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Volunteer river monitoring plan for the urban reach of the Santa Fe River Watershed

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Volunteer River Monitoring Plan for the Urban Reach of the Santa Fe River Watershed

by

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Committee Approval

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Executive Summary

Background Information

In designing a monitoring plan, it is important to first look at the overview of the watershed, issues and uses. In our case, we are looking at the Santa Fe River Watershed; it is 241 square miles and approximately 37 miles in river length. The headwaters are in the Sangre de Cristo Mountains as Santa Fe Lake east of the City of Santa Fe. The watershed is split into three reaches; forested, urban and rural. In the forested reach, the river is perennial and flow is captured by a sequence of dams, the water is used for drinking supply. The urban reach is ephemeral attaining most of its flow during storm events. The rural reach is mainly perennial with flow coming from the waste water treatment plant located at the top of the rural reach; flow augmented by springs also provide flow. The urban reach is the area of interest since it is contains the City and is heavy urbanization. The urban reach contains a population of approximately 50,000. The City is too small for a sophisticated storm water runoff system, hence storm water runoff is directed into the Santa Fe River. The urban reach of the river is in poor condition, dewatered and eroded in some areas. It is listed as a Category 1 in need for restoration watershed (NMED). The urban reach is currently not routinely monitored. The Environment Protection Agency (EPA) is requiring a storm water management plan by 2002. The storm water management plan requires the City to comply to 6 "minimum measures", three of the 6 measure may be fulfilled with this monitoring plan: public participation, public education and outreach on storm water impacts, and illicit discharge detection.

Monitoring Plan Approach

After reviewing the background of the watershed, it gives one a better idea of what the issues are and what area is in need of focus. In our situation, the urban reach is the focus and the issues are lack of routine water quality monitoring, public participation and education, and storm water pollution. The approach to devise appropriate parameters is to research water quality standards and existing monitoring programs. These sources act as a guide only, due to the fact that the urban reach of the river is ephemeral and heavily urbanized; there were no other existing monitoring programs that fit seemed to fit our situation.

Monitoring Plan Implementation

Implementation briefly consists of the following:

- Writing of the handbook.
- Recruiting volunteers.
- Gathering and purchasing monitoring equipment and materals.
- Training.
- Collection and organization of results.

A few concepts to remember when planning a monitoring plan are to think about who will conduct the monitoring, scientists or non-scientists. For a monitoring plan such as this, the plan must be simple enough to keep the interest for those who are volunteer, non-scientists. The other important consideration is to understand the watershed, issues surrounding the watershed and the area which monitoring is of interest before deciding on the parameters to be measured.

1.0 Introduction

River monitoring can be conducted for many purposes:

- to characterize waters and identify changes or trends in water quality over time.
- to identify specific existing or emerging water quality problems.
- to gather information to design pollution prevention or remediation programs.
- to increase local awareness about watershed health and to involve locals actively

Monitoring may be conducted on a volunteer basis. Volunteers benefit from monitoring by learning more about their local water resources, identifying what conditions or activities might be contributing to pollution problems, and working with others to address such problem areas. Volunteer monitors also become trained in monitoring techniques, provide data for waters that may otherwise be unassessed, and increase the amount of water quality information available to decision makers at all levels of government.

There are many ways to monitor watershed conditions. The approach depends on what type of river or watershed is to be monitored, what the monitoring objectives are, and the level of program sophistication. For example, some federal programs require a high level of quality control and expensive monitoring of many parameters. By contrast, the volunteer monitoring program described in this document has a limited budget, uses non-scientist volunteers, and does not require any type of certification. Nonetheless, the data generated by this program will contribute significantly to the Santa Fe River and its watershed.

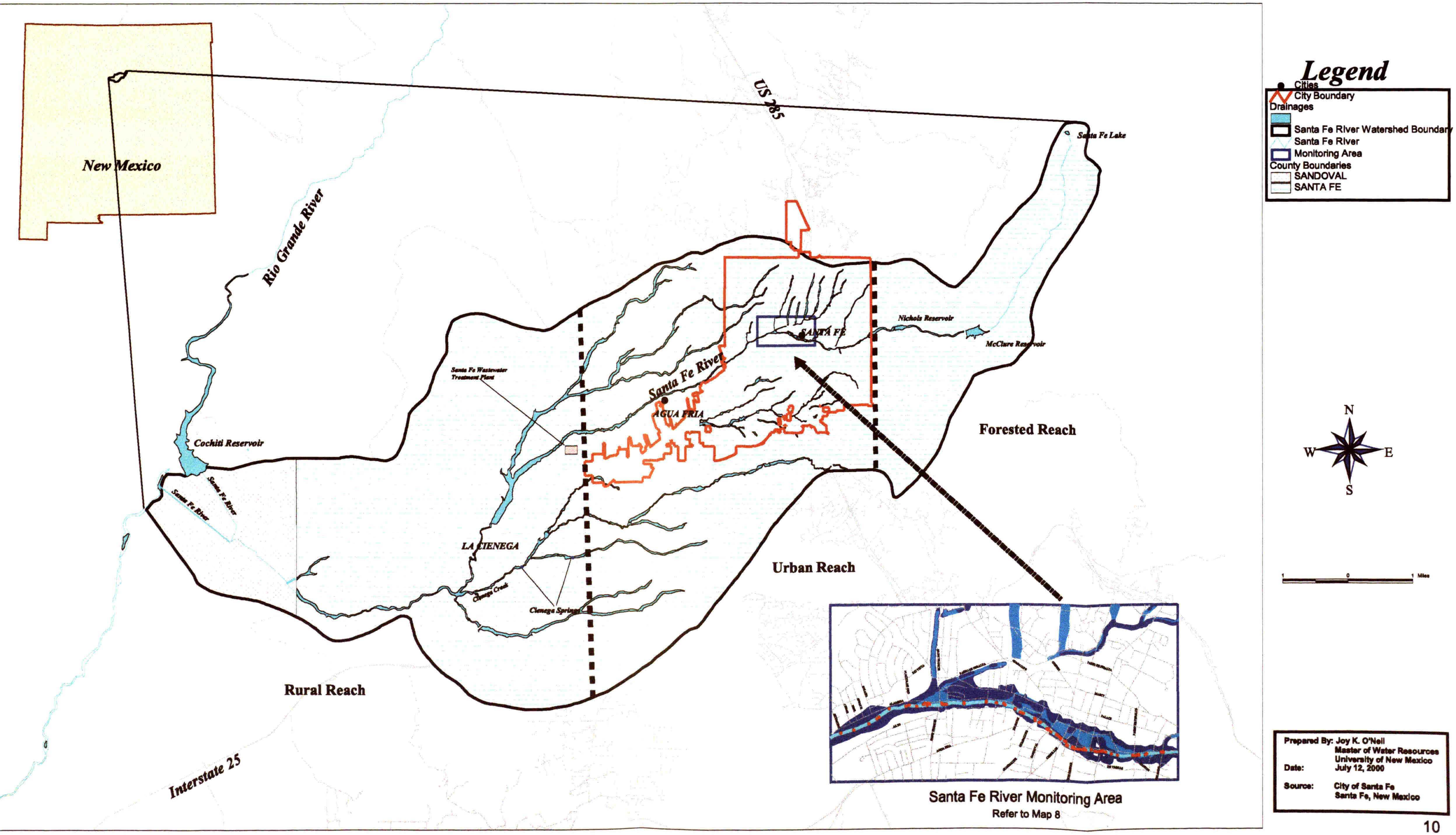
The Santa Fe River Watershed can be broken into three distinct reaches: forested, urban and rural (Map 1). Each of these reaches calls for a different approach to monitoring.

This report will focus on the urban reach. The objectives of this report are to:

- establish a program to monitor water quality and flow for existing uses (wildlife, secondary contact recreation, aesthetics, recharge)
- to promote public education, outreach and participation in improving river health
- identify parameters and locations for monitoring within the urban reach of the Santa Fe River Watershed
- to create a monitoring handbook specific to those parameters
- set up data organization

It is important to realize that under current conditions, the urban reach of the Santa Fe River does not usually flow and when it does, consists largely of storm water runoff. This situation could change, as the City of Santa Fe is actively considering the use of treated effluent to sustain streamflow through the urban

Santa Fe River Watershed



reach (Grant, 2000). Thus a monitoring plan must be designed for both flow and non-flow conditions and the parameters need to fit such conditions. Finally, the plan must take into consideration the small budget and limited number of volunteers available for monitoring. The following section introduces the entire Santa Fe River Watershed and briefly describes each reach and existing conditions.

2.0 Overview of the Santa Fe Watershed

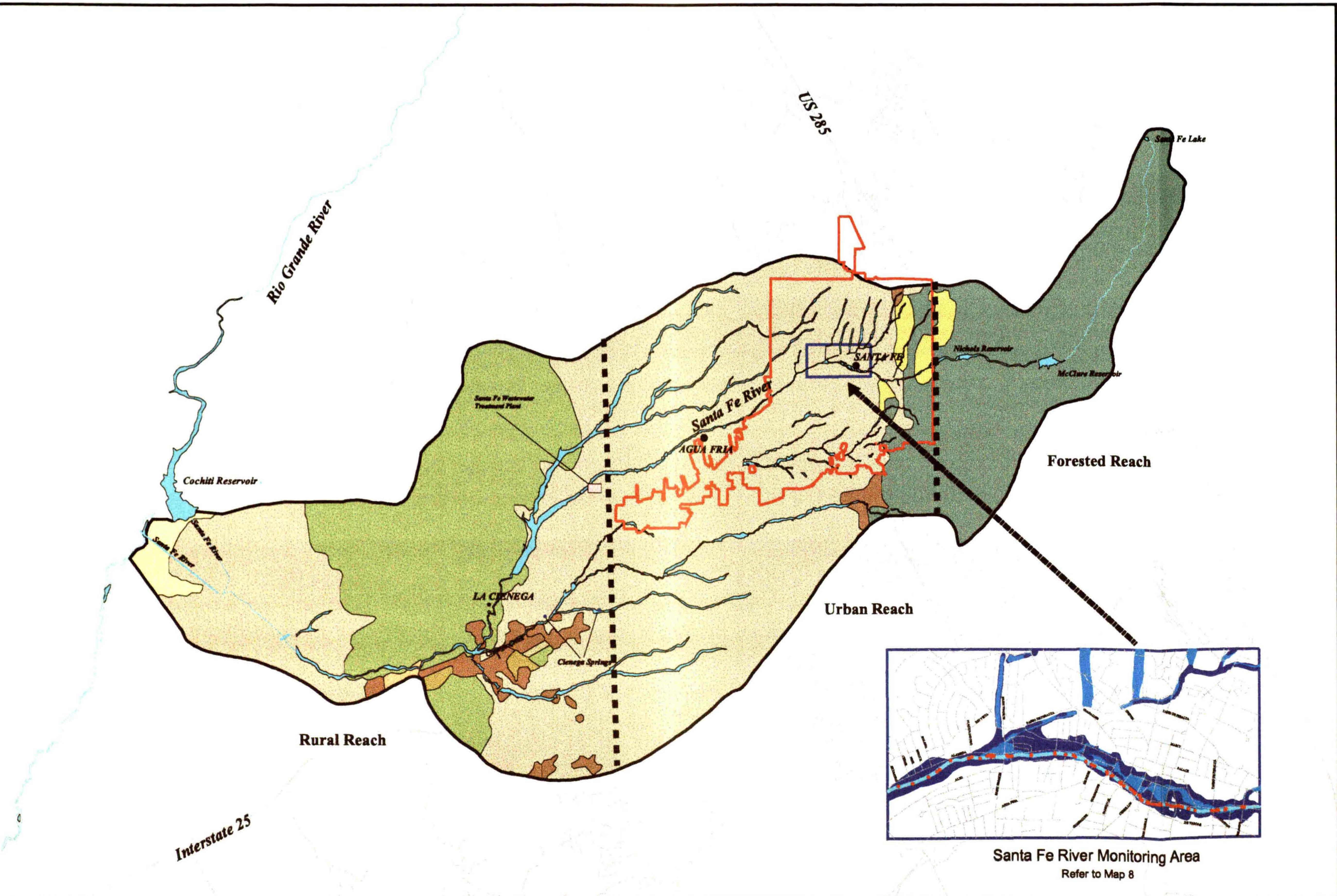
The Santa Fe River Watershed is a subbasin of the Upper Rio Grande Basin, located in north central New Mexico. The area of the watershed is approximately 241 square miles and approximately 37 miles in river length (NMED, 1999). The headwaters are in the Sangre de Cristo Mountains at Santa Fe Lake east of the City of Santa Fe and the river flows west towards the Rio Grande (Map 1). The watershed can be divided into three distinct sub-watersheds. The uppermost unit is high in elevation and forested, the middle unit is temperate in climate and largely urbanized, and the lower unit is drier rural range land. The watershed is dominated by forest land (57.7%), range land (28.9%), and urban land (10.0%) (NMED, 1999). Other land uses account for the remaining 3.4% of the watershed (NMED, 1999). Annual rainfall varies from 35 inches in the upper watershed to 14.22 inches in the lower reaches (City of Santa Fe, 1997). Table 1 provides further description of the units and their existing conditions and Map 1 shows the boundaries of each reach.

Table 1 Santa Fe River Watershed Reaches and Conditions

	FOREST REACH	URBAN REACH	RURAL REACH
Geology (Map 2)	[1]Predominantly Precambrian granite, gneiss, schist	[1,3] Tertiary Santa Fe Group sands and gravels, Quaternary alluvium and terrace sand and gravel, several normal faults	[1]Quaternary basalt, alluvium, Tertiary/ Cretateous Intrusive
Terrain	Elevation range of 12,000-7500ft = 4500 feet of relief over 12+ miles = 7% slope (i.e., steep).	Elevation range of 7500-6500ft = 1000 feet of relief over 15 miles = 1.3% slope (moderate).	Elevation range of 6500-6000ft = 500 feet of relief over 23 miles = 0.4% slope (minimal).
Climate (Map 3)	[1] Summer (June-Sept.) Average Annual Precipitation: Ranges with altitude, 7.2-22 inches, , mostly in thunderstorms, but less intense than in urban and desert reach [1]Winter (Oct.-May) Precipitation Average: Ranges with altitude, 8.8-35.2 inches; mostly snowfall, ranges with altitude. Combined average annual precipitation: 16-35 inches.	[3] Summer (June-Sept.) Average Annual Precipitation: Ranges with altitude,[3]14.22 inches; mostly in short, high intensity thunderstorms in May-July, maximum occurring in July [1] Winter (Oct.-May) Precipitation Average: 5.5-8.8 inches; partly rain partly snow. Combined average annual precipitation: 12-16 inches.	Summer (June-Sept) Average Annual Precipitation: Similar to urban reach; mostly in short high intensity thunderstorms in July and August Winter (Oct.-May) Precipitation Average: Similar to urban reach, mostly rain with some snow. Combined average annual precipitation: 8-10 inches.
Soils (Map 4) Refer to p.16 for soil definitions.	[1,3] Character: shallow mountain soils, predominantly shallow layers of very cobbly, stony and bouldery sandy loams underlain by bedrock.	[1,2] Character: area largely paved with compacted dirt roads, sandy clay loam over sand and gravel on moderate to gentle slopes.	[1] Character: sandy loams on gentle slopes
Water	[2] Perennial flow from snowmelt and springs. Reservoir spill is typically 10 to 30 cfs, with an average of 1,600 AFY. Minimal seepage and groundwater.	[2] Intermittent in response to storm events, with flows in the hundreds of cfs. Moderate seepage (0 to –2 cfs/mi). Ground water in the Santa Fe Formation (thick sands and gravels); depth to ground-water from less than 100 ft to several hundred ft.	[2] Largely perennial flow from the municipal wastewater plant, augmented by springs. Flow at La Bajada 8-10 cfs; average annual inflow of about 8,000 AFY. Seepage rates of 0 to –6 cfs/mi. Groundwater: see urban reach.
Vegetation (Map 3)	[1] Ponderosa pine, spruce, fir.	[1] Pinyon, juniper, and grassland away from streams; cottonwoods and willows in stream valleys.	[1] Grassland, predominantly gramma grass, cottonwood and willows in stream valleys
Current Land Use (Map 5)	Protected for water supply, open space, public institutional.	Largely urban, semi-rural and residential.	Irrigated agriculture, grazing, industrial, residential, public institutional.
Future Land Use (Map 6)	None.	Residential, business, parks, public institutional, open space	Minimal future land use, public institutional, parks, open space, residential
Ownership (Map 7)	Largely forest land, private land.	Largely private lands, State, Bureau of Land Management (BLM) land.	Private, BLM, State, forest, and Native Amercian lands.
Population	None.	Approximately 50,000.	A few thousand.

[1] Spiegel, Z. and Baldwin, B., 1963. Geology and Water Resources of the Santa Fe Area, New Mexico. Geological Survey Water-Supply Paper 1525, US Geological Survey, Washington, D.C.
[2] CDM and LWA, 1998. City of Santa Fe Treated Effluent Management Plan. Camp Dresser and McKee, Albuquerque, NM and Lee Wilson and Associates, Santa Fe, NM.
[3]City of Santa Fe, 1997. DRAFT Final Santa Fe Drainage Management Plan Santa Fe River Watershed. Santa Fe, NM.

Santa Fe River Watershed: Geology



Legend

- Cities
- City Boundary
- Drainages
- Monitoring Area
- Santa Fe River Watershed Boundary
- Santa Fe River

Geology
- Pennsylvanian Magdelana Group
- Quaternary/Tertiary Ancha Formation
- Cretaceous Mancos
- Quaternary Tertiary Sediments
- Quaternary Alluvium
- Quaternary Basalt
- Tertiary/Cretateous Intrusive
- Tertiary Galisteo Formation
- Precambrian

