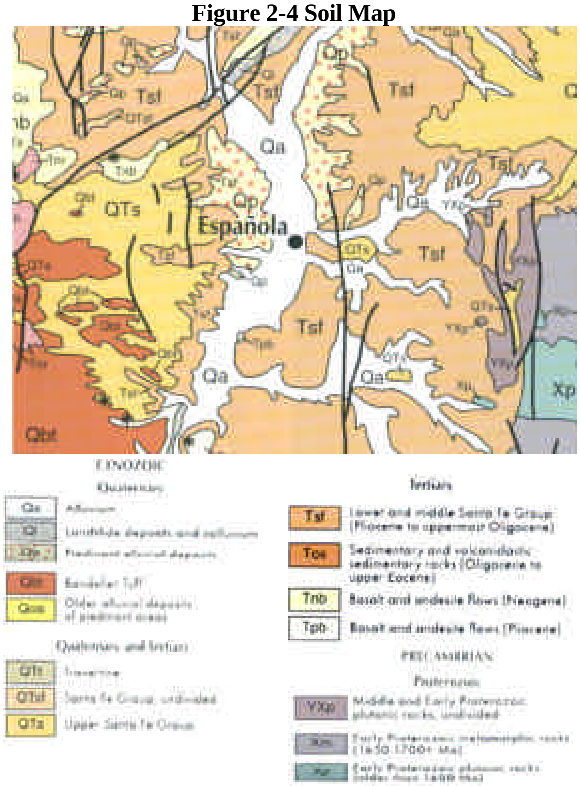
Figure 2-4 Soil Map



Source: Johnson 2001

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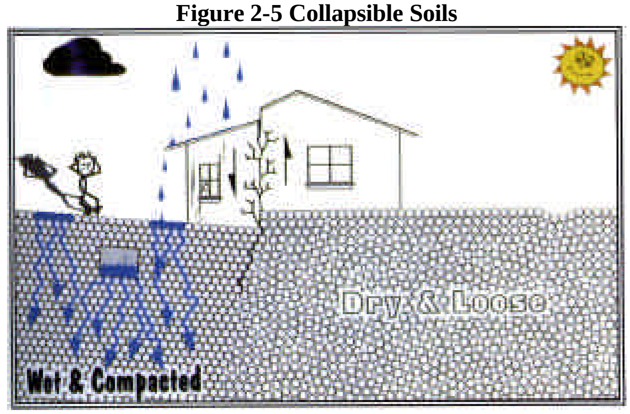
B. **Collapsible Soils.** Like many parts of New Mexico, the city of Española and surrounding region contains 'collapsible' or hydrocompactive, soils that compact and then collapse upon getting wet. The compact/collapse nature of these soils is due to the proportion and characteristics of clay particles in the soil. Collapsible soils tend to develop along valley margins. Collapsible soil events are increasing as new development (and associated water use) moves outside of the irrigated low lands (where development traditionally occurred) to the drier soils at the valley margins. (Love 2001) In New Mexico, collapsible soils have caused millions of dollars of damage to public infrastructure and facilities as well as many housing developments across the state.

In El Llano, just east of the City of Española, a soil collapse event created a crater approximately 150 feet across and 15feet deep that split and tilted the foundations of two homes and threatened the stability of others in the area. In this case, the naturally dry soil became saturated through septic tank and municipal water line leakage, and stormwater run-off from roads and roofs. (Love 2001)

In Española, areas that have not yet been developed should be tested for collapsibile soils as well as other soil-related issues (shrink-swell potential, corrosiveness, and depth to bedrock). In already developed areas that have collapsible soils, care should be taken to manage water saturation of the soil. Management techniques include minimizing landscape / garden irrigation requirements by using native plants (xeriscaping), minimizing water and septic leaks by using municipal water and sewer lines rather than individual wells and septic tanks, and reducing runoff from roads, driveways and roofs by implementing innovative, effective stormwater management techniques. (Love 2001) To avoid damage from collapsible soils, all future public facilities and infrastructure development in Española should have proper sub-surface testing and evaluation.

Figure 2-5 Collapsible Soils



Source: Johnson 2001

2.05 Watershed Sub-basins

The City of Española is located in three watersheds, or natural basins and sub-basins of streams and rivers, including the Santa Cruz River Sub-basin, Santa Clara Sub-basin, and Velarde Sub-basin. Española draws its water from the Santa Cruz River and the Santa Clara sub-basin aquifers, with the majority of its water resources coming from the aquifers of the Santa Cruz River Sub-basin. (Jemez y Sangre Water Planning Council 2001) Aquifers are underground deposits of rock, silt, sand, gravel, clay, and soil that contain water. Aquifers are created and replenished from water that has infiltrated through the earth from rainfall, streams, and rivers on the surface of the ground. All aquifers are limited in size—if more water is pumped out than is replaced through the infiltration process in the watershed, the water level will decline and wells may go dry. (City of Española 2001)

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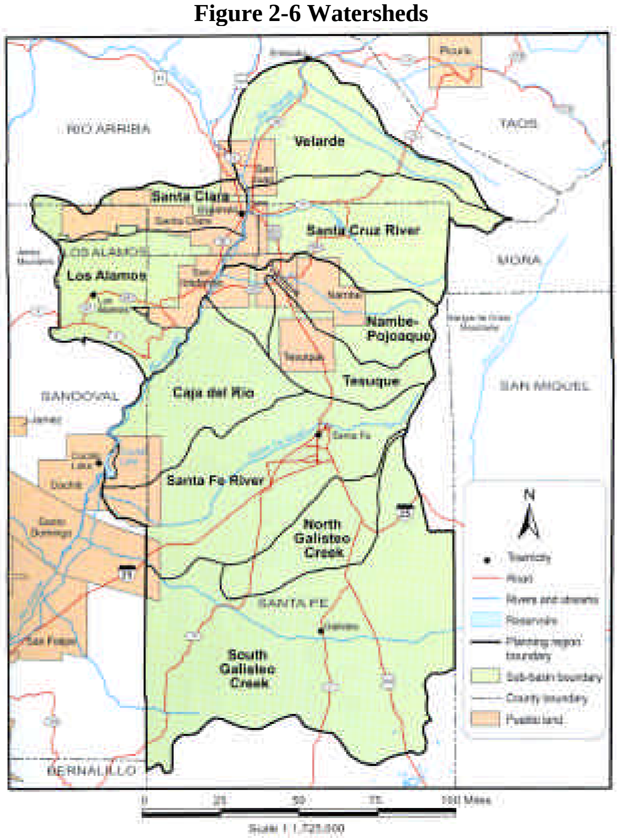
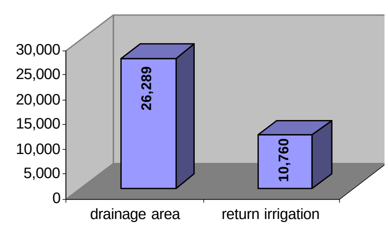
Figure 2-6 Watersheds



Source: Jemez y Sangre Water Planning Council 2001

Figure 2-7 Santa Cruz Sub-Basin Surface Water Inflow (acre-feet per year)



Source: Jemez y Sangre Water Planning Council 2001

The City has a total of nine wells on line with depths ranging from 130 feet to 750 feet, with production totaling 1,146 gallons per minute at 60% design usage. (City of Española 2001) The water service area is separated into three zones. Zone One is serviced from Meadow Acres Well and McCurdy Well which are located in

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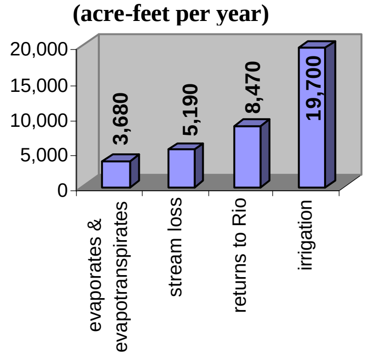
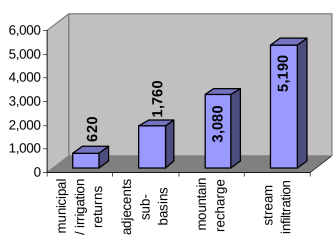
Figure 2-8 Santa Cruz Sub-Basin Surface Water Outflow (acre-feet per year)