Prepared By: Joy K. O'Neil
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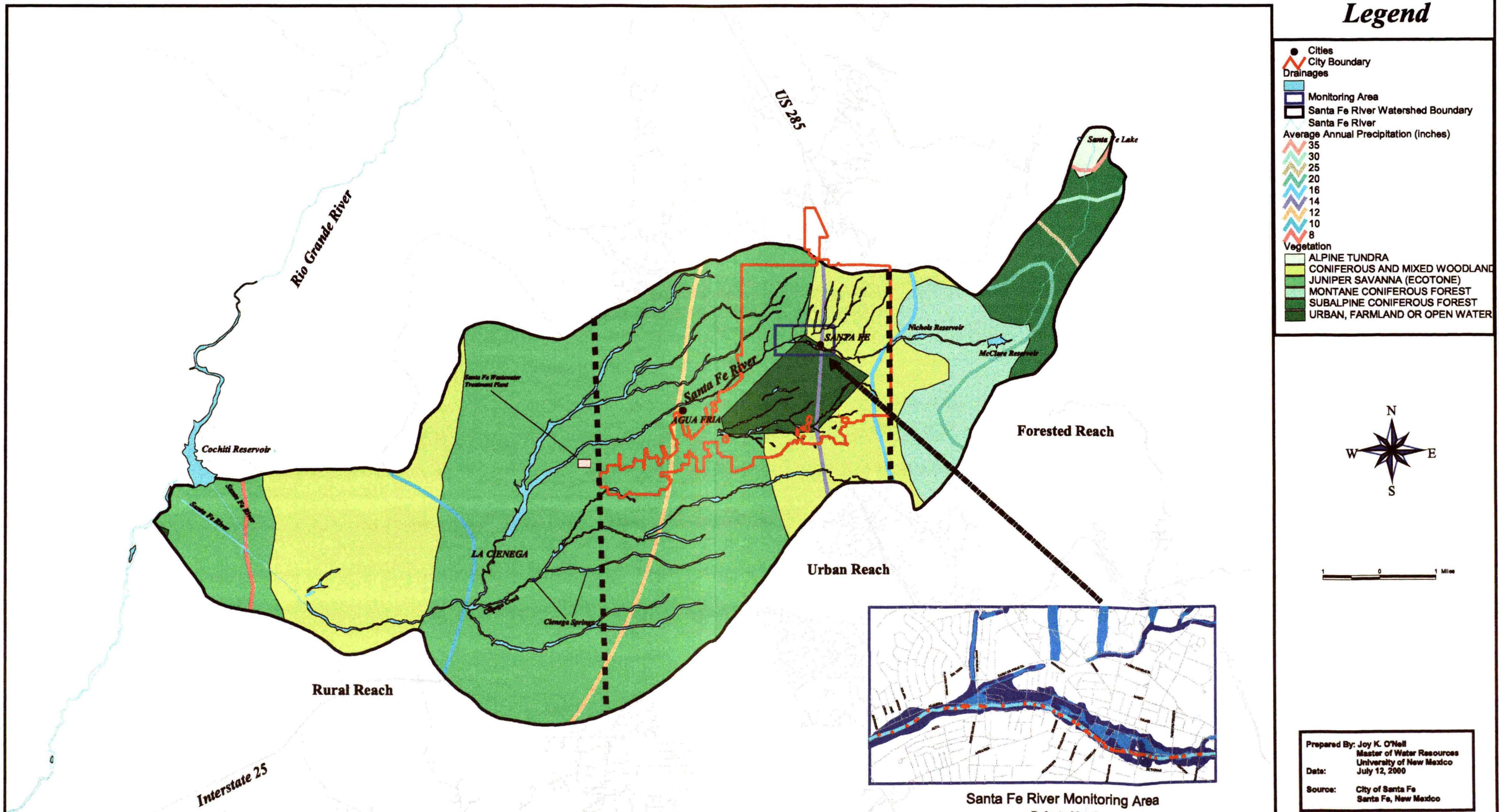
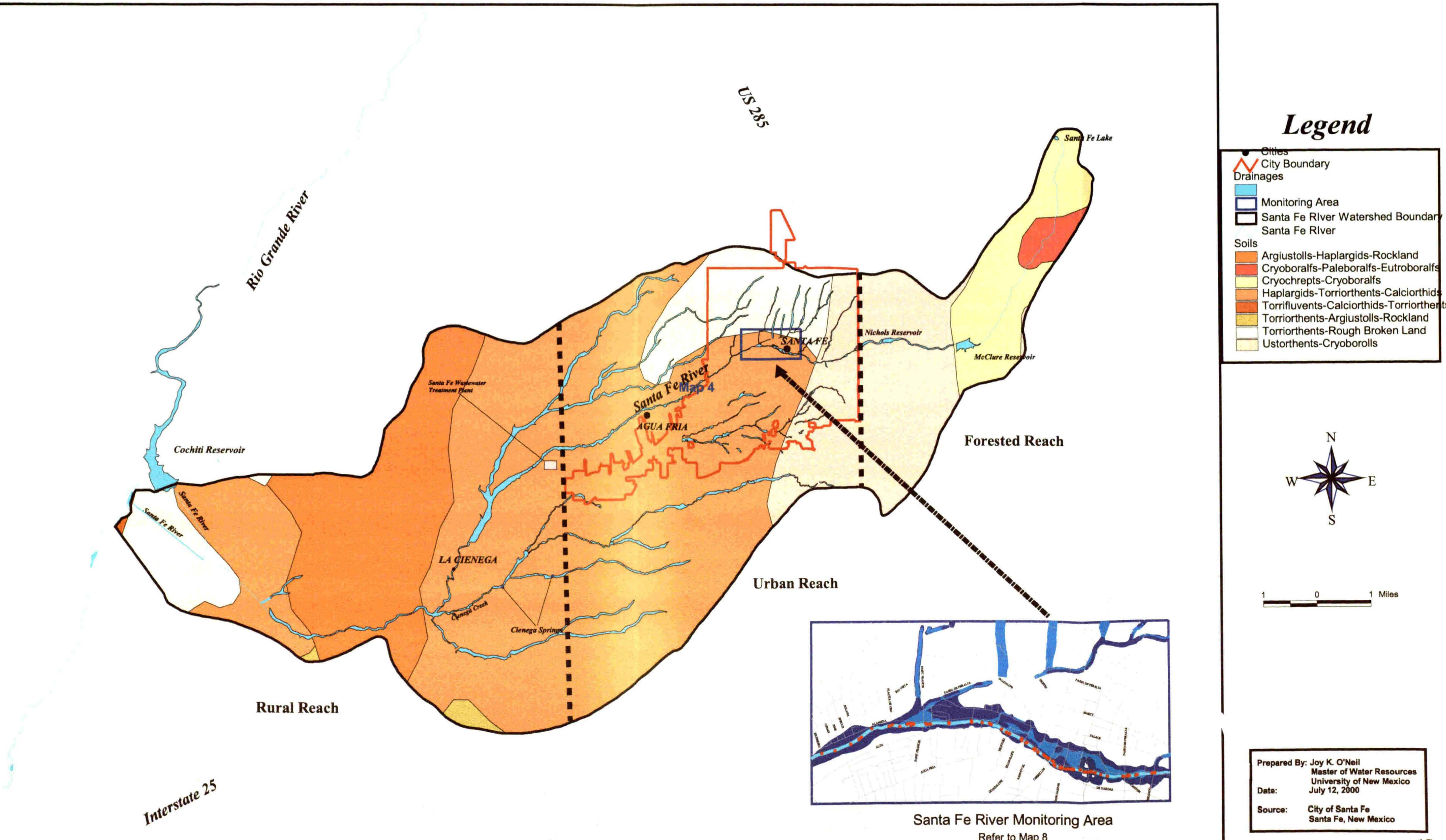
Source: City of Santa Fe
Santa Fe, New Mexico

Map 3

Santa Fe River Watershed: Vegetation and Precipitation



Santa Fe River Watershed: Soils



Soil Definitions

These definitions are directly related to the proceeding soils map:

Argiustolls – a sandy or loamy particle-size, relatively stable slopes moderate to level.

Haplargids – erosion surfaces or sediments and commonly they have gentle slopes. Most are in sediments that have little of no lime. Mostly considered desert soils.

Cryoboralfs – usually in mountains of the western states and have a coniferous vegetation.

Paleboralfs – in the mountains, their stability may be the result of stoniness. Their vegetation is mostly coniferous forest.

Eutroboralfs – frigid temperature regime. They have a base saturation of 60 percent or more. They mostly occur under either deciduous hardwood, coniferous, or mixed forests.

Cryochrepts – found in cold high mountains with high altitudes. Some have permafrost. The vegetation is a mostly conifer, mixed conifers, and hardwood trees or tundra. Few are cultivated.

Torriorthents – dry or salty of cool to hot arid regions. Mostly, they are neutral or calcareous and are on moderate to strong slopes. Have a sandy particle-size. The vegetation usually is sparse and consists mostly of shrubs, grasses, and forbs.

Calciorthids – have much lime in the parent materials. Soils are commonly white. If the soils are irrigated and cultivated, nutrient deficiencies of trace elements are normal.

Torrifluvents – common in arid climates that are not flooded frequently or for long periods of time. The larger areas having favorable topography and location close water are commonly irrigated. The natural vegetation of these soils consists mostly of shrubs, and cacti.

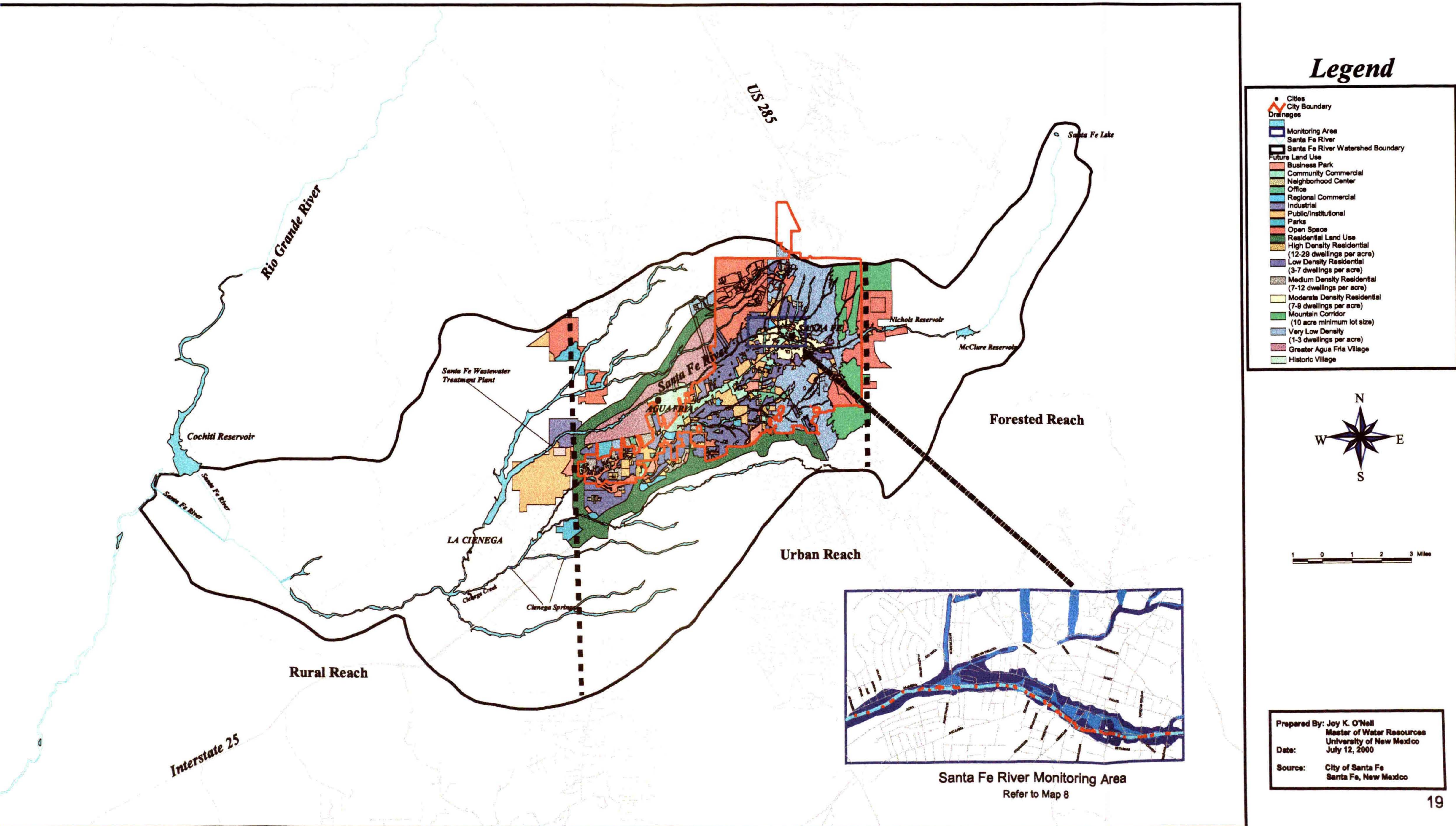
Calciorthids – much lime in the parent materials. The soil is commonly nearly white. If the soil area is irrigated and cultivated, nutrient deficiencies of trace elements are normal.

Torriorthents – are dry and salty of cool to hot arid regions. They hold moisture or salt or both. Mostly, they are neutral or calcareous and are on a moderate to strong slopes. Some have gently slopes. The vegetation usually is sparse and consists of shrubs, grasses and forbs. The soils are used mainly for grazing.

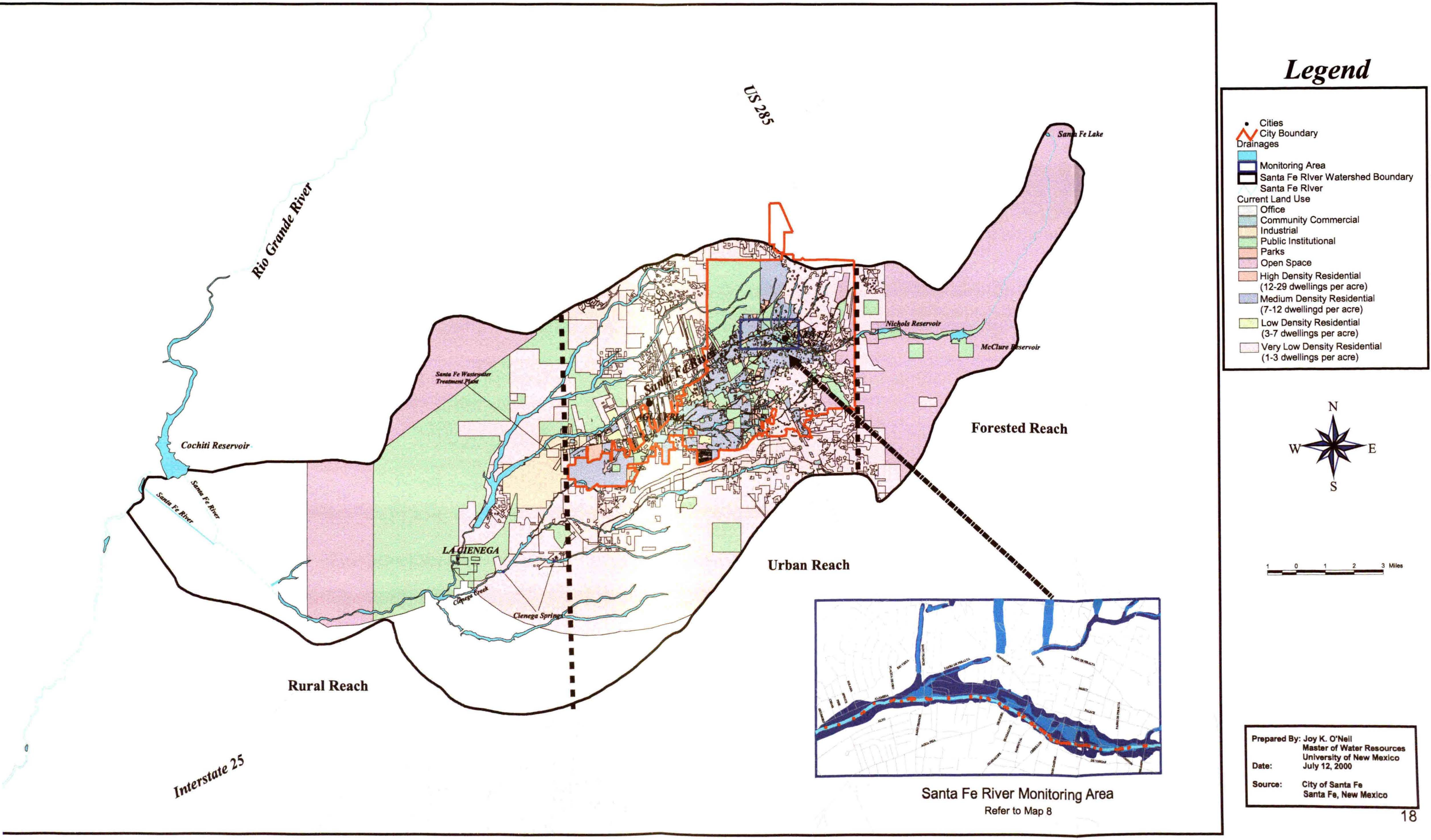
Ustorthents – are common in mid or low altitudes. Their vegetation is warm regions commonly is deciduous forest. Soils that have a frigid temperature regime commonly have scattered grasses mixed with shrubs.

Cryoborolls - are common where summers are cool or short, usually in the mountains. Many had grasses and scattered conifers. Some are now cultivated and used to produce small grains or hay. Many are grazed and also some wood products (Soil Conservation Service, 1975).

Santa Fe River Watershed: Future Land Use



Santa Fe River Watershed: Current Land Use



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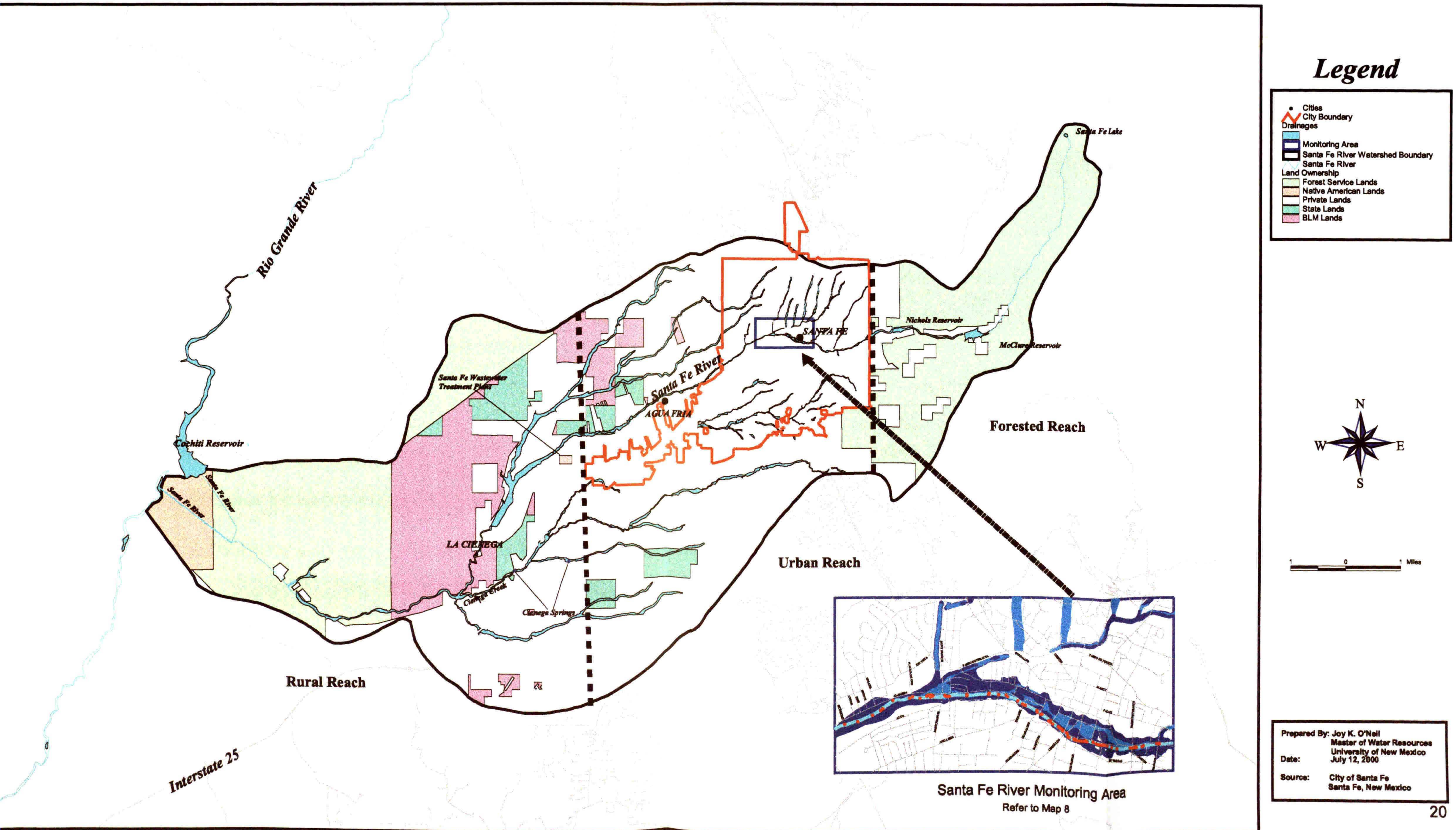
Date:	July 12, 2000
Source:	City of Santa Fe Santa Fe, New Mexico

Santa Fe River Watershed: Land Ownership



3.0 Hydrologic History Affecting the River

3.1 Forested Reach

In October 1880, the Board of County Commissioners, Santa Fe, in the Territory of New Mexico, executed legal documentation which provided the Santa Fe Water and Improvement Company with the exclusive right and privilege of erecting dams and reservoirs for impounding water on the Santa Fe River (PNM, 1996). In exchange, the Santa Fe Water and Improvement Company was required to distribute an adequate water supply at reasonable rates to the city within a 3 mile radius in every direction starting from the center of the Santa Fe plaza. This was accomplished by installing a series of three reservoirs and appropriate water pipes.

In 1881, Old Stone Dam was the first dam to be built, and when the Two Mile Dam and Reservoir was built. Two Mile Dam and Reservoir was built in approximately 1893, and eventually took place of the Old Stone Dam. From 1926 to 1928, McClure Reservoir was constructed, and Nichols Reservoir was constructed from 1942 to 1943. In 1992, Two-Mile Reservoir was drained for safety reasons, leaving McClure and Nichols as the only two reservoirs in use. These dams and reservoirs are primarily used for water supply, and secondarily for flood control. Water is released into the river channel to meet the irrigation right of the Acequia Madre and Cerro Gordo and to regulate reservoir levels.

Prior to 1932, the forested reach was heavily used for drinking, irrigation, agriculture, livestock grazing, logging and homesteading. In order to protect the water quality of the city's drinking water, the forested reach was officially closed to the public in 1932, prohibiting bathing, wading, camping, fishing, picnicking, and grazing (Scurlock, 1998).

3.2 Urban Reach

Pedro de Peralta royal governor of the recently created province of New Mexico (Scurlock, 1998). Peralta's first task was to go north to relocate the capital (San Gabriel) from near the current site of San Juan Pueblo to a more central location. Peralta chose a site that had been previously occupied by a Native American pueblo, and named it Santa Fe. Peralta chose this site based on the fact that there were a running river and springs with plenty of water for drinking, irrigating, and pasture. In 1774 a Spanish merchant described Santa Fe as being situated at the "foot of a high mountain range from which flows a crystal-clear river full of small but choice trout" (Scurlock, 1998).

In establishing the town of Santa Fe, Peralta was expected to comply with the city ordinances issued by King Phillip II in 1573. The orders were to plan an orderly layout, ample room for growth, and a plentiful supply of water. For the first few decades, growth was slow but steady. The number of Spaniards grew from a few hundred to a few thousand (Scurlock, 1998). The population and the amount of irrigated land use surface led to an increased demand for water. The river supply was usually insufficient, and only in the rainy season would there be enough water for everyone. The problem got increasingly worse as the years went by and eventually dams were installed upstream to capture the flow mainly for municipal drinking supply, as described above. Currently, streamflow consists only of storm events, snowmelt and minimal releases from the reservoirs after the City's and the acequia's water rights are served, or when inflow exceeds reservoir capacity.

3.3 Rural Reach

The rural reach was never as intensely developed as the urban reach. Currently it contains several small villages, irrigation fields, and some mining activity. The Santa Fe River flows westward through the rural reach beginning at the current Wastewater Treatment Plant, past the airport and forks at the Cochiti Dam extension. One fork continues through Cieneguilla to Cochiti Reservoir and the Rio Grande. Beginning at the Wastewater Treatment Plant to Cieneguilla, the flow is perennial, and consists of virtually 100% effluent most of the time (CDM and LWA, 1998). Cieneguilla is a late prehistoric-early historic pueblo and historic Spanish settlement, it is also an Anasazi site containing petroglyphs on the basalt rocks. The river then passes the early colonial settlement of La Cienega and flows through a canyon carved in La Bajada Mesa, which eventually deepens to approximately 300 feet (CDM and LWA, 1998). While effluent is an essential part of flow in this reach, but there is also substantial natural streamflow resulting from groundwater discharge, springs and natural tributaries

(CDM and LWA, 1998). In portions of this reach the channel is narrow and vegetated and is bounded by river alluvium. Historically, acequias' have diverted streamflow for the irrigation of small farms (CDM and LWA, 1998).

The Cochiti Dam extends to the Santa Fe River below La Bajada canyon. Streamflow is diverted to Cochiti Reservoir by the Cochiti Dam extension on the Santa Fe River (CDM and LWA, 1998). The natural channel continues west-southwest to the Rio Grande: the channel is narrow, vegetated, and fed by Cochiti Springs less than a mile below the Main Cochiti Dam. Since installation of the dams, flow is perennial (CDM and LWA, 1998). Map 1 shows this area of the Santa Fe River divides with one fork flowing to the Rio Grande in the natural course of the river. The other fork flows to the reservoir as diverted flow after installation of the dam.

4.0 Current Uses

4.1. Forested Reach

In 1926 the U.S. National Forest Service closed the upper watershed to grazing. This closure was followed in 1932 with an agreement signed by the Department of Agriculture, the City of Santa Fe and the power company prohibiting bathing, fishing, picnicking, and similar forms of human activity on government lands. Currently, the forested reach is used solely for wildlife and water supply. The

Forested Reach ownership includes City of Santa Fe, U.S. Forest Service and a few parcels of privately owned land (Romero, 1995).

4.2 Urban Reach

The Urban Reach population is centrally located around the Santa Fe River. The downtown area is highly developed with residential and commercial areas (City of Santa Fe, 1997). The northern and eastern sections of the City are in the foothills and are less populated with scattered residential development and steeper slopes (City of Santa Fe, 1997). Map 5 shows the current land use for the area and Map 6 shows the future land use of the area. The western section of the urban reach is undergoing development, mostly residential. This section has relatively flat terrain along the river, with increasing slopes to the north.

The urban reach contains a significant amount of asphalt and concrete and other largely impervious surfaces (homes, stores etc.). Most of the runoff drains to the Santa Fe River in a rapid pulse following a storm event, causing degradation of the riverbed. There are "river restoration" projects along this reach to help stabilize the condition of the riverbed. A few of these include the reach from St. Francis to Camino Alire, and the following additional city projects: Santa Fe River Erosion Control and Greenway Project, Phase II; Santa Fe River Downtown Urban Trail Project; and Santa Fe River Erosion Protection below DeFouri Street Bridge (Lange, 2000).

4.3 Rural Reach

The area below the wastewater treatment plant is largely in private ownership, used mostly for grazing and increasingly for suburban development and BLM land (Map 7). The rural reach contains Santa Fe County and Sandoval County (Map 1). The village of La Bajada and La Cienega maintain something of their agricultural character. The remainder of this paper will focus on a monitoring plan for the area of interest in the urban reach (Map 8).

5.0 Urban Reach Focus

The urban reach of the river will be the focus of this monitoring plan. The list below indicates reasons why this reach has been chosen as priority for a volunteer monitoring program.

1. It is the most heavily impacted reach of the river as a result of: encroachment of roads; erosion caused by grade controls along the river and heavy stormflows; and dewatering of the river.

2. Currently, the Santa Fe River is monitored at a number of locations along the Forest Reach and Rural Reach, but just two sites in the Urban Reach is monitored, and those only for flow. The City of Santa Fe monitors river flow for the Urban Reach at gaging stations located (1) above St. Francis Drive and (2) above Frenchy's Park. These

gages were installed in 1998 and have yet to be calibrated. Starting in summer 2000, the gages will be calibrated and monitored on a monthly basis and during storm events (Williams, 2000). Table 2 presents a summary of monitoring activities along the river including locations, parameters, frequency and contact information.

3. The City of Santa Fe will be required to have a storm water management plan by the year 2002, as required by the EPA Phase II National Pollution Discharge Elimination System (NPDES) program addressing storm water discharges and 6 "minimum measures" (discussed further in this report) (Clarke, 1999). A Phase II NPDES permit is required by municipalities with a population fewer than 100,000 and with a population density greater than 1000 persons per square mile; the City of Santa Fe fits this category.
   While monitoring will not be required for the plan, monitoring may help track point source pollution, which would ultimately require the implementation of the controls necessary to minimize the discharge of pollutants. Part of this monitoring plan will be to locate all drainage outlets into the monitoring segment of the river and identify high concentrations of outlets; monitoring will take place to help in identifying the point source pollutants.

Out of the 83 watersheds in the state of New Mexico identified by the New Mexico Environmental Department (NMED) Unified Watershed Assessment (UWA), the Santa Fe River Watershed the has been defined as a Category 1 watershed (Figure 1) (NMED, 1999). Category 1 means that it is listed as a watershed that is in need of restoration (NMED, 1999). Following development of a Watershed Restoration Action Strategy (WRAS), a five-year implementation schedule is planned to institute best management practices (BMPs) to improve water quality. The schedule for the Santa Fe Watershed is as follows:

Priority-One Watershed 8-digit code	**2000-2001**	**2001-2002**	**2002-2003**	**2003-2004**	**2004-2005**
Rio Grande/ Santa Fe 13020201	**Intensive outreach and monitoring**	Target	BMP Implementation and monitoring	BMP Implementation and monitoring	BMP Implementation and monitoring

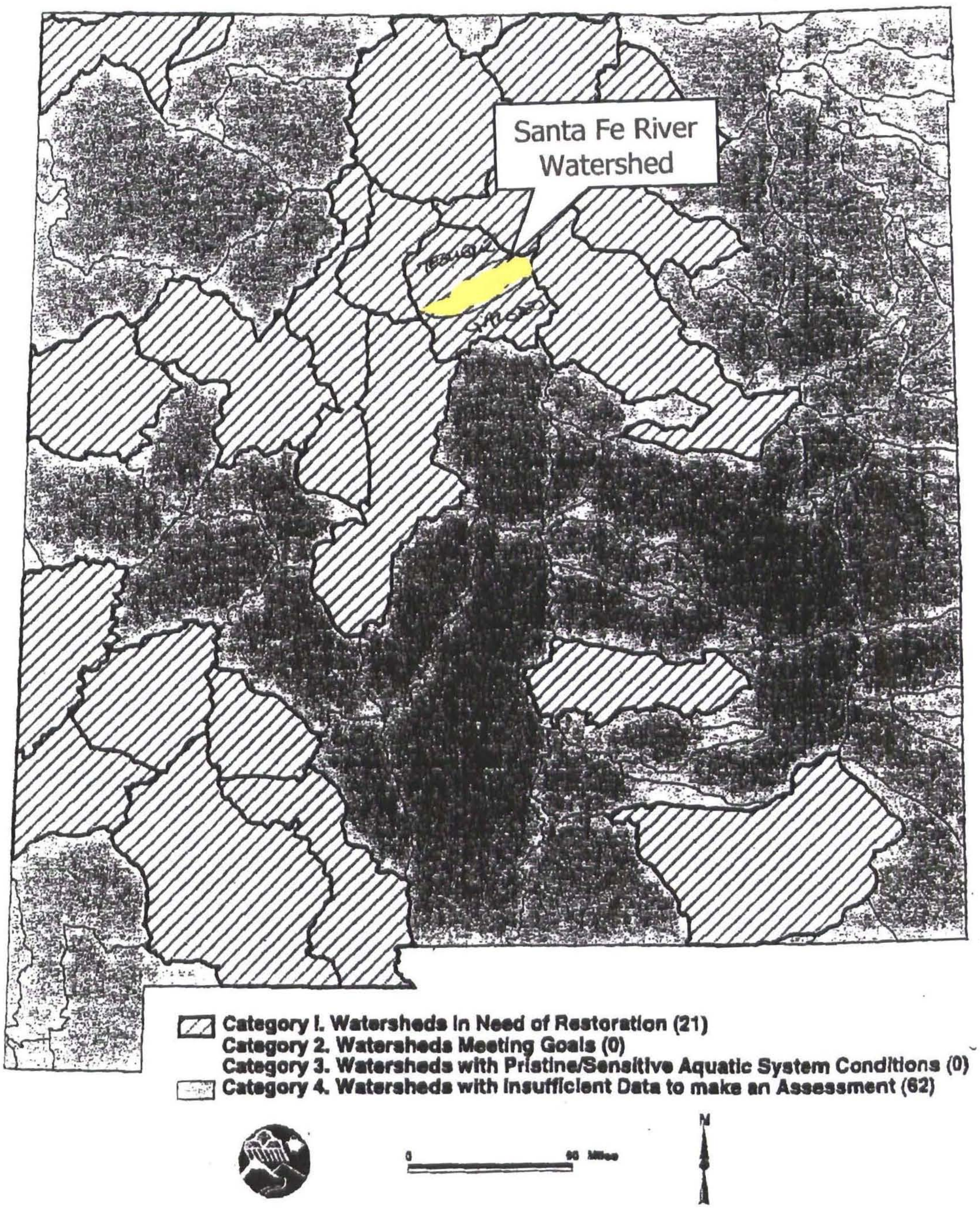
4. Data collected from this volunteer monitoring plan may serve as a key element to in designing, developing, and implementing restoration projects in the Urban Reach of the Santa Fe River.

5. Finally, the Santa Fe Watershed Association River Monitoring Technical Advisory Committee, as well as other volunteers, agree that the Urban Reach of the Santa Fe River lacks monitoring and feels it is of great interest to community members.

Table 2 Comprehensive List of Water Quality Monitoring Groups and Parameters for the Santa Fe River

PARAMETERS	Watershed Watch	USGS	State Land Office	NMED Surface Water Quality Bureau	City of Santa Fe Waste Water Treatment Plant
Streamflow in cfs	X	X			
PH	X				X
Water Temp. (C°)	X			X	
Hardness (mg/l)	X			X	
Turbidity (NTU)	X			X	X
Aluminum	X			X	
Ammonia	X				
Chlorine	X				
Copper	X				
Chromium	X				
Iron	X				
Nitrate	X			X	X
Total Phosphorus	X			X	X
Silver	X				
TDS (mg/L)	X		X		
Zinc (1997-98)	X				
Benthic Macroinvertebrates:					
Standing Count	X				
Total # Taxa	X				
Percent Dominant Taxa	X				
*EPT Index	X				
*FBI Index	X				
Riparian Health Survey	X				
X-Section onto Floodplain			X		
Stream Profile			X		
Particle Size Distribution	X		X		
Embeddedness	X		X		
Dissolved Oxygen (mg/L)				X	
TSS (mg/L)				X	X
Ca (mg/L)				X	
K (mg/L)				X	
Na (mg/L)				X	
Alk (mg/L)				X	
Bicarbonate (mg/L)				X	
Chloride (mg/L)				X	
Sulfate (mg/L)				X	
Mg (mg/L)				X	
Ba (ug/L)				X	
Be (ug/L)				X	
B (ug/L				X	
Nitrate – Nitrogen (mg/L)					X
Kjeldahl Nitrogen (mg/L)					X
Flow in Conduit or thru Treatment Plant					X
Fecal Coliform (mL)					X
Carbonaceous Biochemical Oxygen Demand (mg/L)					X

Figure 1 Category 1 Watershed by the New Mexico Environmental Department (NMED) Unified Watershed Assessment (UWA)



6.0 Three Step Screening Process in Determining Parameters

Monitoring Standards and other Sources of Parameters

Monitoring parameters need to be determined for measuring storm water and general water quality. This is complex for the Santa Fe River because the river is no longer perennial and it passes through a small city (fewer than 100,000). Based on research gathered for this project, no other communities were found with similar conditions for establishing monitoring parameters. Thus, parameters selected for the urban reach of the Santa Fe River will be based on a number of criteria:

1. State of New Mexico Standards for Interstate and Intrastate Surface Waters (NMWQCC, 2000). These standards do not apply to the Santa Fe River Urban Reach since it is not a perennial stream, but the General Standards and Standards Applicable to Attainable or Designated Uses are appropriate ones based on the uses of the urban reach of the Santa Fe River when flowing. These standards are listed in Section 6.1.1.

2. The Environmental Protection Agency (EPA) has written Phase II Storm Water Regulations for cities smaller than 100,000. The regulations include 6 "minimum measures": 1) public education and outreach on storm water impacts; 2) public participation; 3) illicit discharge detection and elimination; 4) construction site storm water runoff control; 5) post construction storm

water management in new development and redevelopment; and 6) pollution prevention/good housekeeping for municipal operations. This monitoring plan will ultimately fulfill minimum measure numbers 1, 2 and eventually be part of number 3 (illicit discharge detection and elimination).

3. Texas Watch Urban Monitoring Program (TNRCC, 2000), Watch Our Waters (Schaffer,1998), and New Mexico Watershed Watch (Fleming and Schrader, 1998), and community input will serve as guidelines for the parameters chosen for this monitoring plan.

4. The Federal Clean Water Act Secondary Standards, based on aesthetics, are also parameters to be considered.

6.1 Step One – First Level of Screening

The parameters for river monitoring were based on the following standards and sources. A three-step process was used to determine the monitoring parameters that will be used for the Santa Fe Urban Reach Monitoring Area. The first step (below) involved listing all standards and parameters from other sources. The second screening step entailed listing in tabular format all parameters, their definitions, equipment needed and relevance or non-relevance to the designated monitoring area. From that table, another matrix was developed containing only those parameters relevant to the Santa Fe River, Urban Reach Monitoring Area. The final step of the screening process was to set a final list of parameters that would be monitored given budget constraints. A volunteer monitoring handbook was then written with detailed instructions on how to monitor for each parameter (see handbook in Appendix C).

6.1.1 State of New Mexico Standards for Interstate and Intrastate Surface Waters

General Standards Applicable to Santa Fe River Urban Reach

"General standards are established to sustain and protect existing or attainable uses of surface waters of the State. These general standards apply to all surface waters of the State at all times, unless a specified standard is provided elsewhere in Part I" (NMWQCC, 2000). Santa Fe River, urban reach does not have specific standards in Part I.

1. Bottom deposits– "Surface waters of the State shall be free of water contaminants from other than natural causes that will settle and damage or .....alter the physical or chemical properties of the bottom" (NMWQCC, 2000).

2. Floating Solids, Oil and Grease – "Surface waters of the State shall be free of oils, scum, grease and other floating materials resulting from other than natural causes that would cause the formation of a visible sheen or visible deposits on the bottom or shoreline, or would damage or impair the normal growth, function or reproduction of human, animal, plant or aquatic life" (NMWQCC, 2000).

3. Color – "Color-producing materials resulting from other than natural causes shall not create an aesthetically undesirable condition nor shall color impair the use of the water by desirable aquatic life presently common in surface waters of the State."

4. Odor and Taste of Fish – "Water contaminants from other than natural causes shall be limited to concentrations that will not impart unpalatable flavor to fish, or result in offensive odor arising in surface water of the State or otherwise interfere with the reasonable use of the water."

5. Plant Nutrients – "Plant nutrients from other than natural causes shall not be present in concentrations which will produce undesirable aquatic life or result in a dominance of nuisance species on surface waters of the State."

6. Toxic Pollutants – "Surface waters of the State shall be free of toxic pollutants attributable to discharge in amounts, concentrations or combinations which affect the propagation of fish or which are toxic to fish or other aquatic organisms, wildlife using aquatic environments for habitation or aquatic organisms for food..."

7. Radioactivity – "The radioactivity of surface waters of the State shall be maintained at the lowest practical level and shall in no case exceed the

standards set forth in Subpart 4 of the New Mexico Radiation Protection Regulations, 20 NMAC 3.1, effective May 3, 1995."

8. Pathogens – "Surface waters of the State shall be virtually free of pathogens. In particular, surface waters of the State used of irrigation table crops such as lettuce shall be virtually free of *Salmonella* and *Shigella* species."

9. Temperature – "The introduction of heat by other than natural causes shall not increase the temperature, as measured from above the point of introduction, by more than 2.7°C (5°F) in a stream."

10. Turbidity – "Turbidity attributable to other than natural causes shall not reduce light transmission to the point that the normal growth, function, or reproduction or aquatic life is impaired or that will cause substantial visible contrast with the natural appearance of the water."

11. Dissolved Gases – Surface waters of the State shall be free of nitrogen and other dissolved gases at levels above 110% saturation when this supersaturation is attributable to municipal, industrial or other discharges."

Standards Applicable to Attainable or Designated Uses

1. Primary Contact – "The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100mL, no single sample shall exceed 400/100mL and pH shall be within the range of 6.6 to 9.0."

2. Wildlife Habitat – "Wildlife habitat should be free from any substances at concentrations that are toxic to or will adversely affect plants and animals that use these environments for feeding, drinking, habitat or propagation, or can bioaccumulate and impair the community of animals in a watershed to the ecological integrity of surface waters of the State. In the absence of site-specific information, and subject to the following paragraph, the following chronic numeric standards shall not be exceeded":

Total Mercury	0.77 ug/L
Total recoverable selenium	5.0 ug/L
Cyanide, weak acid dissociable	5.2 ug/L
Total chlorine residual	11 ug/L
Total DDT and metabolites	0.001 ug/L
Total PCBs	0.014 ug/L

(NMWQCC, 2000)

6.1.2 Texas Watch Volunteer Urban Watch Monitoring

Texas Watch is a statewide volunteer monitoring program coordinated by the Texas Natural Resource Conservation Commission. The goal of their program is to "help locate illicit discharges and illegal conditions into the stormdrain system" (Drinkwin, 1995). The conditions of the urban reach at the City of Fort Worth are similar to City of Santa Fe, Santa Fe River Urban Reach except that their river is perennial and the city is approximately 500,000. Even with the differences, the parameters may be similar to what the Santa Fe River Monitoring Plan may use. The Santa Fe Monitoring Plan will take into consideration and monitor both wet and dry conditions.

The parameters of the Texas Watch program are as follows:

1. Flow
2. Temperature
3. Turbidity
4. pH
5. Detergent
6. Total copper
7. Phenols
8. Total Residual Chlorine
9. Ammonia-Nitrogen
10. Color
11. Odor
12. Oil Sheen
13. Trash, Sewage and Surface Scum

6.1.3 Federal Clean Water Act Secondary Standards Based on Aesthetics

Federal Clean Water Act secondary standards based on aesthetics will also be screening criteria. These are shown below.

Contaminants	Levels	Contaminants	Levels
Chloride	250 mg/L	Manganese	0.05 mg/L
Color	15 color units	Odor	3 threshold odor number
Copper	1 mg/L	PH	6.5-8.5
Corrosivity	Noncorrosive	Sulfate	250 mg/L
Fluoride	2.0 mg/L	Total Dissolved Solids (TDS)	500 mg/L
Foaming agents	0.5 mg/L	Zinc	5 mg/L
Iron	0.3 mg/L		

Sorce: 40 CFR Ch. 1 (7-1-88 Edition), 141.51, Environmental Protection Agency (1988)

6.1.4 Other Monitoring Parameters to be Considered

1. River journal describing conditions of river during monitoring event
2. Sediment – tracking erosion problems
3. Staff gage – captures flow in a storm water event

There are some monitoring parameters that will not be significant for the reach of concern, thus the next section will explain in further detail the parameters that should be monitored with reference to the uses of the river and incoming pollution into the Monitoring Area of the Urban Reach. And finally the last section will refine the parameters to what can be monitored given volunteer time, minimal equipment and low budget.

6.2 Step Two – Second Level of Screening

Step two screening involves listing all the parameters from step one and writing conditions, if is relevant to the urban reach fo the Santa Fe River and equipment needed for the measurements. This step will help eliminate parameters that do not pertain to the urban reach.