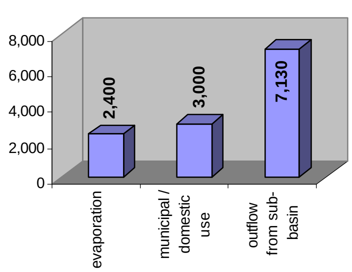
Source: Jemez y Sangre Water Planning Council 2001

Figure 2-9 Santa Cruz Sub-Basin Ground Water Inflow (acre-feet per year)



Source: Jemez y Sangre Water Planning Council 2001

Figure 2-10 Santa Cruz Sub-Basin Ground Water Outflow (acre-feet per year)



Source: Jemez y Sangre Water Planning Council 2001

the Santa Cruz River Sub-basin. Zone Two is serviced from the South Well (also located in the Santa Cruz River Sub-basin) and the North and West Wells located in the Santa Clara Sub-basin. Zone Three is serviced from East Well (which has just been brought on line recently) located in the Santa Cruz Sub-basin. (City of Española 2002)

On November 13, 2001, the City Council approved a moratorium on new utility connections for the City of Española upon declaring an emergency regarding the City’s water situation. Though ground water supply in the Santa Cruz and Santa Clara Sub-basins was sufficient, the City’s water production was not able to sustain new development without infringing on required fire protection water resources. At that time, municipal wells were drawing nearly 1000 gallons less than required for adequate fire protection.

The moratorium (originally set to be in effect for 90 days) was lifted by the City Council in September 2002. (City Manager’s Office 2001; Trapp 2002)

In August 2002, citizens voted to increase Gross Receipt Tax by 3/8 percent to generate revenue (which is hoped to be matched by federal and state sources) for a comprehensive capital improvement program, including replacing leaky water lines; developing a water filtration plant and two new wells; and, developing a new regional wastewater treatment facility. (City of Española 2002)

The Federal Emergency Management Agency began a new flood Plain Survey for the Española Valley in 2002. Maps of the study area will be available at City Hall on March 20, 2003 for community review. (Trapp 2002)

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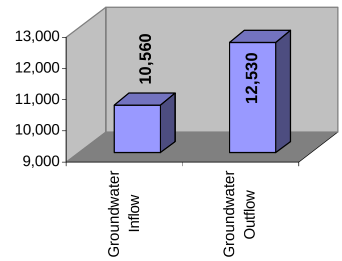
A. **Santa Cruz Sub-Basin**. The Santa Cruz sub-basin encompasses an area of about 200 square miles to the east of Española, bounded on the west by Rio Grande, and the north by the Velarde Sub-basin, on the east by the crest of the Sangre de Cristo Mountains, and on the south by the Pojoaque-Nambe Sub-basin. Most of the Santa Cruz Sub-basin lies in extreme northeast Santa Fe County and Southeast Rio Arriba County. The Santa Cruz River is the stream that drains the sub-basin, alongside the rivers principle tributaries—the Rio Quemado, Rio Medio and Rio Fijoles. This river system, with numerous associated arroyos, drains the western slopes of the Sangre de Cristo range between Pecos Baldy on the south and Truchas Peak on the north. Other significant drainages within the lower elevation areas of the sub-basin flow only after major storm events and include the Arroyo Seco, Arroyo Madrid, and Arroyo de la Mesilla. (Jemez y Sangre Water Planning Council 2001)

The Santa Cruz sub-basin average annual precipitation is 16.3 inches, with the lower elevations experiencing substantially less rainfall than the higher elevations. Surface water in the Santa Cruz Sub-basin is primarily used for irrigation (an estimated 9,890 acres of agricultural land), while domestic and municipal uses rely primarily on the Santa Cruz groundwater supply. Both surface and groundwater water quality is generally good within the sub-basin. However, in some areas in and around Española, septic tanks and drain fields have raised nitrate levels and contaminated groundwater at these localized sites. (Jemez y Sangre Water Planning Council 2001) In addition, pollution (tetrachloroeylene or PCE) from a dry cleaning laundry has migrated underground to form a shallow plume of contaminated water (approximately 58 acres) near North Railroad Avenue and Hunter Street in Española. The plume was responsible for the contamination of two City wells in 1989 and is slowly migrating south towards the Rio Grande. A federal Superfund cleanup is expected to begin in 2003 and will take ten years to complete. (Collins 2002)