PARAMETER	CONDITIONS	RELEVANT? Y/N	EQUIPMENT NEEDED
Bottom Deposits [1]	Surface waters shall be free of water contaminants from other than natural causes that will settle and damage or impair the normal growth, function, or reproduction of aquatic life or significantly alter the physical or chemical properties of the bottom.	Yes	Grain size sampling
Floating Solids, Oil, Grease and Foam[1]	Surface waters shall be free of oils, foam, grease and other floating materials resulting from other than natural causes that would cause the formation of visible sheen or visible deposits on the bottom, or would damage or impair the normal growth, function or reproduction of human, animal, plant or aquatic life.	Yes	Visual observation
Color [1,4]	Color-producing materials resulting from other than natural causes shall not create an aesthetically undesirable condition nor shall color impair the use of the water by desirable aquatic life presently common in surface waters.	Yes	Visual observation
Odor and Taste of Fish	Foul odor or taste of fish.	No (no fish)	N/A
Plant Nutrients [1,5,6] **Nitrate-Nitrogen**	Sources include human wastewater (including septic tanks), animal feces, and agriculture. Ingestion may impact infant health.	Yes	La Motte Nitrate-Nitrogen Test Kit
Toxic Pollutants [1]	Surface waters shall be free of toxic pollutant attributable to discharge in amounts, concentrations or combinations which affect the propagation of fish or which are toxic to fish or other aquatic organisms; wildlife using aquatic environments for habitation or aquatic organisms for food; or to livestock or other animals.	See specific pollutants listed below	N/A
Pathogens [1]	See fecal coliform below	Yes	Hach Incubator Kit
Fecal Coliform [2,5]	Sources are human wastewater, septic tanks, and animal feces. The presence of fecal coliform indicates the potential for numerous diseases, some of which are contagious through water contact.	Yes	Hach Incubator Kit
Temperature [1,4,5,6]	High temperatures can indicate industrial discharges and can impact sensitive aquatic species.	No (no aquatic species)	N/A
Turbidity [1,4,5,6]	Impacts area to aesthetics and to some aquatic organisms (e.g. smothering). Turbidity shall not reduce light transmission to the point that the normal growth, function, or reproduction of aquatic life is impaired or that will cause substantial visible contrast with the natural appearance of the water.	Yes	Nephelometer

Dissolved Gases [1]	Surface waters shall be free from nitrogen and other dissolved gases at levels above 110% saturation when this supersaturation is attributable to municipal, industrial or other discharges.	No (no municipal or industrial discharges)	N/A
	Mercury is released to surface waters from naturally occurring mercury in rocks and soils and from industrial activities. Sources of mercury in soil include direct application for fertilizers, disposal of solid waste, including batteries and thermometers, to landfills. Wastewater facilities may also release mercury into water. Mercury can accumulate in fish. Consumption of contaminated fish can result in central nervous system impairment such as peripheral vision, mental symptoms, loss of feeling, and at high doses, seizures, and death.	No (no industry, no fish)	N/A
Total Mercury [2]	Selenium is used in manufacture of glass, pigments, rubber, metal alloys, textiles, petroleum, medical therapeutic agents, and photographic emulsions. Selenium is a nutrient at low levels, at higher levels (above 0.05mg/L) it can cause fingernail and hair changes, damage to nervous system, fatigue and irritability. Long-term exposure health effects include fingernail and hair loss, damage to kidney and liver tissue and circulatory problems.	No (no significant amounts of such industries and not a drinking supply)	N/A
Total recoverable Selenium [2]	An acid used in industry, with impacts to aquatic life.	No (no aquatic life)	N/A
Cyanide, weak acid dissociable [2,5]	Indicates discharges from water or wastewater treatment may result in impact to aquatic life.	No (no treatment sources)	N/A
Total chlorine residual [2,3,]	Pesticide used on fruits and vegetables from agriculture.	No (no agricultural sources)	N/A
Total DDT and metabolites [2]	Polychlorinated biphenyls, used in industry.	No (no industrial)	N/A
Total PCBs	Measurement of volume of water flow in cubic feet per second, data collected can be plotted on a hydrograph and show seasonal variation.	Yes	Velocity times cross sectional area measurement, staff gage or City gage flow reading
Flow [4]	The pH is a measure of how acidic or basic a solution is. Low pH indicates industrial discharges or urban toxins and reduces viability of fish and wildlife.	Yes	pH paper
PH [3,5]	Unusual odor of water	Yes	Olfactory observation
Odor [3]	Detergent sources include urban runoff from stormdrains, car washing, outdoor cleaning or screens, grills and leaking sanitary sewers. Detergents can be toxic to aquatic plants, bugs and fish and can lower oxygen levels to aquatic life.	No (refer to floating solids, oil, grease and foam)	N/A
Detergent [4,5]	Sources are urban runoff, metal plating, pesticides, and herbicides. Impacts are to aquatic life.	No (no aquatic life)	N/A
Total Copper [3,5]	Phenols come from domestic and industrial wastewater and natural waters. Sources include wood distillation, gas works, refineries, chemical plants and disinfectants. Ingestion may affect human health and aquatic life.	No (no sources)	N/A

Phenols [4,5]	Visible trash, visible human and animal waste and algal plumes all have negative affects to the riparian area and possible toxins to the waters.	Yes	Visual observation
Trash and sewage	Chloride is a major component of salinity. Levels from 400-10,000 mg/L can cause corrosion, damage to crops, and kill fish..	No (refer to TDS)	N/A
Chloride [3,5]	Sources include urban runoff (such as from car washing) and human and industrial wastewater. Impacts are aesthetic (foam).	No (refer to floating solids, oil, grease and foam above)	N/A
Foaming Agents [3]	Mostly associated with industries i.e. concrete products, steel factories, coal-mining related activities, landfills and water transportation facilities.	No (no industry)	N/A
Iron [3]	Associated with septic tank effluent, wastewater. Mainly groundwater source. May cause algal plumes, growth and eutrophication of standing water bodies.	No (refer to trash, sewer and surface scum)	N/A
Manganese [3]	Naturally occurring in drinking water. Also found in septic tanks. Health concerns are diarrhea associated with ingestion of water with high levels of sulfate. Aesthetic affect is associated with taste and odor of water.	No (refer to odor)	N/A
Sulfate [3]	Dissolved solids may consist of calcium, bicarbonate, nitrate, phosphate, iron, sulfur, and other ions found in a water body.	No (refer to conductivity)	N/A
Total Dissolved Solids (TDS) [3]	This is a field measure of general salinity levels. Levels tend to reflect natural conditions; most uses raise levels. Very high levels of salinity (e.g. over 10,000 mg/L) can cause corrosion, damage crops, and kill fish. (Conductivity meters are identical to resistivity meters, only inverse.)	Yes	Hanna DiSt WP Conductivity Meter
Conductivity [5,6]	Generally found in recovered cars, bridges and buildings.	No (no aesthetic effect)	N/A
Zinc [3]	Smell coming from stormdrains or river could be an indicator of leaking septic tanks or illicit sewage discharge.	Yes	Olfactory observation.
Odor [3]	Fluorine is a common element in the earth's crust, and is present in groundwater naturally. Fluoride increases the resistance of tooth enamel to acids that begin tooth decay. There is no visual or odor effect to surface water.	No (no aesthetic effect)	N/A
Fluoride [3]	Excess deposition or erosion can both negatively affect the condition of the watershed and alter the morphology. Extreme erosion can kill aquatic life, incise the channel narrowing it making water velocity to increase and leaving pipes exposed. Extreme deposition can kill aquatic life, fill in the riverbed,increase the potential flooding.	No (refer to bottom deposits)	N/A
Sediment	Excess deposition or erosion can both negatively effect the condition of the watershed and alter the morphology. Extreme erosion can kill aquatic life, encise the channel narrowing it making water velocity to increase and leaving pipes exposed. Extreme deposition can kill can kill aquatic life, fill in the riverbed leaving for potential flooding.	No (refer to bottom deposits)	N/A

1. State of New Mexico Standards for Interstate and Intrastate Surface Waters, Section 1105, NMWQCC, (2000).
2. State of New Mexico Standards for Interstate and Intrastate Surface Waters, Section 3100, NMWQCC, (2000).
3. 40 CFR ch.1 (7-1-99 Edition) 141.51 Environmental Protection Agency, (1988).
4. Texas Natural Resources Conservation Commission, Texas Watch Urban Monitoring Manual. Austin, TX, (2000).
5. Lee Wilson and Associates, El Paso Water Quality Appendix, Bureau of Reclamation Drains for Stormwater Conveyance by El Paso, Santa Fe, NM., (1990)
6. NMED, Watch Our Waters Volunteer Monitoring Handbook, (1998).

6.3 Step Three - Third Level of Screening

6.3.1 Regularly Monitored Parameters

1. Floating Solids, Oils and Grease
2. Color
3. Bacterial Pathogens
4. Odor
5. Trash, Sewage and Surface Scum
6. Foam
7. Conductivity
8. Sediment
9. Plant Nutrients (Nitrate-nitrogen)
10. Turbidity
11. Flow

6.3.2 Future Monitoring Parameters to Consider

1. Bacterial Pathogen Identification
2. Detergents
3. Total copper
4. Total Dissolved Solids
5. Phenols
6. Other heavy metals

7.0 Techniques in Determining the Monitoring Area and Monitoring Points

7.1 Monitoring Area

The monitoring area will be located within the urban reach, beginning east of Delgado Street and ending at Sicomoro Street (north side of river) adjacent to Alto Street Park (Map 2). This area was selected for monitoring because (1) it is the most heavily urbanized zone within the urban reach and therefore, it is hypothesized, the most susceptible to water quality and storm flow impacts; and (2) because there are no other routine monitoring programs in the urban reach, this monitoring project will be filling an information gap.

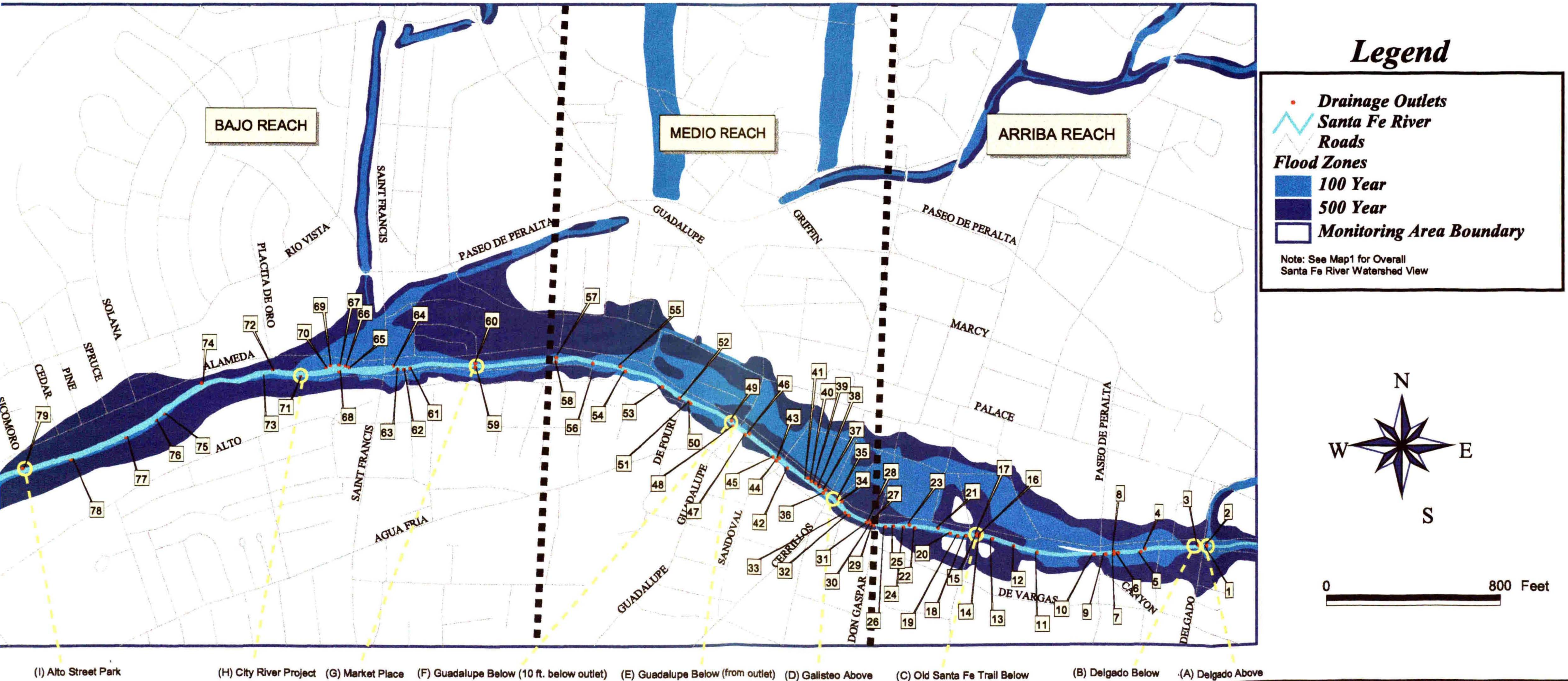
7.2 Monitoring Points within the Monitoring Area

Plotting all the drainage outlets onto a map was the primary step in the evaluation of the location and number of monitoring points that would be needed Photograph 1 shows an example of this process. Drainage outlets are pipes that drain water (storm water, greywater etc.) from streets, restaurants, buildings, parks or any other areas. Refer to Photograph 2 and 3 for photos of typical drainage outlets on the urban reach of the Santa Fe River. Large cities over 100,000 in population are required to process these types of waters before entering a stream, but smaller cities like Santa Fe have not been required to do so (such controls will be required in 2002, see section 5.0, number 2); thus the water drains directly to the river.

Map 8 shows all the drainage outlet points that were plotted within the monitoring area. The method used to plot the drainage outlets was to walk the entire urban reach of the

Santa Fe River Monitoring Area

Drainage Outlet Points

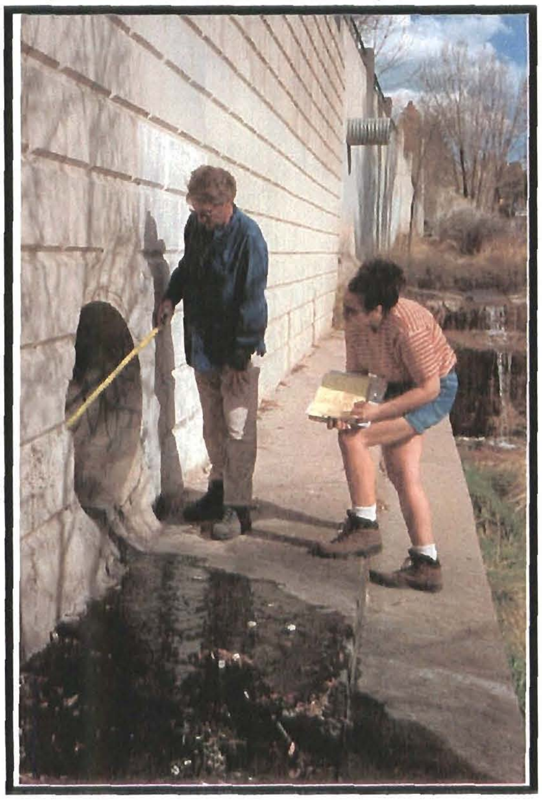


Prepared by: Joy K. O'Neil
Master of Water Resources
University of New Mexico

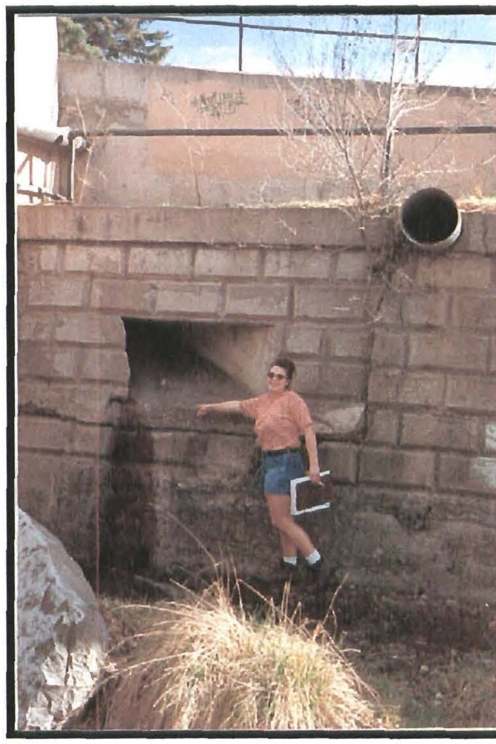
Date: July 12, 2000

Source: City of Santa Fe
Santa Fe, New Mexico

Photograph 1 Plotting the drainage outlets onto a map and describing the location of the outlet



Photograph 3 Typical drainage outlets



Photograph 2 Typical drainage outlet in the urban reach of the Santa Fe River

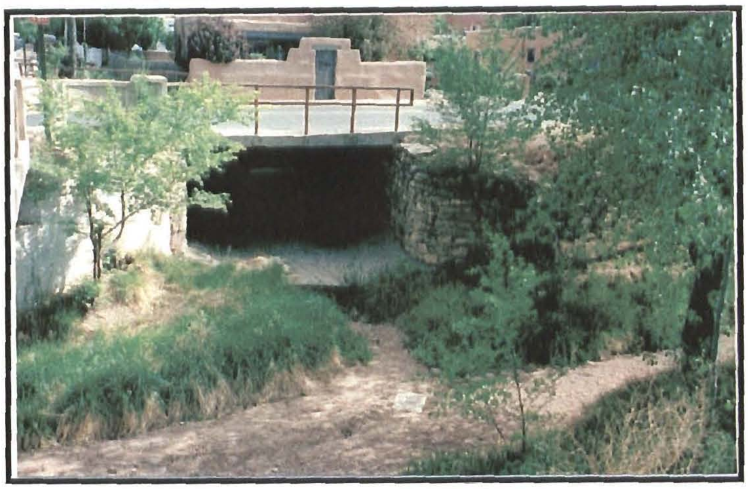
River, plotting the drainage outlets by hand on a map provided by the City of Santa Fe Planning Geographical Information Systems (GIS) Department.

Outlets were then recorded on a computer using ArcInfo and ArcView GIS. The table in Appendix B is a detailed description of drainage location, pipe diameter and comments with an asterisk placed at drainage outlets of most concern due to odor, color and discharge without a storm event. This table can be used with Map 2 for locating drainage outlets.

From this process, the monitoring area was split up into three reaches: Arriba (upper), Medio (middle) and Bajo (lower), Map 8 shows these reaches. Within each reach, three monitoring locations were chosen, for a total of 9: they are highlighted with a yellow circle on Map 8. Refer to Photographs 4-11 (a highlighted yellow circle on the photo coincides with the circle on the map). Refer to Table 4 for the rationale of each chosen monitoring location.

There are two types of monitoring in this project: "wet data" monitoring and the River Journal for observational monitoring. Refer to the handbook in Appendix C for details of the two types, and refer to Table 3 and 4 for the schedule, parameters, monitoring locations.

Photograph 4 Monitoring Location A – Above Delgado St. and Arroyo Saiz

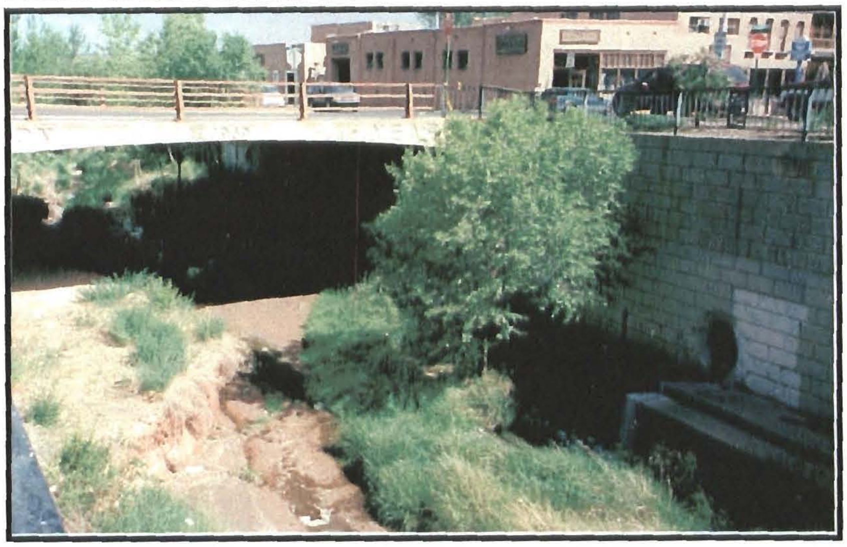


ARRIBA REACH MONITORING LOCATIONS

Photograph 5 – Location B – Below Delgado St. and Arroyo Saiz

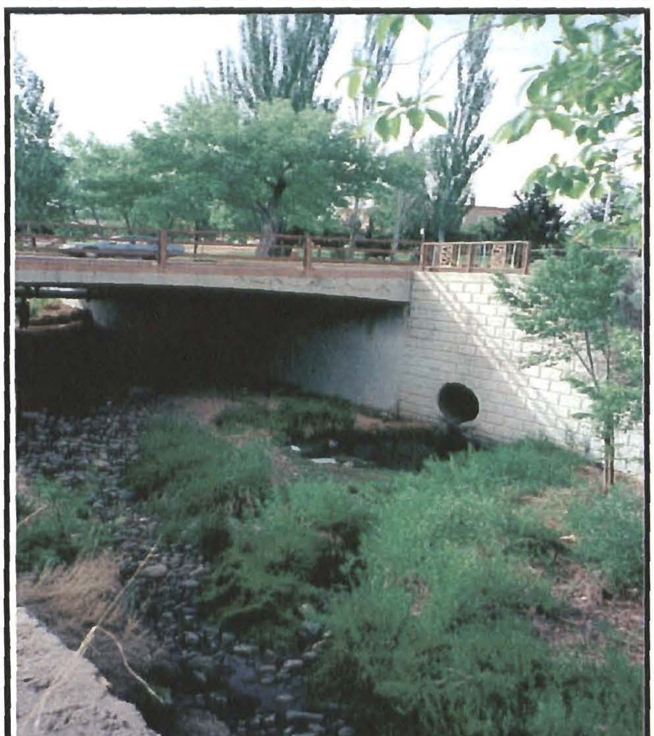
Photograph 6 – Monitoring Location C – Below Santa Fe Trail

Photograph 7 – Monitoring Location D – Above Galisteo

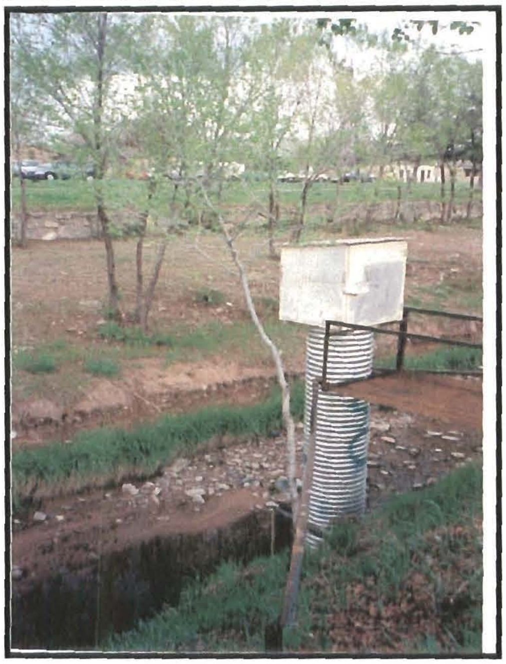


MEDIO REACH MONITORING LOCATIONS

Photograph 8 – Monitoring Location E and F
E – Drainage outlet #48, West of Guadalupe St.
F – Approximately 10 ft. downstream of E

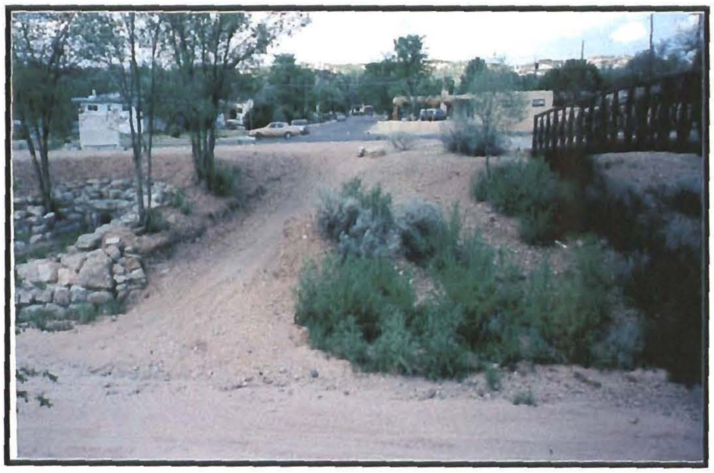


Photograph 9 – Monitoring Location G – Adjacent from the Market Place on Alameda St. directly below gaging station # 08316530



BAJO REACH MONITORING LOCATIONS

Photograph 11 – Monitoring Location I – North of Alto St. Park. West side of



Photograph 10 – Monitoring Location H – City river project area West of St. Francis, West side of footbridge, below Arroyo Mascaras

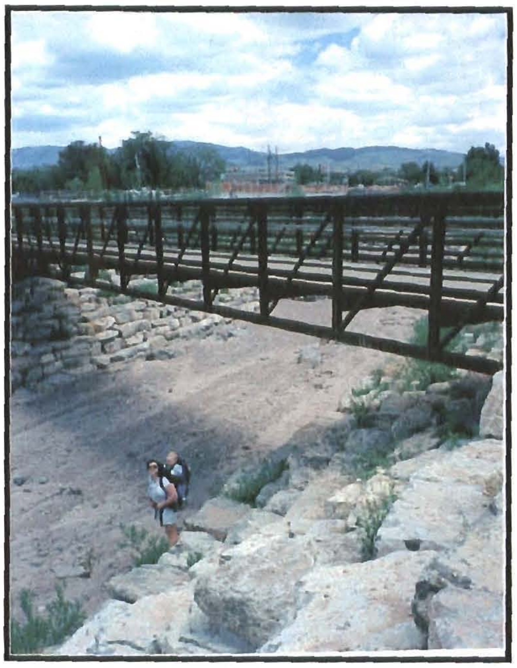


Table 3 Monthly Monitoring Parameters and Locations

RJ = The River Journal
WET = "Wet data" Monitoring

PARAMETER	MONITORING LOCATIONS								
	Arriba			Medio			Bajo		
	A	B	C	D	E	F	G	H	I
Channel	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Flow (present/not present)	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Color	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Oil, Grease, Gasoline and Foam	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Odor	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Trash/Sewage	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
PH	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Turbidity	-----	-----	-----	-----	-----	-----	-----	WET	-----
Nitrate	-----	-----	-----	-----	-----	-----	-----	WET	-----
Bacterial Pathogens	-----	-----	-----	-----	-----	-----	-----	WET	-----
Conductivity	-----	-----	-----	-----	-----	-----	-----	WET	-----
Flow (measurement)	-----	-----	-----	-----	-----	-----	*WET	WET	-----

* This flow measurement will be recorded from the City flow gage.

Table 4 Monitoring Locations, Rationale, Frequency and Monitoring Parameter Source

(Refer to Figure 4-11 for photographs of monitoring locations)

REACH	LOCATION	IDENTIFICATION	RATIONALE	FREQUENCY	MONITORING PARAMETER SOURCE
ARRIBA	A	Delgado above	Baseline, above Arroyo Saiz	Whenever possible, at least once a month (15^{th} of every month and/or during a storm event is recommended)	The River Journal
ARRIBA	B	Delgado below	Below Arroyo Saiz , sediment issue	Whenever possible, at least once a month (15^{th} of every month and/or during a storm event is recommended)	The River Journal
ARRIBA	C	Old Santa Fe Trail below	Cluster of drainage outlets, mid-downtown, water quality issue	Whenever possible, at least once a month (15^{th} of every month and/or during a storm event is recommended)	The River Journal
MEDIO	D	Galisteo above	Adverse effects from drainage outlet 35, water quality issue	Whenever possible, at least once a month (15^{th} of every month and/or during a storm event is recommended)	The River Journal
MEDIO	E	Guadalupe below (directly from drainage outlet)	Water with no precipitation, stagnant pond, odor	Whenever possible, at least once a month (15^{th} of every month and/or during a storm event is recommended)	The River Journal
MEDIO	F	Guadalupe below (10 feet below drainage outlet)	Adverse effects from drainage outlet 48, water quality issue	Whenever possible, at least once a month (15^{th} of every month and/or during a storm event is recommended)	The River Journal
BAJO	G	Marketplace	City of Santa Fe flow gage (08316530) location, above Arroyo Mascaras	Whenever possible, at least once a month (15^{th} of every month and/or during a storm event is recommended)	Flow (City of Santa Fe flow gage data), The River Journal
BAJO	H	City river project	City river project, Arroyo Mascaras, sediment issue	15^{th} of every month and during first storm event of each month (if applicable)	"Wet data" conductivity, turbidity, fecal coliform, nitrate, flow, River journal
BAJO	I	Alto Street Park	End of monitoring area	Whenever possible, at least once a month (15^{th} of every month and/or during a storm event is recommended)	The River Journal

8.0 Steps in Planning a Successful Monitoring Program

Below is a list of steps to follow to establish a successful monitoring program. These are the steps that were thought out and implemented for the Santa Fe urban reach monitoring program. Refer to the Volunteer Monitoring Field Handbook for the urban reach of the River (Appendix C) for the complete program background, goals of the program, monitoring types ("wet data" and river journal), schedule, and data recording.

8.1 Steps

- Identify the watershed and issues surrounding the watershed (refer to Sections 2.0 and 3.0) and determine a rationale for selecting a focus area (refer to Section 5.0).

- Research all existing monitoring efforts along the river and summarize the parameters (refer to Table 2 for summary and the table in Appendix A for details).

- Start the recruiting process, with a general introductory meeting (see Introduction Meeting Agenda in Figure 3). Refer to Figure 2 for introduction meeting invitation.

Figure 2 Invitation for Introductory Meeting

> ***The pleasure of your company*** IS REQUESTED AT A **SANTA FE WATERSHED ASSOCIATION POTLUCK DINNER AND GENERAL MEETING -- THURSDAY MAY 4TH FROM 6 TO 8:30**
> CAPSHAW JUNIOR HIGH SCHOOL LIBRARY
> ZIA ROAD BETWEEN ST. FRANCIS & BOTULPH
> *PLEASE BRING FOOD OR DRINK TO SHARE.*
>
> The agenda will include a presentation by Capshaw students on their special study of the Santa Fe River; a report from Joy O'Neil on the Watershed Association's river monitoring project; a quick update on the rest of our activities; and multiple opportunities to get involved in the projects that interest you most. For further information contact Paige Grant at 982-4081 (*paige@trail.com*).
>
> **ALSO REMEMBER:** (1) Acequia Madre's spring cleaning in late April: contact Eleanor Bove at 983-3546; (2) Walking tours of the upper Santa Fe River watershed, the last Saturday of every month: call Leslie C. de Baca at City Water Division, 954-7120.

Figure 3 Introductory Meeting Agenda

Urban River Volunteer Monitoring Meeting

5-4-00
Joy K. O'Neil
Master of Water Resources

As part of my master's degree professional project, I am developing a Volunteer Urban River Monitoring Handbook. The Santa Fe River is VERY unique from other rivers in that it is partially in the urban reach and this particular reach is ephemeral and there is minimal aquatic life. These conditions make it difficult to decide on monitoring parameters.

The objective of the monitoring plan is to protect water quality for existing uses which are **wildlife, contact recreation** and **aesthetics.**

Keeping in mind these three uses, I have gone through a three-step process on deciding parameters to satisfy these uses:

1. **First Level Screening** -- research and list state and federal standards as well as several monitoring programs for parameters
2. **Second Level Screening** – table format of all parameters from first screening with list of definitions, relevance or non-relevance, and equipment needed
3. **Third Level Screening** – table format of all parameters specifically selected for monitoring area with definitions, and equipment needed (see attached document)

I NEED YOUR INPUT!

1. **Proposed Third level screening (see attached)**
2. **Proposed Monitoring locations (see attached)**
3. **Monitoring schedule for storm events and non-storm events**
4. **VOLUNTEERS!!!**

- Locate an area that is not consistently being monitored and/or area of interest to monitor. The area of interest in the case of the Santa Fe Watershed Association and this monitoring program was the area that is most impacted by urban development, concentration of storm drainage outlets, erosional impacts as well as an area that has not been closely monitored (refer to Map 1 and 2 for the monitoring area chosen).

- Walk the area of interest within the selected reach, locate all the drainage outlets into river, measure their size, and record observations. Plotting the outlets with GIS makes for easier identification. Refer to GIS generated Map 2 for drainage outlets and Appendix C for the detailed description of each outlet. By locating the drainage outlets, it is easier to designate the "Monitoring Area" and assign monitoring locations within the Monitoring Area. The Monitoring Area is further split into three reaches (Arriba, Medio and Bajo) and three monitoring points were decided for each reach. There is also observation at each drainage outlet within the reaches. Refer to Photograph 4-11 for each monitoring point with each reach.

- Research existing monitoring programs and incorporate parameters and ideas that may apply (refer to section 6.0 for programs considered).
- Identify all water quality standards for surface waters then narrow them down to a list of parameters that may apply to the Santa Fe urban reach

monitoring area (refer to section 6.1-6.3 for details of standards and sources).

- A list is then devised of all the parameters that are to be measured (refer to section 6.3 for the list for the Santa Fe River Urban Reach).

- Write the monitoring handbook based on the list of monitoring parameters. From the list and advice from others, it was determined that "wet data" monitoring would be limited to the downstream end of the reach and a river journal at other locations for observational monitoring. Refer to the Neighborhood River Watch Volunteer Monitoring Field Handbook in Appendix C for the description of the two types. In the process of writing the handbook, many questions came up, such as: when to monitor; exactly how to monitor (especially for the River Journal for Observational Monitoring); who will monitor what; and, at what monitoring locations. The handbook in the appendix answers all these questions.

- Continue the recruiting process. In our case, everyone on the Santa Fe Watershed Association mailing list who lives near the river was invited to the Phase 1 monitoring training. Table 5 is a list of all the people who were called and their response. A postcard is also mailed out inviting the 240 individuals who are on the Santa Fe Watershed Association mailing list (refer to Figure 4).

- Finalize maps are required as part of the handbook (refer to Map 2).

- Design and order T-shirts for distribution to the first 12 monitoring volunteers (in our case funding was provided by Santa Watershed Association grants). Refer to Figure 5 for the T-shirt design.

- Order monitoring materials to supplement the existing materials. Refer to Table 6 for "new" materials needed and who to contact to order more when needed, as well as cost and "existing" materials for monitoring.

- Design, and purchase materials to construct and assemble handbooks for volunteer monitors. Refer to Table 7 for a list of materials, where to purchase materials if more are needed and associated cost. This list will help the next monitoring coordinator make the appropriate purchases for more handbooks as the program expands.

- Conduct Phase 1 Training (June 10, 2000). Refer to Figure 6 for the Phase 1 training agenda. Make phone/address list of all volunteers who were recruited (phone list for the Santa Fe River Watchers is in the back of the handbook).

Table 5 Phone List for Recruiting Volunteers

NAME	PHONE NUMBER	RESPONSE
John Porter	434-0599	Maybe, call in the Fall
Rich Schrader	992-0726	Yes
Mary Ann Waltz	Mailed a notice only	No answer
David Ohori	Mailed a notice only	No answer
Anita Sanders	988-5934	No
Malinda Romero-Pike	471-0285	Maybe, call in the Fall
Amy Lewis	954-7123	No
Chris Wuest	820- 7458	No
Charlene Owen	982-6648	No
Gert Tierney	989-5464 (Gonzales Elementary School)	Yes, in the Fall with her school kids
Kent Williamson	989-8606	Yes
Greg Mellow	820-7822	No
Craig Ohare	954-7125	No
Michael Smith	995-1013 cel 490-1159	Yes
Harvel Sabastian	983- 6364	No answer
Neal Schaffer	827-2912	No
Virginia Gould	466-2225	No answer
Lauri Hakola	466-2225	No answer
Zachary Grifen	466-4621	No answer
Jan-Willem Jansen	H747-1592 W982-9806 811 St. Michaels Dr. Suite 106, Santa Fe, NM 87505	No, but very interested in keeping in touch because he is working on a monitoring program for the Galisteo Watershed.
Andrew Kelton	95-0095	No answer
Mary Ann McGraw	450-8883	No
Moria Peters	820-2499 1710 W. Alameda #9 Santa Fe, NM 87501	Yes, but interested farther downstream. Can start in July.
Pam Homer	474- 7973	No
Jamie Brytouski	438-3389	No answer
Sam Kunkle	466-9182	No
Mark Tardiff	662-0730 #12	Yes
Nina Wells	827-0572	Interested but no time.
Neil Williams	H988-4359 W982-5180	Yes
Ted Williams	984-2664	Yes
Wil Barnes	982-8748	Yes
Lesile Barclay	982-1000	No
Andrew Kelton	995-0095	No answer
Cathie Sullivan	982-7144	No answer
Pat Coppel	955-0701	No answer
Miles Conway	424-1404	No
Ron Sandoval	984-6628	No answer
Pat D'Anvrea	466-0635	No answer
Alan Jager	984-0904	No answer
Bob Ertmer	424-3815	No answer
Lesily Dieruf	474-5810	No answer
John Horning	988-9126	No answer
Freddy Johnson	W982-1829 #262 H989-8008 Santa Fe Prep Home- 820 E. Zia Rd., Santa Fe, NM 87505	Yes, in the Fall on Thursdays with her school kids
Jay Sheldon	W982-1829 Santa Fe Prep	Freddy thinks Jay will be interested with his kids starting in the Fall
Richard Jennings	986-1719, 471-5180	No answer
Bob Jankes	827-5733	No
Nicoli Bachman	988-4304	No answer

Figure 4 Invitation for Phase 1 Training

The Santa Fe Watershed Association announces two important events:

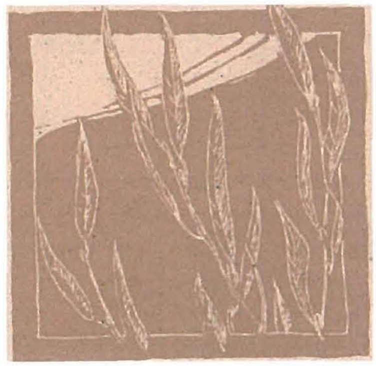
June 10th: kickoff meeting and training for **Neighborhood River Watch**. Meet at the Santa Fe River in front of the Supreme Court (Don Gaspar bridge) at 9:00 a.m. Dress for a walk in the riverbed. First 12 Riverwatchers get Watershed Association T-shirts, featuring our famous water strider! More information? Joy O'Neil, 988-1095.

June 27th: colloquium on forest management issues relevant to the upper Santa Fe watershed, including fire return intervals; thinning to reduce the incidence of crown fire; management of riparian zones; etc. Public meeting 6-9 p.m. at State Land Office, Old Santa Fe Trail just south of the river. Technical discussion 12-4 at Forest Service office on Rodeo Road. For more information, call Paige Grant, 982-4081.

Figure 5 T-shirt Design

FRONT DESIGN

SANTA FE



WATERSHED ASSOCIATION

BACK DESIGN

NEIGHBORHOOD RIVER WATCH

Santa Fe, New Mexico

Table 6 Monitoring Materials, How to Order, and Cost

NEW MATERIALS (Santa Fe Watershed Association budget)	**EXISTING MATERIALS** (NMED Donation)	**HOW TO BUY MORE**	**COST**
Latex Gloves 25904-03		HACH Company 1-800-227-4224	PK100 = $24.00
PH Test Strip 0-14 26013-00		""	PK 100 = $13.00
Whirl-Pak Sampling Bags Sterile w/ Dechlorinating Agent 177ml		""	PK 100 = $18.55
Pathoscreen Medium Presence/Absence Powder Pillows		""	PK 50 = $33.39
Distilled Water		Albertsons	1 Gallon = .89
Garbage Bags		""	50 bags = $3.59
Paper towels		Walmart	2 pack = $3.38
Antibacterial Wet Wipes		""	1 Pack = 2 $1.50
	Conductivity Meter (calibration solution may be ordered from Hanna)	Hanna	N/A
	Nitrate Test Kit (Nitrate #1 and #2 tablets may be ordered from La Motte)	La Motte	N/A
	Turbidimeter (calibration solution may be ordered from Orbeco-Helllige)	Orbeco-Hellige	N/A

Table 7 Materials, Where to buy more, and Cost

MATERIALS	HOW TO BUY MORE	COST
Notebook Binder	Walmart	1 binder = $2.34
Pencil Case to carry rubber glove, plastic bags and pH paper	Walmart	1 case = .58
Envelopes for holding maps	Office Depot	1 envelope = .25
Ruler	Walmart	1 ruler = .24
Ziploc bags for color and odor observation	Walmart	100 bags = $1.50

- Conduct Phase 2 training. This process took about two weeks to schedule everyone for a one-on-one training (~ June 15-June 30). Refer to the Background section of the handbook for details of the Phase 1 and Phase 2 training. Refer to Table 8 for the trained River Watchers, their designated reaches and the schedule of phase 2 training.

- Collect and organize data results from the monitoring conducted in Phase 2 into a spreadsheet. Refer to Table 9 for June monitoring results. This spreadsheet helps keep the data in order and a "state of the river" report will be written and distributed to interested parties. (The spreadsheet and "state of the river" report will be maintained by the next Monitoring Coordinator).

- Spread the word that we are looking for a monitoring coordinator to start August 1st to continue the monitoring program. (There are three people interested in becoming monitoring coordinator.)

- The phone list in Table 6 can serve as a database for the Monitoring Coordinator to call people for Fall training.