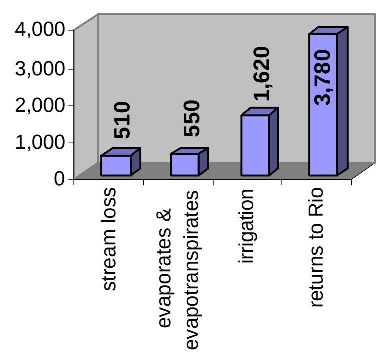
The surface water inflow of the combined drainage areas of Rio Medio, Rio Frijoles and Rio Quemado of the mountain, as well as the return irrigation flow from agricultural lands into the sub-basin is estimated to be 37,049 acre feet per year (afy). Surface water outflow—including stream loss (to groundwater), diversions for irrigation, water losses to evaporation and evapotranspiration, and outflow to the Rio Grande, averages 37,040 afy. (Jemez y Sangre Water Planning Council 2001) Figures 2-7 and 2-8 provide a breakdown of surface inflow and outflow regimes.

Figure 2-11 Santa Cruz Sub-Basin Ground Water: Total Inflow versus Total Outflow (acre-feet per year)



Source: Jemez y Sangre Water Planning Council 2001

Figure 2-12 Santa Clara Sub-Basin Surface Water Inflow (acre-feet per year)



Source: Jemez y Sangre Water Planning Council 2001

The total inflow to groundwater is estimated to be 10,650 afy. Inflow sources include mountain front recharge; surface water infiltration along stream courses; flow from adjacent sub-basins, as well as return flow from irrigation and municipal/industrial uses. Groundwater outflow is estimated to be 12,530 (Jemez y Sangre Water Planning Council 2001)—approximately 1,880 afy (more than half of Española's annual water use) less than the estimated inflow. (Jemez y Sangre Water Planning Council 2001) Figure 2-9 and figure 2-10 provide estimated inflow and outflow quantities of the above sources. Figure 2-11 indicates the imbalance in groundwater inflow versus outflow of the Santa Cruz Basin.

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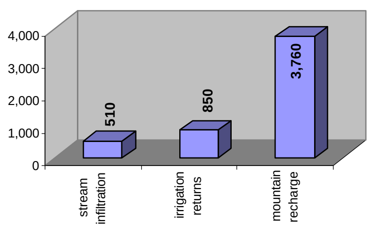
Figure 2-13 Santa Clara Sub-Basin Ground Water Inflow (acre-feet per year)

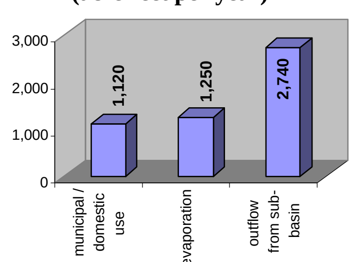


Source: Jemez y Sangre Water Planning Council 2001

B. **Santa Clara Sub-basin.** The Santa Clara Sub-basin encompasses 84 square miles on the eastern slopes of the Jemez Mountains north of Los Alamos and southwest of Española. The sub-basin is bounded on the west by the Jemez Mountains, on the south by the Los Alamos sub-basin, on the east by the Rio Grande, and on the north by the drainage divide located north of Santa Clara Canyon. The majority of the land in this sub-basin is within the Santa Clara Pueblo reservation boundary in Rio Arriba County. (Jemez y Sangre Water Planning Council 2001)

Santa Clara Creek is the only perennial stream in the Santa Clara Sub-basin, but it has several ephemeral tributaries along its reach. The sub-basin receives an average of 18.2 inches of precipitation annually, mainly from mountain snow and summer monsoon rains.

Figure 2-14 Santa Clara Sub-Basin Ground Water Outflow (acre-feet per year)



Source: Jemez y Sangre Water Planning Council 2001

Within the sub-basin, surface water is used predominantly for agriculture (approximately 699 acres are irrigated). In addition, alterations to surface flow have resulted since the Santa Clara Canyon has been developed into a recreational area with three retention ponds for fishing, numerous picnic sites, and the Santa Clara ruins as a tourist destination. Santa Clara Pueblo and adjacent communities south of Española currently use approximately 1,120 afy of groundwater for domestic and municipal purposes. (Jemez y Sangre Water Planning Council 2001)