Table 8 Trained River Watchers, Designated Reach, River Journal or "wet data" Monitoring and Phase Two Training Schedule

RIVER WATCHER	REACH	RIVER JOURNAL OR "WET DATA" MONITORING	TRAINING DAY
Kristen Kuester 1622 Paseo Conquistadora SF, NM 87501	Bajo Reach, last monitoring location (I) and down to her house	River Journal	June 13th
Elizabeth Farley 621 Gomez Rd. SF,NM 87501	Bajo Reach, last monitoring location (I) and down to her house	River Journal	Kristen trained Elizebeth since they monitor together on their walks
Rich Schrader 1803½ Agua Fria SF, NM 87501	Bajo Reach	Both	June 15th and June 20th for "wet data" monitoring training
Michael Smith 240 Closson St. SF, NM 87501	Medio Reach	River Journal	June 16th
Paige Grant 60 Canada Villlage Rd. SF, NM 87505	Medio Reach	River Journal	June 16th
Neil Williams	Medio Reach	Both	To be Scheduled
Will Barnes 322 Otero SF, NM 87501	Arriba Reach and Bajo Reach for "wet data" monitoring	Both	June 15th and June 20th for "wet data" monitoring training
Ted Williams 250 E. Alameda #814 SF, NM 87501	Arriba Reach	River Journal	June 15th
Mark Tardiff 19 Estambole Rd. SF, NM 87505	Arriba Reach	River Journal	June 20th
Olivia 473-5708	Below Bajo, near her house in Agua Fria	River Journal	To be scheduled

Table 9 June 2000 River Journal Monitoring Results

* = Baseline installation measurement

? = No data recorded

Monitoring Location	Arriba	Arriba	Medio	Medio	Medio	Bajo
Monitoring Reach	A	C	D	E (drainage outlet)	F	H
River Watcher	TW	TW	PG, MS	PG, MS	PG, MS	RS
Date	6/15/2000	6/15/2000	6/16/2000	6/16/2000	6/16/2000	6/15/2000
Time	8:45:00am	9:40:00am	2:05pm	2:50		8:00pm
WEATHER						
Now	Sunny	Sunny	Sunny	Sunny	Sunny	Clear
Past 24-48 Hours	Sunny	Sunny	Overcast	Overcast	Overcast	Clear
WATER						
Flow						
Amount	None	None Trickle	Yes	None	None	None
Width	N/A	N/A	?		N/A	N/A
Depth	N/A	N/A	?		N/A	N/A
pH	N/A	N/A	?	9	N/A	N/A
Aesthetics	N/A	N/A			N/A	N/A
Color	N/A	N/A	2	7	N/A	N/A
Odor	N/A	N/A	No	7	N/A	N/A
Description	N/A	N/A		Stagnant, rotten	N/A	N/A
Oil Sheen/Foam/Scum	N/A	N/A	Foam	Scum	N/A	N/A
Description	N/A	N/A	Much algae		N/A	N/A
CHANNEL						
North Pin	*12.7cm	N/A	N/A	N/A	N/A	*7.5cm
Middle Pin	*10.5cm	N/A	N/A	N/A	N/A	*6.8cm
South Pin	*7.2cm	N/A	N/A	N/A	N/A	*9cm
Trash/Sewage	Trash	Trash	Trash - plastic	Trash/Sewage	N/A	Trash - broken glass
Description			bottles and bags bike frame, cans			& plastic, no large pieces

Cont. June 2000 River Journal Monitoring Results

DRAINAGE OUTLET NUMBER	9	12	16	18 & 19	22	35	37
Flow	0	<1 gpm	0	<1 gpm	<1 gpm	<1 gpm	>1 gpm
Description						Looks like a constant flow. Pond below outlet 12'x6".	perrenial, black algae
Isolated Pool	Yes	Yes	Yes	Yes	No	Yes	Yes
Depth	3"	2"	5"	8"	3"	6"	
Width	18"	24"	3"-5"	6'	36"	12'	1' x 3'
Color of Pool (color chart p. 26)	6	2	7	4	2	3	2
Odor, describe	None	None	None	None	None	Sewery (hotel kitchen?)	None
Oil Sheen/Foam/Scum	None	None	Scum	None	None	None	None

DRAINAGE OUTLET NUMBER	43
Flow	<1 gpm
Description	perrenial
Isolated Pool	Yes
Depth	2'
Width	12'
Color of Pool (color chart p. 32)	black
Odor, describe	organic
Oil Sheen/Foam/Scum	?

ADDITIONAL DRAINAGE OUTLET AND FLOW OBSERVATIONS

TW - #11 runnning <1gpm, river flow - clear water from here down, some slime, insects and red worms, no odor, 20 ft. downstream prolific algae, flow disappears just above #16.

#22 below is wet w/ algae, no flow

PG, MS - #28 appears to be used as squirl nest, below #28 through D: weepholes on both sides of river, some active wet patch in grass on E side of Galisteo, we assume longterm seepage is what is showing up I river. River flow from above D to #41 seems to be partly groundwater.

#37 <1 gpm perrenial, black algae pool 1'x3' wide, clear no smell. #43 constant flow, Below 43 ther is flow approx. 40', guy sleeping under bridge

NAME ABBREVIATIONS

Ted Williams - TW	Rich Schrader - RS
Paige Grant - PG	Kristen Kuester - KK
Michael Smith - MS	

8.2 Revisions and Additions

8.2.1 Revisions

After completing the first copy of the handbook and training, many new ideas came up. The River Watchers had some great ideas and the handbook was revised a number of times after Phase 1 and Phase 2 training. The main revisions are as follows:

- Change the River Journal Worksheet to a table format for easy recording. Include all the drainage outlet numbers 1-79 on the table so the river watchers can record observation at each drainage outlet within their reach.

- On the River Journal table worksheet also include flow or no-flow in the river at each drainage outlet rather than only at the monitoring location. This will help identify if there is a trend of flow patterns in the river to identify possible seepage and losing or gaining flow patterns.

- There are approximately three River Watchers at each reach; responsible for observational River Journal monitoring on the 15th of each month. It was agreed that the river watchers should try to monitor together on that day, or at least two of the three get together. This will help in attaining consistent and non-repetitive data, and also is a good safety measure. Only one set of data will be recorded for the event.

- During the first Phase 2 training session, the River Watcher found it difficult to identify each drainage outlet just by using Map 2; thus, Appendix B has been included in the River Journal. The Phase 2 training sessions following the addition made for easier identification and observation.

8.2.2 Additions

There are several tasks that have not been added due to time constraints. The first is the staff gage to record flow. It was recently donated by the New Mexico Environmental Department Surface Water Quality Bureau (NMED). It needs to be installed and calibrated. It will be located at Monitoring Location H along with the other "wet data" monitoring parameters. The next Monitoring Coordinator will work with the NMED on the installation of the Staff Gage.

The other addition is the Site Characterization. This will be a general characterization of morphology of the streambed, banks and slope will give a better idea of where the sediment is being deposited or eroded in a given area. This will be conducted on yearly basis using survey equipment.

9.0 Conclusion

This particular monitoring plan is one-of–a-kind. Through the research of existing monitoring programs, there were none found like this one, involving two types of monitoring ("wet data" monitoring and River Journal for Observational Monitoring) and especially focusing heavily on storm flow. There appear to be no other monitoring programs on rivers with intermittent flow such as the Santa Fe River-urban reach. Also, there are no State standards for ephemeral streams other than coliform and the parameters on which this monitoring program is based are from existing programs and standards for perennial streams and drinking water standards.

Researching and writing a monitoring plan is in the control of the writer, but actually getting the public to participate is in a sense, out of ones' control. The implementation of this program happily was a huge success. Out of the approximately 240 individuals invited, 11 were recruited and by the fall 2000 approximately 25 will be participating depending on how many school will get involved. Out of the 11 River Watchers, three were interested on becoming the next monitoring coordinator.

After implementing this plan for one year, the current monitoring coordinator will write-up an "end-of-the–year" report. The report may reveal alterations to the program, such as:

1. Deletion or addition of parameters. For example, if nitrate remains constant at each monitoring location for the year, then nitrate monitoring may be deleted from the program or possibly, the monitoring locations can be moved. An example of a possible addition may be if the bacterial pathogen screening reveals positive trends, then the next step would be to detect what types of bacteria are in the samples. This would require a more expensive testing procedure: the sample would need to be incubated and bacteria colonies identified and counted. Lee Wilson with Lee Wilson of Associates has donated the incubators for this type of analysis, but the media would need to be purchased. Another parameter that may change is the Pin and Washer measurement. This parameter measures soil erosion or deposition. Since the main flow is storm water, pins and washers may be swept away in an event.

2. There were several River Watchers that were interested in the River Journal, but were focused on the river near their house downstream from the designated Monitoring Area. These people were given a Handbook and encouraged to observe the area of their interest. Given this volunteer involvement, the Monitoring Area may be extended as necessary.

3. Along with consideration number 2, it would be helpful for accurate and efficiency if each drainage outlet had their designated number stenciled in

paint or tagged just above the outlet. If the Monitoring Area was expanded as suggested above, the stenciling could continue from 79 downstream and start with 0 then –1 and so on upstream.

4. A couple of schools were called and the teachers were very interested in the monitoring program starting in the fall. The Monitoring Coordinator can call all the schools and get teachers and students involved in the observational monitoring with the River Journal.

The end-of-the-year report should be distributed not only to the volunteers and the Santa Fe Watershed Association members, but also City, County and state agencies. If there are special concerns such as: (1) presence of bacterial pathogens; (2) constant flow coming from drains; (3) consistent odors; and (4) high levels of parameters from the "wet data" monitoring, then the City and possibly the Environment and Health Departments should be notified.

Interested parties such as the City of Santa Fe and the storm water management plan committee should be invited on guided river walk tours with the River Watchers and Monitoring Coordinator. This will help to educate and involve the interested parties. This monitoring plan can directly aid in the planning and implementing process of future river projects and with the Stormwater Management Plan which is due in the year 2002.

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APPENDIX A

Comprehensive List of all Water Quality Monitoring for the Santa Fe River

Monitoring Group: Watershed Watch
Monitoring Locations: Cieneguilla Bridge
Latitude: 35° 37′ 36.27″ Longitude: 106° 07′ 10″
Santa Fe River below Wastewater Treatment Plant
Latitude: 35° 63′ N Longitude: 106° 09′ W
School Name: Capital High
Teacher Name: Donna Schmidt
School Year: Continuous since 1995
Contact Person for More Information: Bill Fleming, Director- 982-8313; Rich Schrader, Coordinator- 992-0726

PARAMETERS	METHODOLOGY	FREQUENCY
PHYSICAL		
Streamflow in cfs	Velocity x cross section	Monthly (Aug.-May)
pH	pH paper	""
Water Temp. (C°)	Thermometer	""
Hardness (mg/l)	Hach Spectrophotometer	""
Turbidity (NTU)	Hach Turbidimeter	""
CHEMICAL (mg/l)		
Aluminum	Hach DR2000 Spectrophotometer	When time allows
Ammonia (1997-98)	""	""
Chlorine (1997-98)	""	""
Copper	""	""
Chromium	""	""
Iron	""	""
Nitrate	""	""
Total Phosphorus	""	""
Silver	""	""
TDS (mg/L)	Hach "pen pal"	Monthly (Aug.-May)
Zinc (1997-98)	Hach DR2000 Spectrophotometer	When time allows
BIOLOGICAL		
Benthic Macroinvertebrates:	Kicknet Sieve 1m^2 area	1-2 times a year
Standing Count	Visual count	""
Total # Taxa	""	""
Percent Dominant Taxa	""	""
*EPT Index	""	""
*FBI Index	""	""
General Observations		

*EPT = Latin name of the orders mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trocoptera)
*FBI = Family Biotic Index. The method uses a tolerance index or riparian health survey which indicates the tolerance of families of insects to unnatural disturbance. A value of 10 indicates a very high tolerance to sediment, toxic chemicals and other types of pollution, and an insect that does not require a high quality watershed to survive. A value of 0 and 1 shows that the insect is "very sensitive" to human disturbance and therefore is an indicator of excellent watershed and riparian conditions.

Monitoring Group: Watershed Watch
Monitoring Locations: Santa Fe River below La Bajada above USGS gauge on Santa Fe National Forest land
Latitude: 36° 32′ 45″ Longitude: 106° 12′ 00″
School Name: Cochiti School
Teacher Name: Victor Castagna
School Year: Continuous since 1995
Contact Person for More Information: Bill Fleming, Director- 982-8313; Rich Schrader, Coordinator- 992-0726

PARAMETERS	METHODOLOGY	FREQUENCY
PHYSICAL		
Streamflow in cfs	Velocity x cross section	Monthly (Aug.-May)
pH	pH paper	""
Water Temp. (C°)	Thermometer	""
Hardness (mg/l)	Hach Spectrophotometer	""
Turbidity (NTU)	Hach Turbidimeter	""
CHEMICAL (mg/l)		
Aluminum	Hach DR2000 Spectrophotometer	When time allows
Ammonia (1997-98)	""	""
Chlorine (1997-98)	""	""
Copper	""	""
Chromium	""	""
Iron	""	""
Nitrate	""	""
Total Phosphorus	""	""
Silver	""	""
TDS (mg/L)	Hach "pen pal"	Monthly (Aug.-May)
Zinc (1997-98)	Hach D2000 Spectrophotometer	When time allows
BIOLOGICAL		
Benthic Macroinvertabrates:	Kicknet Sieve 1m² area	1-2 times a year
Standing Count	Visual count	""
Total # Taxa	""	""
Percent Dominant Taxa	""	""
*EPT Index	""	""
*FBI Index	""	""
General Observations		

*EPT = Latin name of the orders mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trocoptera)
*FBI = Family Biotic Index. The method uses a tolerance index or riparian health survey which indicates the tolerance of families of insects to unnatural disturbance. A value of 10 indicates a very high tolerance to sediment, toxic chemicals and other types of pollution, and an insect that does not require a high quality watershed to survive. A value of 0 and 1 shows that the insect is "very sensitive" to human disturbance and therefore is an indicator of excellent watershed and riparian conditions.

Monitor: USGS
Frequency: Constant

PARAMETER	LOCATION DESCRIPTION	LOCATION (lat/long)	METHODOLOGY (gauges)
Streamflow, Santa Fe River	Inflow to McClure Reservoir	35° 41′ 20″ 105° 49′ 17″	USGS # 8315480
""	Between reservoirs	35° 41′ 12″ 105° 50′ 35″	USGS # 8316000
""	Below Nichols Reservoir	35° 41′ 22″ 105° 52′ 55″	USGS # 8316505
""	Above St. Francis	35° 41′ 19″ 105° 57′ 02″	USGS # 8316530
""	Ricardo Rd.	35° 40′ 44″ 105° 5′ 27″	USGS # 8316585
""	Above Cochiti	35° 32′ 49″ 106° 13′ 41″	USGS # 8317200

Data User: City of Santa Fe Water Company
Contact person for more information: Amy Lewis 954-7123

Monitor: State Land Office
Frequency: Baseline and Periodically Revisit

Parameter	Location Description
X-Section onto Floodplain	State Land Reach of Santa Fe River above Bypass Route crossing
Stream Profile	""
Particle Size Distribution	""
Embeddedness	""

Monitoring Group: NMED Surface Water Quality Bureau
For more Information, refer to the Quality Assurance Project Plan for Water Quality Management Programs 1999 (SWQB, NMED): Kristen Dors (505) 827-2904 or Julie Tsatsaros (505) 287-2814
For Information on Methodology Contact: Chris Dean (505) 821-2555
Frequency: Daily, Fecal Coliform- Periodically

Parameter	Parameter (cont.)	Location Description for all Parameters
Temperature (C°)	Cd (ug/L)	Santa Fe River at City of Santa Fe WWTP
Dissolved Oxygen	Ca (ug/L)	Latitude: 35° 63' N
(mg/L)	Cr (ug/L)	Longitude: 106° 09 W
Turbidity (NTU)	Co (ug/L)	Santa Fe River below Cienega Creek
Phosphorus (mg/L)	Cu (ug/L)	Latitude: 35° 33' 38.902" N
Nitrate (mg/L)	Fe (ug/L)	Longitude: 106° 09' 38.601" W
NH_3 (mg/L)	Pb (ug/L)	Altitude: 1750m
pH	Mg (ug/L)	Santa Fe River at River Preserve
TDS (mg/L)	Mn (ug/L)	Latitude: 35° 37' 14.866" N
TSS (mg/L)	Mo (ug/L)	Longitude: 106° 06' 27.381" W
Total Hardness	Ni (ug/L)	Altitude: 1869m
(mg/L)	Si (ug/L)	Santa Fe River at Canon
Ca (mg/L)	Ag (ug/L)	Latitude: 35° 34' 53.177" N
K (mg/L)	Sr (ug/L)	Longitude: 1809m
Na (mg/L)	Sn (ug/L)	Cienega Creek above Santa Fe River
Alk (mg/L)	V (ug/L)	Latitude: 35° 33' 27.942" N
Bicarbonate (mg/L)	Zn (ug/L)	Longitude: 106° 08' 30.706" W
Chloride (mg/L)	As (ug/L)	Altitude: 1777m
Sulfate (mg/L)	Se (ug/L)	Santa Fe River at USGS Gage at La Bajada
Mg (mg/L)	U-nat (ug/L)	Latitude: 35° 32' 48.9" N
Al (ug/L)	Gross Fecal Coliform	Longitude: 106° 13' 45.2" W
Ba (ug/L)	Streambed Deposits	Altitude: 1683m
Be (ug/L)		
B (ug/L)		

Monitor: City of Santa Fe Waste Water Treatment Plant, Airport Road Plant
Contact Person for More Information: Mike Mier, City Manager
NPDES Permit Monitoring Requirement Reports Submitted to EPA
Location: Waste Water Treatment Plant, Treated Effluent
Latitude: 35° 37 '30" N **Longitude**: 106° 05'19" W

PARAMETERS	FREQUENCY
pH	Weekly
Total Suspended Solids (mg/L)	Weekly
Nitrate – Nitrogen (mg/L)	Weekly
Kjeldahl Nitrogen (mg/L)	Weekly
Flow in Conduit or thru Treatment Plant	Daily
Fecal Coliform (mL)	Weekly
Carbonaceous Biochemical Oxygen Demand (mg/L)	Weekly

APPENDIX B

Drainage Outlets into the Santa Fe River within the Monitoring Area of the Urban Reach

(Data below recorded between March and April, 2000. "*" are drainage outlets of most concern due to odor, color and discharge without a storm event)

Map Location	Location Description	Drain Outlet Description	Active/Not Active	General Comments
(see Map 8)				
1	S bank S trend 12 ft. E. of Delgado	17 in., corrugated metal	Active	Street drain, 2 ft. x 4 ft. pool currently empty, around this seeps to groundwater
2	N bank N trend E. Side Delgado	18 ft. wide x 7 ft. high paved arroyo	Active	Arroyo runoff, some black in soil channel
3	N bank N trend	32 in. wide 7 in. deep open drain, cement	Active	Street runoff, new, no discoloration
4	N bank NE trend	12 in., corrugated plastic	Active	street runoff, new, no discoloration, soil blackish
5	S bank S trend	4 in. diameter, tile	Active	Driveway, yard runoff, new, no discoloration
6	S bank S trend	4 in. diameter, plastic	Active	Residential runoff?, looks new, looks "clean"
7	S bank S trend	4 in., tile	Not Active	old, plugged up with debris
8	N bank N trend	24 in. diameter, cement	Active	Street runoff, black soil, erosion to river, open sewer look
9	S bank S trend 5 ft. E. Paseo bridge	2 ft. x 3 ft., square stone inside	Active	Street runoff, very black soil and wall
10	S bank SE trend ~10 ft. W. Paseo de Peralta Bridge	2 ft. diameter, concrete	Active	Street runoff, black soil
11	S bank, SE trend W. El Castillo entrance bridge	2 ft. diameter, plastic	Active	Runoff now, coming from? New, gabion basket attached,

				algae, no smell
12	S bank SE trend W. of foot bridge	18 in. diameter,	Active	Always running, algae around, El Castillo parking lot runoff?
13	S bank S trend	4 in. diameter	Active	Runoff now coming from Desert Inn kitchen, no color
14	S bank SW trend ~150 ft.E. of Santa Fe Trail Bridge	2 ft. diameter, stone	Active	Restaurant roof runoff
15	S bank S trend	8 in. x 8 in. wood box	not active	no comment
16	N bank N trend	3 in. x 12 in. metal rectangle	not active	looks "clean"
17	N bank N trend 2 ft. E. of Santa Fe Trail Bridge	18 in. diameter, concrete	Active	street runoff, 3x5 ft. black took 2 pictures, black pool, stagnant, black soil,
18	S bank SE trend	3 ft. diameter	Active	Street runoff, black into river
19	S bank S trend	10 in. diameter, cast iron	?	No color, coming from office building
20	S bank S trend	5x10 inch drain	Active	Parking lot, new pipe, attached to acequia ditch opening, eroded channelized to river
21	N bank N trend 1 ft. East of Shelby Bridge	18 in. diameter	Active	Channelized and eroded to river, blackish street runoff
22	S bank S trend	16 in. cement	Active	Large eroded channel below #26 to the river, channel is 2 ft. deeper than river level (flow in the river)

23	N bank N trend	3 in. diameter	Active	No discoloration, erosional gully
24	S bank S trend	4 in. diameter, clay	Active	*Coming from Supreme Ct. Bldg., Clay type plaster coming out of pipe with residue in river. A citizen said there is a hot stream of grey clayey water coming out of the pipe every morning. Took picture
25	S bank S trend	4 in. diameter, clay	Not Active	Coming from Supreme Ct. Bldg.?
26	N bank N trend	12 in. diameter, clay	Active	Pool below, no color
27	S bank SE trend	2 ft. x 4 ft., concrete	Active	Blackish water came out as I measured! Water looked sudsy, took picture
28	N bank N trend	2 ft. diameter, level to ground	Active	Little discoloration
29	S bank S trend	16 in., corrugated metal	Not Active	Looks "clean"
30	S bank S trend	15 in., corrugated metal	?	3/4 full of debris, active?, not much color
31	S bank S trend 45 ft. W of Don Gaspar Bridge	12 in. Diameter, clay	Not Active	No color, 1/2 filled with debris
32	S bank S trend	8 in. diameter	Not Active	1/2 full of debris and sprder webs
33	S bank S trend	16 in.diameter	?	Street drain?, no discoloration
34	N bank N trend 50 ft. E of Galisteo Bridge	18 in.diameter, corrugated metal	Active	No discoloration, no debris
35	N bank N trend 20 ft. E of Galisteo Bridge	3 ft. diameter	Active	Water running with no precip., algae around area fecal smell,

				black ponding, took 3 pictures
36	S bank SE trend 17 ft. W Galisteo Bridge	2 ft. diameter	Active	Black, eroded, channelized, blocked by a sleeping bag!
37	N bank E trend 17 ft. W Galisteo Bridge	4 ft. diameter	Active	Street runoff?, discolored, black soil
38	North bank, N trend	9 in. diameter	Active	Looks "clean", roof and sidewalk
39	N bank N trend 5 ft. W of 24-10	9 in. diameter	Active	Looks "clean", roof and sidewalk runoff?, no color
40	North bank, N trend	18 in diameter	?	Ground level, 1/2 full soil
41	N bank NE trend	2 ft. diameter	Active	Street runoff, no discoloration
42	N bank N trend 2 ft. E of Sandoval Bridge	22 in. diameter		Street runoff, black outlet
43	N bank N trend 5 ft. W of Sandoval Bridge	3.5 ft x 4.5 ft	Active	Very dirty, stagnant ponding, trash, green water, draining, 12 ft x 12 ft. wide, 3 ft deep
44	S bank S trend 1 ft. W of Sandoval Bridge	20 in. diameter	Active	Street runoff, black stained wall
45	S bank S trend 20 ft. W of Sandoval Bridge	30 in. diameter	Active	Street drain, black near outlet
46	N bank N trend 50 ft. E of Guadalupe Bridge	2.5 ft. diameter	Active	Street runoff, black outlet, ponding, stagnant waters pond 2 ft. deep, 8 ft. x 4 ft. wide
47	S bank S trend 25 ft. E of Guadalupe Bridge	4 in. diameter		coming from skate board park and streets

48	S bank S trend of Guadalupe Bridge	4 ft. diameter	Active	Street runoff, 8 x 8 ft. pond, sewage smell, black water with oil on surface, trickle of water from pipe
49	N bank NE trend of Guadalupe Bridge	3 ft. diameter	Active	street runoff, undercutting road, black deposits from drain to river
50	S bank S trend 25ft. N of Defouri Bridge	18 in. diameter	Active	church parking lot runoff, from drain to river is rip-rap
51	S bank SW trend E side of Defouri Bridge,	24 in. diameter	?	street runoff, 1/2 of pipe obstructed with debris
52	S bank S trend Alto and Defouri	4 ft. across, 8 in. deep Flat open drain	Active	street runoff
53	S bank S trend across from Campos	5 drains - 4 in. diameter	?	5 drains from house backlots, no stains or erosion
54	S bank S trend 150 ft. West of Campos St.	6 in. diameter	?	one driveway drain, black soil
55	N bank N trend 300 ft. West of Campos St., 200 ft. E of footbridge	24 in. diameter	Active	Alameda St. drain, dark soil just below outlet
56	S bank S trend 20 ft. W of Closson foot bridge	4 ft. x 16 in., cement	Active	Flat open street drain. Looks okay
57	N bank N trend 20 ft. W of Closson foot bridge	24 in. diameter	Active	street drain, drop structure from bank to river
58	S bank S trend N of Candelario	4 in diameter	Not Active	drain from residential
59	S bank S trend across from boys and girls club	24 in. diameter	Active	Alto St. drain, very black at outlet

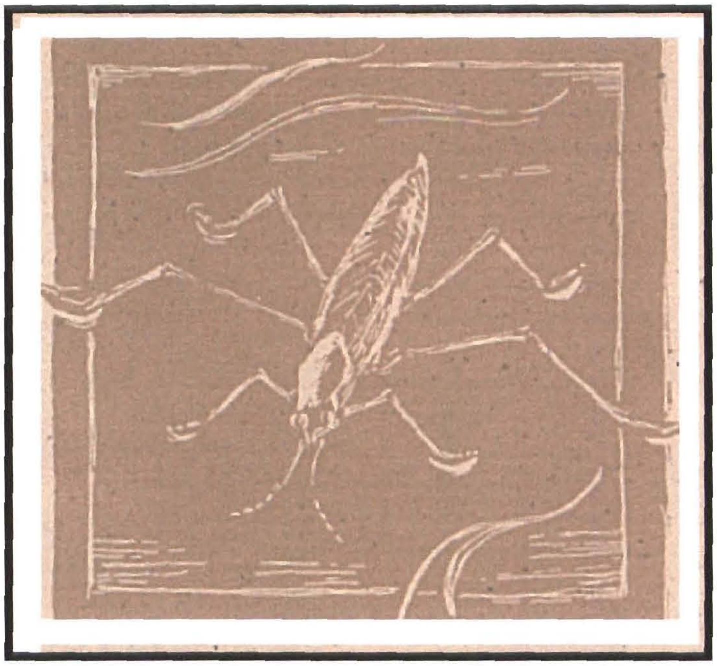
60	N bank N trend across from boys and girls club,	24 in. diameter	Active	Street runoff, very black at outlet
61	S bank S trend across Crucitas St.	8 ft. wide, flat drain	Active	Large street drain, blackish
62	S bank S trend across Crucitas St.	24 in. diameter	Active	no discoloration
63	S bank S trend across Crucitas St.	4 in. diameter	?	white colored pipe coming from residential yard
64	N bank N trend corner of St. Francis & Alameda	3 ft. wide, flat cement drain	Active	open, blackish, does not appear to be well constructed
65	N bank N trend	19 in. diameter, corrugated metal	Active	start of the City river project area, flow in the river, sidewalk runoff, blackish
66	N bank E trend located on park wall	4 in. diameter, plastic	Active	sidewalk runoff. Looks "clean"
67	N bank, NE trend	7 - 8 ft. x 12 ft. cement openings	Active	Large arroyo
68	S bank, S trend	4 in. plastic	Active	wall, sidewalk runoff
69	N bank, N trend	4 in. plastic	Active	wall, sidewalk runoff
70	N bank, N trend	4 in. plastic	Active	wall, sidewalk runoff
71	S bank, S trend W side of footbridge	24 in. corrugated metal	Active	looks okay, river dry
72	N bank, N trend across De Oro	24 in. corrugated metal	Active	Street runoff, black rocks

73	S bank, S trend Well monitoring spot	5 in. diameter	Active	Water flowing out, well water?, 10 ft. wide terracing no discoloration
74	N bank, NE trend 300 ft. E of footbridge 420 ft. E of Solona St.	24 in. diameter, corrugated metal	Active	discolored, debris
75	S bank, S trend	18 in. diameter, corrugated metal	Active	gabion in place, eroded channel street and parking lot runoff
76	S bank, S trend	6 in. plastic	Active	river is trickling, parking lot and street runoff,gabion in place
77	S bank, S trend	6 in. diameter	Active	parking lot and sidewalk runoff, gabion to river, very steep bank river has no flow
78	S bank, S trend	8 in. diameter, corrigated metal	?	park and sidewalk runoff, steep banks, looks "clean"
79	N bank N trend	36" diameter, cement	Active	street runoff, newly built, area looks recently restored

APPENDIX C

Neighborhood River Watch

Santa Fe Watershed Association



VOLUNTEER MONITORING FIELD HANDBOOK FOR THE URBAN REACH OF THE RIVER

PREPARED BY:
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University of New Mexico

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BACKGROUND

1.0 WHAT IS THE NEIGHBORHOOD RIVER WATCH?

Neighborhood River Watch is a project of the Santa Fe Watershed Association, dedicated to:

- Bringing the Santa Fe River back to life.
- Increasing public awareness of the issues surrounding the river.

Neighborhood River Watch involves water quality monitoring and observation of river conditions, and bringing these conditions to the attention of those responsible for the river's health.

This handbook was designed for the neighborhood river watcher, to provide a step-by-step approach to evaluating the condition of the urban reach of the Santa Fe River.

1.1 What are the Issues?

The condition of the urban reach of the Santa Fe River can be defined using the following parameters:

- Presence or absence of flow
- Timing and volume of runoff (storm and flood flows)
- Channel stability, streambed and streambank erosion
- Litter
- Discharge into the river: volume, quality and location

1.2 Neighborhood River Watch Goals

The goals of water quality monitoring and observations of the river are:

- To improve storm water management
- To protect existing uses: wildlife, contact recreation, and aesthetics
- To educate the public regarding river and watershed issues

These goals are founded on the premise that urban river issues are directly linked to land and human uses, and that the protection of our river requires the active, positive cooperation of all Santa Feans.

2.0 VOLUNTEER MONITORING SET-UP

2.1 "Wet Data" Monitoring vs. River Journal Observations

Since the urban reach of the Santa Fe River is not always flowing and stormwater runoff seems to be one of the main concerns, this monitoring program will be split into two separate monitoring efforts:

- Water quality monitoring using field equipment ("wet data" monitoring)
- Recording observations in the river journal

2.1.1 "Wet data" Monitoring

Designated Neighborhood River Watchers will conduct "wet data" monitoring for storm events and non-storm events. This handbook contains the procedures for such monitoring. Results from monitoring can be recorded in the worksheet provided in the section labeled *"Wet data" Monitoring Worksheets.*

2.1.2 The River Journal

The River Journal requires mostly observation only. The River Journal is provided in the section labeled *The River Journal* and contains pages formatted to prompt the recording of certain specific observations (i.e. presence or absence of flow; appearance of an oil slick on a pool in the riverbed). Each Neighborhood River Watcher will use the Journal to record observations any time the river watcher walks his/her stretch of the river. It is essential that this is done once a month at the very least. Instructions for observation monitoring are included in the journal (see River Journal for Observational Monitoring P. 30). The results can be recorded in the journal.

The River Watcher can choose to participate in the "wet data" monitoring plus the River Journal project, or the River Journal project alone. The worksheets needed to record results of the "wet data" monitoring and the River Journal will be provided in the sections to follow.

2.2 Geographic Locations

The Santa Fe Watershed is separated into three distinct reaches: the upper, forested reach; the middle, urban reach; and the lower, rural reach (Map 1). The Neighborhood River Watch monitoring area will be located within the urban reach, beginning a few feet east of Delgado Street and ending at Sicomoro Street (north side of river) adjacent to Alto Street Park (Maps 1 and 2). This area was selected for monitoring because (1) it is the most heavily urbanized zone within the urban reach and therefore, it is hypothesized, the most susceptible to water quality and stormflow impacts; and (2) because there are no other routine monitoring events in the urban reach, so that the Neighborhood River Watch project will be filling an information gap.

The urban monitoring area can be further split into three reaches: Arriba (upper), Medio (middle), and Bajo (lower) (Map 2). There are 9 monitoring sites within this monitoring area; three each in the Arriba, Medio and Bajo reaches (Map 2 and Table 2). Refer to Photographs 1-8 and description of each monitoring location. These monitoring sites were chosen by plotting and describing all 79 stormdrain outlets within the monitoring area and deciding which area is representative of each reach. Refer to Table 2 for a rationale of each chosen location.

Other reaches upstream or downstream from the urban monitoring area may be observed
if the River Watcher chooses to do so. In this case, the River Watcher will site the location by describing the landmarks around the observed area.

2.3 Training

Training will be in two phases:

2.3.1 Phase 1

- Introductory meeting of all Neighborhood River Watchers
- Assignment of reaches
- Assignment of "wet data" monitoring and the river journal
- Review handbook and river journal
- Train and practice safety precautions and monitoring parameters
- Discussion of data dissemination

2.3.2 Phase 2 (one-on-one training)

- Visit the monitoring area: reaches and monitoring locations
- Practice monitoring and observation techniques
- Discuss any problems or questions

After the training sessions, Neighborhood River Watchers are READY to work

2.4 Monitoring Schedule

All Neighborhood River Watchers will choose a reach (Arriba, Medio, Bajo or another area of interest to the River Watcher). There is the river journal observation at three

Map 1

See page 10 of main document for Map 1.

Map 2
See Map 8 on page 44 of main document.

Table 1 Monthly Monitoring Parameters and Locations

RJ = The River Journal
WET = "Wet data" Monitoring

	MONITORING LOCATIONS								
	Arriba			Medio			Bajo		
PARAMETER	A	B	C	D	E	F	G	H	I
Channel	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Flow (present/not present)	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Color	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Oil, Grease, Gasoline and Foam	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Odor	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Trash/Sewage	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
PH	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ	RJ
Turbidity	------	------	------	------	------	------	------	WET	------
Nitrate	------	------	------	------	------	------	------	WET	------
Bacterial Pathogens	------	------	------	------	------	------	------	WET	------
Conductivity	------	------	------	------	------	------	------	WET	------
Flow (measurement)	------	------	------	------	------	------	*WET	WET	------

* This flow measurement will be recorded from the City flow gage.

Table 2 Monitoring Locations, Rationale, Frequency and Parameters

(Refer to Photographs 1-8 for monitoring locations)

REACH	LOCATION	IDENTIFICATION	RATIONALE	FREQUENCY	MONITORING PARAMETER SOURCE
ARRIBA	A	Delgado above	Baseline, above Arroyo Saiz	Whenever possible, at least once a month (15th of every month and/or during a storm event is recommended)	The River Journal
	B	Delgado below	Below Arroyo Saiz , sediment issue	Whenever possible, at least once a month (15th of every month and/or during a storm event is recommended)	The River Journal
	C	Old Santa Fe Trail below	Cluster of drainage outlets, mid-downtown, water quality issue	Whenever possible, at least once a month (15th of every month and/or during a storm event is recommended)	The River Journal
MEDIO	D	Galisteo above	Adverse effects from drainage outlet 35, water quality issue	Whenever possible, at least once a month (15th of every month and/or during a storm event is recommended)	The River Journal
	E	Guadalupe below (directly from drainage outlet)	Water with no precipitation, stagnant pond, odor	Whenever possible, at least once a month (15th of every month and/or during a storm event is recommended)	The River Journal
	F	Guadalupe below (10 feet below drainage outlet)	Adverse effects from drainage outlet 48, water quality issue	Whenever possible, at least once a month (15th of every month and/or during a storm event is recommended)	The River Journal
BAJO	G	Marketplace	City of Santa Fe flow gage (08316530) location, above Arroyo Mascaras	Whenever possible, at least once a month (15th of every month and/or during a storm event is recommended)	Flow (City of Santa Fe flow gage data), The River Journal
	H	City river project	City river project, Arroyo Mascaras, sediment issue	15th of every month and during first storm event of each month (if applicable)	"Wet data" conductivity, turbidity, fecal coliform, nitrate, flow, River journal
	I	Alto Street Park	End of monitoring area	Whenever possible, at least once a month (15th of every month and/or during a storm event is recommended)	The River Journal

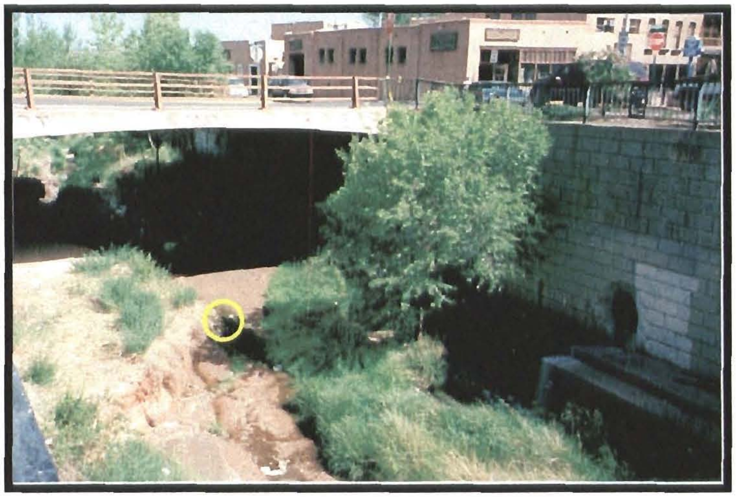
Photograph 1 Monitoring Location A – Above Delgado St. and Arroyo Saiz

ARRIBA REACH MONITORING LOCATIONS

Photograph 2 – Location B – Below Delgado St. and Arroyo Saiz

Photograph 3 – Monitoring Location C – Below Santa Fe Trail

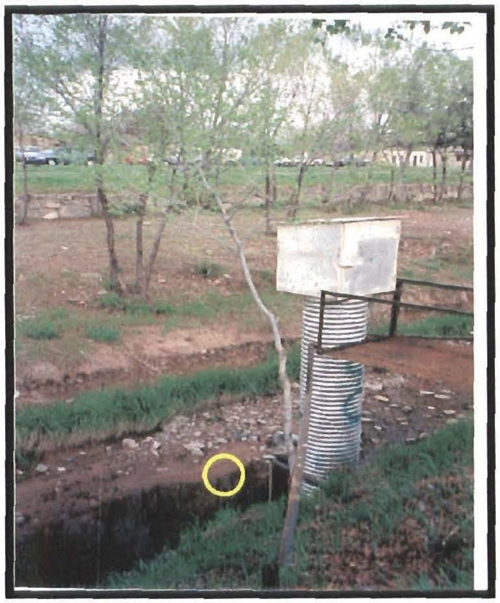
Photograph 4 – Monitoring Location D – Above Galisteo



MEDIO REACH MONITORING LOCATIONS

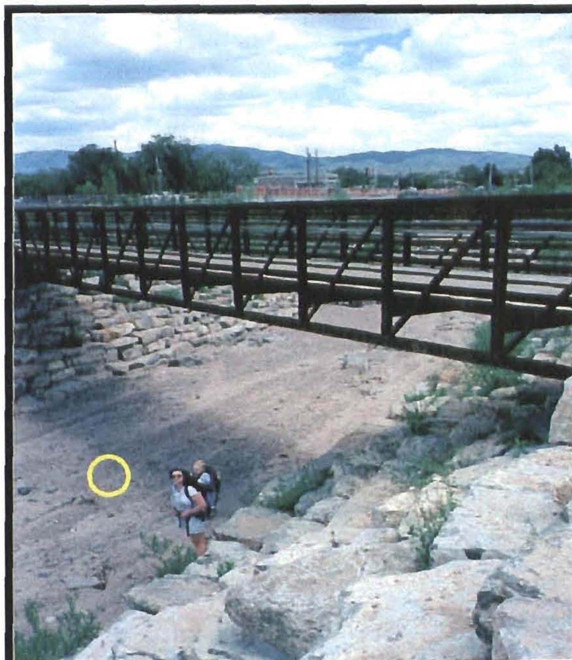
Photograph 5 – Monitoring Location E and F
E – Drainage outlet #48, West of Guadalupe St.
F – Approximately 10 ft. downstream of E

Photograph 6 – Monitoring Location G – Adjacent from the Market Place on Alameda St. directly below gaging station # 08316530



BAJO REACH MONITORING LOCATIONS

Photograph 7 – Monitoring Location H – City river project area West of St. Francis, West side of footbridge, below Arroyo Mascaras



Photograph 8 – Monitoring Location I – North of Alto St. Park. West side of footbridge

locations in each reach and "wet data" monitoring at one location in the Bajo reach, location H (City river project) below Arroyo Mascaras (Table 1 and 2). ("Wet data" monitoring locations will be added as soon as additional monitoring equipment becomes available).

2.4.1 "Wet Data" Monitoring

- There will be one person conducting the "wet data" monitoring on a minimum of a one-month time schedule (preferably a commitment of three months or longer). That person will be responsible for the "wet data" equipment including calibration.

- After a three-month period, there will be a monitoring meeting in which we will discuss results, problems, and transfer of monitoring duties if necessary.

- The "wet data" River Watchers will monitor their reach on the 15th of every month, whether or not flow is present. If he/she *can not do so* on that particular day, there will be a back-up person or persons that will take over duty for that monitoring session. Please provide as much notice as possible.