The water quality of Santa Clara Creek is subject to some recreational and cattle grazing land use. The Cerro Grande fire (May 2000) burned through the headwater area of the Santa Clara Sub-basin, impacting the rate of runoff and water quality in the area. And (as with the Santa Cruz Sub-basin), in certain areas in and around Española, septic tanks and drain fields have raised nitrate levels and contaminated groundwater at localized sites within the sub-basin. (Jemez y Sangre Water Planning Council 2001) Inflow from rain and snow melt run-off for the sub-basin was calculated as

6,460 acre feet per year—less than a quarter of the surface water inflow of the Santa Cruz Sub-basin. Total surface water outflow into the Rio Grande is estimated to be 3,780 afy from flow measurements taken on Santa Clara Creek near Española. Total groundwater inflow (through mountain front recharge, stream channel infiltration, and infiltration of irrigation return flows) is estimated at 5,120 afy. Unlike the Santa Cruz Sub-basin, total groundwater outflow remains less than inflow (approximately 10 afy less, at 5,110 afy) of the Santa Clara Sub-basin, indicating a relative balance between the current rates of groundwater use versus rates of recharge. (Jemez y Sangre Water Planning Council 2001)

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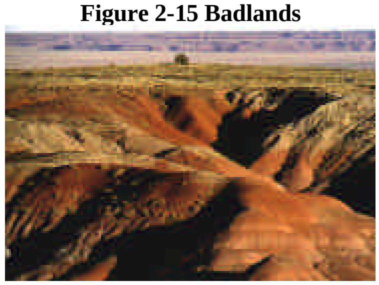
C. **Flooding.** At the time of this report, Watershed Concepts Inc. of Carey N.C. was in the process of studying the flood plain of the Española Valley for the Federal Emergency Management Agency (FEMA). The study incorporates terrain data and field surveys of the Valley to assess 10 to 100-year flood events and/or, percent chance of flooding. The field data and subsequent flood maps are to be presented to the public in "draft" form on March 20, 2003. Final flood maps are expected to be available by December 2003. (Trapp 2002)

Figure 2-15 Badlands



Source: The Southwest Inside Out, 2002

Some commercial, institutional and residential land uses in Española are located above or adjacent to areas of high water tables. For instance, in 2001, the excavation of land for the Española Riverside Plaza LLC (located south of Fairview lane on the west side of Riverside Drive, east of the Rio Grande) lead to the discovery of water just three feet below the existing grade. The high water table resulted in the need for an extensive drainage system, as well as the placement of four feet of fill on site to enable construction.

In addition to high water tables, stormwater run-off has caused flooding in certain locales throughout the City. The natural hydrology of sites within the City has been impacted by transportation and land use development. In certain areas of Española, where stormwater infrastructure is insufficient to manage run-off rates, flooding of streets, institutional, and residential areas has resulted.

2.06 Ecology

The Rio Grande Basin as a whole is the fifth largest watershed in North America. The City of Española lies in the Middle Basin of the Rio Grande watershed. The Middle Rio Grande Basin encompasses the major ecoregion known as the Arizona/New Mexico Mountains Ecoregion which generally consists of upland vegetation of grasslands and pinyon/juniper woodlands, with coniferous forests at the highest elevations. (Muldavin et al 2002)

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The surrounding region north and south of Española (outside of the valley lowlands) is characterized by the sparsely vegetated, desert-like ecology of the Española Barrancas or Badlands. Plants have difficulty growing in these dry soils, especially in the arid climate, where wind and infrequent, yet intense, rainfall tends to readily erode the soil.

In direct contrast to the Española Barrancas, the Española Valley is located in a richly vegetated riparian ecology. As such, its ecological context is unique in New Mexico—rivers and their associated riparian corridors occupy less than one percent of land in the southwest. Historically, Española has depended on the river and its riparian ecology nearly 100 percent for water, fish and wildlife resources and appropriate growing conditions for a variety of agricultural crops.

Figure 2-16 Southwest willow flycatcher

Source: Peterson 1990

This river system and its associated bosque, or riverine forest, is a vigorous and dynamic mosaic of early, middle, and late successional cottonwood forests, ponds, lagoons, wet meadows, and sandbars. (deBuys 2000) In a natural state, the Rio Grande meanders over its historic floodplain, periodically inundating depressions and old channels to generate cottonwood forests and wetlands—two of the most productive and endangered ecosystems in the state. The Rio Grande and its associated bosque and wetlands support a multitude of fish and wildlife species.
Yet, today, many parts of the Rio and its associated tributaries are confined to single, deep, fast flowing channels, quite different from the wide and shallow, multi-channeled historic course of the Rio and its associated streams. These changes to the natural river system in conjunction with significant decreases in riparian forest and wetlands have impacted the critical ecology that many wildlife species in New Mexico rely upon. Currently, the Southwest willow flycatcher and the Rio Grande silvery minnow— both species once common in and around the Española region— are on the federal Endangered Species list. (deBuys 2000)

A. **Endangered Species.** The southwest willow flycatcher (*Empidonax traillii extimus*) was listed as an endangered species in 1995. The southwest willow flycatcher is a small passerine or perching bird found historically in California, Arizona and New Mexico, west Texas, south-western Colorado and southern Nevada, spending its winters in Latin America. The flycatcher forages and nests in dense riparian vegetation—historically in thick willow stands over standing water. A rapid loss of riparian habitat (as much as 95 percent of historic riparian habitat has been lost throughout the west) has resulted in a significant decrease in the southwest willow flycatcher population. Recent studies estimate the population to be somewhere between 500 to 1000 pairs. One of its few remaining nesting sites includes a spot along the Rio Grande just north of Española. (Gibson 2000)

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The Rio Grande silvery minnow (*Hybognathus amarus*) was, historically, one of the most widespread and abundant species of fish in the Rio Grande basin of Texas, New Mexico and Mexico. The silvery minnow ranged through most of the Rio Grande to portions of the Pecos and Chama Rivers. Today, it is estimated that fewer than 1000 fish remain in as little as five percent of their original range. It is believed that 90 percent of the remaining population resides in six mile stretch of the Rio Grande below San Marcial. The minnow was placed on the New Mexico Endangered Species list in 1979 and on the federal register in 1994. Causes for the fish's decline may include decreased water quantity and quality in portions of the Rio Grande, construction of mainstem dams, and introduction of non-native predators. (Gibson 2000)

On June 4, 2002, Española's City Council voted to release a total of 2,248 acre feet of the City's San Juan Chama water rights to increase water quantity and improve silvery minnow habitat in the Rio Grande south of Española. The release of water was carried out in exchange for a monetary lease from the Bureau of Reclamation which was deposited into the water rights bank the City of Española maintains. (Trapp 2002)

B. **Invasive Species.** In the last 100 years, non-native plant species, particularly Russian Olive (*Elaeagnus angustifolia* L.) and Salt Cedar (*Tamarix ramosissima* Ledeb.), have competed with the native riparian vegetation in New Mexico, and in some cases completely displaced the native cotton wood and willow riparian communities along the rivers edge. The alteration of the natural hydrological regimes (including the reduction of annual flow volumes, changes in seasonal summer and spring peak flows, and disruption of annual fluctuations of flow volumes in drought conditions) of river systems in New Mexico has contributed to the decline in native vegetation and the increase in non-native species. (Muldavin et al 2002)

In the summer of 2002, Hands Across Cultures Youth Conservation Corp worked with the San Juan Pueblo Environmental Office to help restore native habitat in the fire damaged San Juan Bosque.
The project was funded by a grant from the National Environmental Protection Agency and the Bureau of Indian Affairs. The Youth Corp has cleared a large portion of the bosque of Russian Olives, Salt

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Cedars and other non-native, invasive species, and replanted native vegetation such as box elder and Cottonwood trees. Nearly 23,000 native species have been planted to date; and, monitoring of the site indicates that these planted species have in turn, initiated new native plant growth in the bosque. The University of New Mexico has installed a BEMP – bosque ecosystem monitoring project – to measure insect diversity, rainfall data, and ground water depth of the bosque. (Lotven 2002)

2.07 Fire Hazards

According to the General Accounting Office (GAO) Report to Congress, "the window of opportunity for taking corrective action is estimated to be only about 10 to 25 years before widespread, unstoppable wildfires with severe and immediate and long-term consequences occur on an unprecedented scale [throughout New Mexico]." (Rossbach 2001)

In 1998, a bosque fire burned through an area from Onate Bridge to Fairview Bridge posing an enormous threat to the urban areas of Espanola. Luckily, an aerial tanker on its way to another fire managed to suppress the bosque fire.

A fire risk analysis of communities throughout the state was developed by the New Mexico Energy, Minerals and Natural Resource Department (EMNRD). In this assessment, the Española Bosque was rated as one of the twenty communities most vulnerable to fire. The analysis is based upon factors including: type of vegetation of the forest or woodland area; proximity of woodland area to homes; availability of water; effective evacuation routes; topography (ridge, valley, slope, and exposure); forest type; number and size of previous forest fires in the area; direction of prevailing and local winds; and, the ability of the community or subdivision to protect homes. (Rossbach 2001)

To assist communities at risk of fire, the EMNRD Forestry Division is developing an implementation plan that will provide communities with the tools to make necessary changes. The plan emphasizes cooperation among all stakeholders (federal, state, tribal and community leaders) and is expected to be completed in 2 to 5 years. The implementation plan includes a complete assessment of at-risk communities—including immediate and long term treatment, as well as a development and implementation of damage prevention and restoration projects. The plan will focus on prevention efforts that range in scale from the backwoods to the urban/wild land interface, to individual backyards. Management strategies will include: Federal and tribal thinning, burning and fire break projects;

EMNRD State Forestry Division education, technical advice and ordinance development; fireproofing home exteriors; clearing vegetation and reducing flammables around homes; and, improving access for fire engines throughout communities. (Rossbach 2001)

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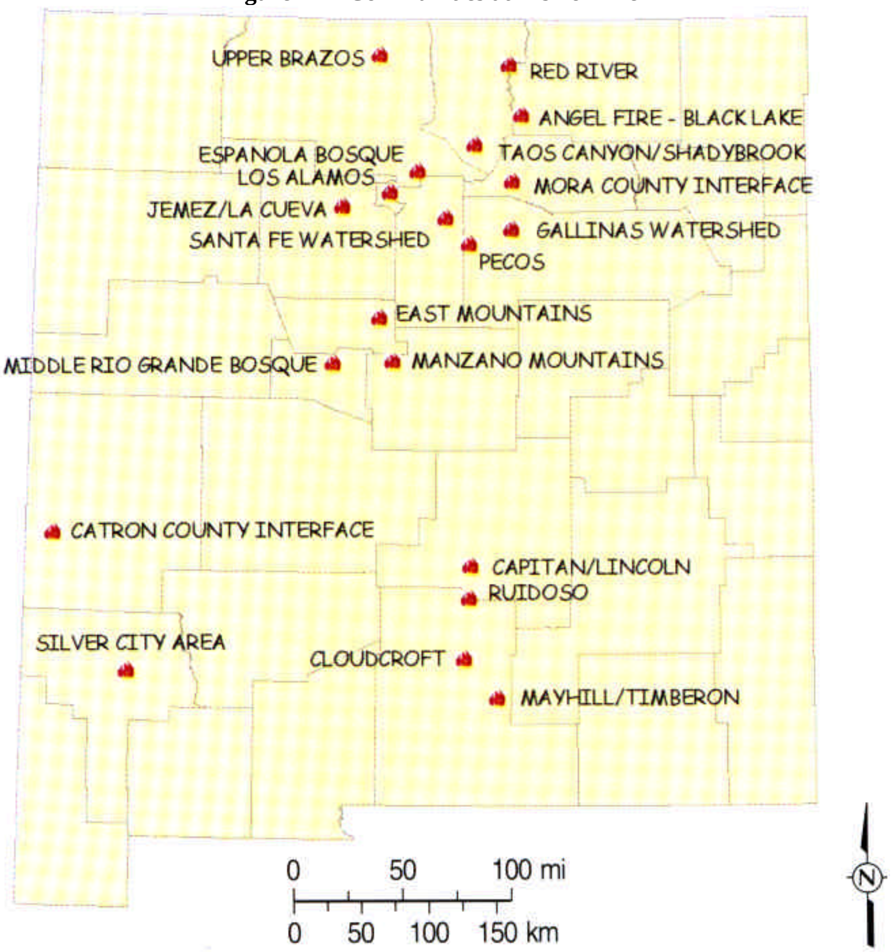
Figure 2-17 Communities at Risk of Fire



Source: Johnson 2002