- The storm event monitoring will be conducted once a month, DURING or IMMEDIATELY after the first storm event of the month. The Monitoring Coordinator will call the scheduled river watcher the day of a storm event for a reminder of the storm event monitoring session. If he/she is not available, the Monitoring Coordinator will call the listed back-up person/s. The scheduled river watcher and the back-up person will need to meet to exchange the equipment.

- If the scheduled river watcher knows in advance he/she will not be able to conduct monitoring duties for any period of scheduled time, please notify the Monitoring Coordinator and call a back-up person to take over duties. There will be a list of Neighborhood River Watchers telephone numbers in the back of the handbook.

- The person conducting "wet data" monitoring will also record observations using the River Journal for his/her reach.

2.4.2 The River Journal

- There will be an unlimited number of river journal Neighborhood River Watchers (the more the merrier).

- Each river watcher will be expected to record observations ONCE A MONTH (on the 15th and/or during a storm event, if possible) and any other time he/she can or sees unusual activity within their reach (Arriba, Medio or Bajo).

- Each river watcher is asked (not required) to observe ALL drainage outlets within their reach located on the map (Map 2) and if one notices any unusual activity he/she will record the observation and drainage outlet number on the table worksheet provided.

- River Watchers are encouraged to bring a partner to help observe.

2.5 Data Collection

At the end of each month, river watchers will send a copy of their completed river journal worksheets and "wet data" monitoring worksheets to the Monitoring Coordinator. The Monitoring Coordinator will then combine the results on a spreadsheet. Again, at the end of three months, there will be a monitoring meeting to discuss results, any problems and assign "new" river watchers as necessary. The monitoring coordinator will be responsible for generating a "state of the river" report at the end of each calendar year based in the data collected by volunteer river watchers and other research.

"WET DATA" MONITORING

3.0 MONITORING EQUIPMENT CHECKLIST

3.1 River Journal Materials
____Volunteer Monitoring Field Handbook/River Journal
____Pen/pencil
____Clear container for observation of water color or plastic bag
____Rubber Gloves
____pH paper
____Ruler
3.2 "Wet data" Monitoring Materials
____Volunteer Monitoring Field Handbook/River Journal
____Turbidimeter
____Nitrate test kit
____Tape measure for flow measurement
Pathogenic Bacteria Material
____Whirl bags for PathoScreen
____Media Pillows
____Scissors
____Antibacterial wipes
Conductivity Material
____Conductivity meter
____Conductivity calibration solution
____Conductivity calibration solution container
Other Needed Material
____Pen/pencil
____Rubber gloves
____Wet wipes
____Paper towels
____Tap water bottle
____Waste jar
____Garbage Bags
____Distilled Water
____Goggles

4.0 SAFETY

The volunteer must:

- Be a trained (phase 1 and phase 2 training sessions) adult (children are encouraged to participate but must be under the supervision of an adult) and have signed the volunteer agreement and release of liability form.
- Be physically fit to do the work.
- Understand the hazards.
- Take precaution for lightning during storm event monitoring.
- Accept personal responsibility for their actions.

A second person is encouraged to accompany the volunteer to lend assistance when needed. This buddy must also sign the Volunteer Agreement and Release of Liability.

4.1 Water

- If any of the tests seem unsafe for you to conduct, volunteers should skip it.
- Do not drink or swim in the water.
- Take caution in deep, slippery, fast flowing or very cold water. Do not enter streams with ice on or near the channel.
- Ensure that streambed and banks offer firm footing. The streambed must be clearly visible with no sudden changes in depth. Volunteers must not walk on slick mud or rocks, bedrock covered by vegetation (like algae), or streambeds that are actively moving (such as flowing sands or rushing storm water). During monitoring volunteers could potentially walk into deep mud and must be able to free themselves. Volunteers must wear footgear that ensures traction and protects against impact from rocks rolling in the current.
- Fast flowing water is hazardous, especially if deep. All monitoring locations are easy to reach and samples may be collected without entering the river. Volunteers may never enter deeper than to their knee.

4.2 Chemical Tests

- Read the material safety data sheets (MSDS) for the chemicals packaged with each reagent test kit.
- Volunteers are advised to wear rubber gloves and safety goggles when testing water with reagents.
- Do not eat or drink the reagents or breathe the vapors.
- If reagents contact skin, eyes, nose or mouth, immediately flush with water.
- Pour used reagent solutions into a container for transport and discard at a municipal sewage system facility (your toilet at home will be sufficient).

5.0 MONITORING PARAMETERS

5.1 Turbidity

Turbidity is the optical effect that occurs when light strikes materials (like clay, organic matter, microorganisms (including algae) and gas bubbles) that are suspended in a fluid, and is a measure of the "cloudiness" of that fluid. The portable turbidimeter measures turbidity by directing a beam of light into the side of a tube containing the test sample, measuring the amount of light that is reflected at a 90° angle by any particles present, and comparing it to the light provided by a special lamp. The intensity of the light reflected at 90° is measured by a stable photodetector, amplified, and displayed on the digital readout. Turbidity is measured in NTUs. The term NTU (Nephelometric Turbidity Units) is used to describe the test result of a measurement performed with a modern 90° angle turbidimeter (like our Orbeco-Hellige Model 966). Its direct reading from the photodetector and incident light beam to the LCD display gives results in NTUs over three turbidity ranges: 0-20.00, 0-200.0, and 0-1000. At zero turbidity, no light is reflected or measured. The more particles that are present, the more light is reflected to the photodetector and the higher the reading.

Equipment Needed

- Orbeco-Hellige Model 966 Portable Turbidimeter
- Paper towel
- Sample collection cup

The turbidimeter has a few special and important DO's and DON'TS; please read them in order to ensure accurate readings.

DON'T'S

- Don't scratch or fingerprint the test tube. Markings of the tube cause inaccurate results. Carry test tubes by the screw threads. It is very important that the containers used to obtain samples, and the tubes for samples and standards used with the instrument are absolutely clean, both inside and out.
- Don't turn the ZERO or CAL control knobs (these are used for calibration every four months).
- Don't sample waters influenced by sediments stirred up from the bottom (this can not be helped if it is a storm event)

DO'S

- Do avoid condensation of the tubes.
- Do avoid and eliminate air bubbles. Pour sample carefully and slowly into the tubes. If bubbles appear, tap bottom of tube or gently swirl.
- Do place turbidimeter on a flat surface.
- Do always fill sample to the neck of the tube.

- Do always place the tube cover over the capped sample tube after the tube has been inserted into the tube well.
- Do make sure the turbidity range is adjusted. If your test sample readout shows a "1" at the left side of the display, then turn the RANGE knob to the next higher range (Orbeco Analytical Systems, Inc., 1995).

INSTRUCTIONS FOR MEASURING TURBIDITY

1. With the sample collection cup, face upstream, rinse the cup (discarding water downstream) and collect a sample.

2. Pour the test sample into a clean, dry No. 965-50 Sample Tube, filling it to the neck. Cap tube tightly, and thoroughly wipe fingerprints from the outside with a paper towel.

3. Holding the tube by its cap, gently swirl to mix and push it down completely into the tube hole on the turbidimeter. Place the black well cap over the cap of the sample tube.

4. Finally, simply press the TEST button down for 5-10 seconds until the reading is stable. Record the results. Release TEST button (Orbeco Analytical Systems, Inc., 1995).

5. Repeat 1-5 again with a new sample. Record results for two samples and average the two results.

6. After use, dump samples back into the stream and clean by rinsing sample tube and cap with distilled water and dry inside and out with a paper towel.

7. If the sample tube is still dirty after procedure #5, then place the sample tube <u>upside-down</u> in the tube holder located in the Turbidimeter case and wash thoroughly.

For more detailed instructions and calibration procedure, refer to the instruction manual enclosed with the turbidimeter. Calibration must be conducted every four months. Record date of calibration in the calibration log located in the Turbidimeter case.

5.2 Bacterial Pathogens (Presence/Absence)
Screening for Hydrogen-Sulfide Producing Bacteria

Many of the microorganisms that cause serious disease such as typhoid fever and dysentery can be traced directly to polluted water. People may contact these pathogens from swimming pools, on bathing beaches, in rivers and streams or from drinking contaminated water. Hydrogen sulfide-producing bacteria such as, Salmonella, Cilrobacter, Clostridium, Proteus, Edwardsiella and some species of Kledsiella, have been shown to be associated with the presence of fecal contamination and total coliform bacteria (HACH Company, 1997). Hach's PathoScreen Medium detects the presence of such bacterial pathogens.

The presence/absence (P/A) method is a qualitative test that indicates only the presence or absence of pathogenic organisms, not the number or specific kind of organisms. If present, the sample will turn black or black precipitate. If absent the sample will remain the dark yellow.

Equipment Needed

- Sodium Thiosulfate Whirl-Pak bags
- PathoScreen Medium P/A Pillows
- Anti-bacterial wipes
- Sample collection glass jar

Precautions

- The PathoScreen Pillows may cause eye and respiratory tract irritation, do not ingest
- It is essential to sanitize for accuracy.

INSTRUCTIONS FOR MEASURING BACTERIAL PATHOGENS

1. With the sample collection cup, collect a sample of water. At least 100mL of sample should be collected for analysis. When collecting sample, fill the sample container below the water surface. Do not sample near the edge or bank. Plunge the cup, mouth down, into the water. (This technique excludes any surface scum.) Fill the container by positioning the mouth into the current (do not stir the water) or in non-flowing water by slightly tilting the cup and allowing to fill slowly.
2. For sterilization, wipe hands and powder pillow with antibacterial wipe.
3. Tear of top of Whirl-Pak Bag at scored line, be careful not to touch the opening.
4. Pull tabs outward to open bag. Sometimes a pull on the bottom is also helpful.
5. Cut corner of sterilized PathoScreen Medium P/A Pillow with sterilized scissors and pour into bag.
6. Fill bag with sample to the fill line.
7. Leave air in bag for mixing. Pull wire ends to close bag.
8. Whirl bags 3 complete revolutions.
9. Turn tape wire inward on opposite face of fold (Nasco, 2000).
10. Put sample in the glass jar and keep sample at room temperature for 24 to 48 hours.

11. After results are recorded, dispose the sample by adding ~12mL of bleach to the Whirl-Pak Bag. Allow 10-15 minutes for bleach to react. Pour the liquid down the drain, then dispose the test container in the regular garbage. **Do not dispose the sample without following this procedure.**

INTERPRETING RESULTS:
- Color change from yellow to black. Record the test as present for hydrogen sulfide-producing bacteria.
- Any formation of black precipitate. Record the test as present for hydrogen sulfide-producing bacteria.
- No color change. Let sit for 12 additional hours and recheck the sample.
- If after 48 hours of incubation and the sample still appears yellow, record the test as absent for hydrogen sulfide-producing bacteria.

5.3 Flow

By measuring streamflow, you can determine how much water is flowing in the river. Ultimately, a month-to-month hydrograph can be developed to show the effect of the seasons on the hydrologic cycle.

City Flow Gage

There is a City flow gaging station at location G (The Market Place) in the Bajo reach. The Hydrologic Unit Code is 08316530. The "wet data" river watcher responsible for this location is also responsible for collecting monthly data from the City.

Staff Gage

At location H (City river project), there is a staff gage. The rating curve for the staff gage is included in the River Journal. Record the depth of water on the staff gage and consult the rating curve for the flow represented by that depth.

5.4 Nitrate

Nitrate belongs to a class of compounds knows as nutrients. Waters in New Mexico, especially groundwaters, often contain nitrate, nitrite, and ammonia. High nitrate levels indicate organic decomposition, and possible contamination from septic tanks or agricultural fertilizer runoff. The New Mexico standard is 10 milligrams per liter (mg/l) as nitrogen. High nitrate levels cause excessive algae growth (eutrophication), especially in stagnant lakes or ponds with low amounts of water inflow.

High levels of nitrate can pose a human health risk known as "blue baby" syndrome during the first six months of life. Nitrate inhibits the capacity for blood to carry oxygen and infants lack the digestive capacity to easily convert nitrite to nitrate.

For this test, the results are reported as nitrate-nitrogen on the assumption that streams generally are well oxygenated and would have little or no dissolved nitrite (all would be nitrate).

Equipment Needed
- LaMotte Nitrate Tablet Kit
- Goggles
- Gloves

Precautions
- The chemical reagents are contact hazards, ingestion hazards and inhalation hazards.
- Read the MSDS sheets in the test kit before proceeding.
- Keep the reagents is a cool dry place.
- Avoid exposing the reagents to direct sunlight.
- Dispose the reagents is a toilet with a septic system.

TEST KIT CONTENTS

QUANTITY	CONTENTS	CODE
50	Nitrate #1 Tablets	2799-H
50	Nitrate #2 CTA Tablets	NN-3703-H
2	Test Tubes, 5mL, plastic, w/caps	0124
1	Nitrate Octa-Slide, 0-15 ppm	3494
1	Octa-Slide Viewer	1100

INSTRUCTIONS FOR NITRATE MEASUREMENT
1. Fill two test tubes (0124) to the 5-ml line with sample water.

2. Add one Nitrate #1 Tablet (2799). Cap and mix until tablet disintegrates.

3. Add one Nitrate #2 CTA Tablet (NN-3703). Cap and mix until tablet disintegrates. Wait 5 minutes.

4. Insert Nitrate Octa-Slide (3494) into the Octa-Slide Viewer (1100). Insert test tube into Octa-Slide Viewer. The Octa-Slide Viewer should be held so non-direct light enters through the back of the Viewer. With the sample tube inserted at top, slide the Octa-Slide through the viewer and match with color standards. Result is in Nitrate-Nitrogen. To convert to nitrate, multiply results by 4.4. Record and average results as ppm (parts per million) nitrate (LaMotte, 1996).

5.5 Conductivity

As solids dissolve in water, the water becomes a better conductor of electricity. Most solids dissolve into ions (molecules that have an electrical charge). Such compounds are called salts. These charged ions move through the water, conducting electricity. Electrical conductivity is related to the concentration of the dissolved salts. In many New Mexico streams, the conductivity (in micromhos/cm) of environmental waters is approximately equal to the total dissolved solids (TDS, in mg/L) times 1.5. This relationship depends on the particular ions in the water and other factors.

Conductivity often serves as a less expensive alternative for measuring the individual ions. Your result will be in microSiemens per centimenter (uS/cm). The Hanna DiSt WP Conductivity Meter has two electrodes (measuring and reference), a temperature-compensating device, and a potentiometer (to measure electrical conductivity).

Equipment Needed

- Hanna DiST WP Conductivity Meter
- Conductivity calibration solution container
- Conductivity calibration solution
- Sample collection cup

INSTRUCTIONS FOR CONDUCTIVITY MEASUREMENT

1. Calibration (must be calibrated before first use of the day) every other month:
   a. Pour calibration solution (HI 7032) into the clean "shot glass" container filled to the red 1/2 ounce line. Immerse the tester into the solution.
   b. Allow the reading to stabilize and using the small black screwdriver in the box, turn to match the solution value (1413 uS/cm) (Hanna Instruments, 1997).

2. Measurement:
   a. Collect a water sample with the cup.
   b. Leaving the unit on after calibration, immerse into the sample without touching the bottom of the sample container.
   c. Stir gently and wait until the display stabilizes. DiST WP compensates for the temperature automatically and variations on the display can be due to the temperature sensor adjusting to the new environment (Hanna Instruments, 1997).
   d. Collect another sample and repeat the test.
   e. Record results and average.

6.0 STANDARDS

Below are the drinking water standards and general standards. Since the Santa Fe River urban reach is not always flowing, there are no standards that specifically apply to this reach of the river. This list will help you understand where the Santa Fe Monitoring Area rates in relation to these standards.

6.1 Turbidity

"In New Mexico, the turbidity of most high quality coldwater fisheries must not exceed 10 NTU" (Schaffer, 1998). The State of New Mexico general standards require that turbidity attributable to other than natural causes shall not reduce light transmission to the point that the normal growth, function, or reproduction of aquatic life is impaired or that will cause substantial visible contrast with the natural appearance of the water (New Mexico Water Quality Control Commission, 2000).

6.2 pH

Federal Clean Water Act Secondary Standard level is 6.5-8.5 (EPA, 1988).

6.3 Coliforms

U .S Environmental Protection Agency (EPA) drinking water regulations, effective December 31, 1990, require reporting the presence or absence of coliforms (HACH Company, 1997). The State of New Mexico general standards require all surface waters of the State to be free of water contaminants from other than natural causes (New Mexico Water Quality Control Commission, 2000).

6.4 Nitrate

Surface and ground waters designated for use as drinking waters must have a level less than 10mg/l as nitrogen.

6.5 Conductivity

The Federal Clean Water Act Secondary Standard level for total dissolved solids (TDS) is 500mg/l or approximately 750 micromhos/cm.

7.0 RIVER JOURNAL FOR OBSERVATIONAL MONITORING

Before monitoring, please read the background and safety section of the handbook. Each river watcher is asked to monitor on the 15th of every month and if possible, following a storm event.

In the front pocket of the handbook, you have a table of all the drainage outlets in each reach. The start of each reach is in bold. Find your reach and use this table along with Map 1 to guide you in locating and observing all the outlets in your reach. Record results in the river journal worksheets provided in the following section. You are given a supply of worksheets. At the end of each month you will send in a copy of the journal to the monitoring coordinator who will then input the data onto a spreadsheet (send to mailing address provided on the "telephone/address list" section). At the end of three months, there will be a river monitoring meeting to discuss group results and any problems that may have occurred.

If you have any questions or problems, contact the Santa Fe Watershed Association Monitoring Coordinator or Paige Grant, Santa Fe Watershed Association Coordinator (phone/address list is in the back of the handbook).

7.1 Water

7.1.1 Flow

Changes in monthly streamflow data can reveal important information about the watershed such as the effects of land use on seasonal flow patterns (Fleming and Schrader, 1998).

PRESENCE/ABSENCE

Just by observing whether flow is present or absent at any given time can help evaluate seasonal trends. Is there a trickle, a steady flow, or a raging river? River watchers will record their observations in the river journal worksheet; the monitoring coordinator will tie these observations to gaging station data.

STAFF GAGE

There is a staff gage located at Arroyo Mascaras (location H). The rating curve for the staff gage is provided on the river journal worksheet. Record the depth of water on the staff gage and consult the rating curve for the flow represented by that depth.

7.1.2 pH

"Water (H_2O) contains both H^+ (hydrogen) and OH^- (hydroxyl) ions. The pH test measures the H^+ concentration of liquids and substances" (Fleming and Schrader, 1998). Water is given a pH value of a scale that ranges from 0 to 14. Values from pH 0 to 7 are termed "acidic" and those from pH 7 to 14 are termed "basic". It is important to note that a pH scale is logarithmic, for example, a pH reading of 6 is ten times more acidic than 7 and a reading of 2 is 100 times more acidic than 4 (Fleming and Schrader, 1998).

Equipment Needed

- pH paper
- pH Color Chart
- Plastic sampling bag

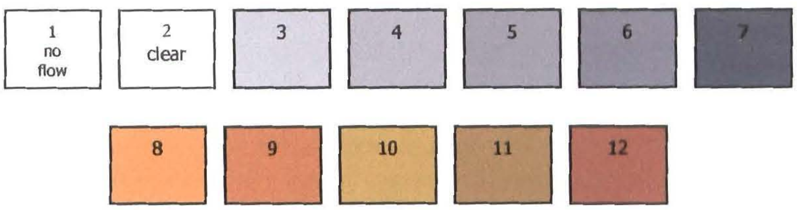
INSTRUCTIONS FOR MEASURING pH

1. Collect sample with the plastic sampling bag.
2. Immerse the pH paper into the bag.
3. Let sit until there is no further color change (1-10 minutes).
4. Take out of water and read while still moist. Compare the color against the color chart and record the appropriate pH number.

7.1.2 Color

The color of water relates to aesthetic standards. The optimal color is clear. It is determined by visual observation of the river (not flow from the drainage outlets).

COLOR OBSERVATION:
At your monitoring site, use the collected water sample from the pH measurement. Compare the shade of the water to the color chart provided below. Choose a number that best represents the color of the river at time of observation and record results on the river journal worksheet.



7.1.3 Odor

Natural drainage water produces no distinctive odors other than a slight mustiness. Since most organic and many inorganic chemicals generate some odor, a "smell" test can be an indicator of pollution in a waterway (Drinkwin, 1995).

OBSERAVATION INSTRUCTIONS:
1. Use collected from pH and color measurement.
2. Hold the sample about six inches from nose. Use your free hand to fan the scent to your nose.
3. Record odor as a yes or no. Describe in your own words (sewage smell, gasoline, smell etc.).

7.1.4 Oil, Gasoline, Grease and Foam

Hydrocarbons such as oil, gasoline and grease often wash into stormdrain systems through storm water runoff. Stormwater runoff reaches the river from the drainage outlets. In the case of the Santa Fe River, sometimes the hydrocarbons are caught in a pool below the outlet next to the river, and sometimes they are washed down the river. In any case, it is detrimental to the environment in large quantities and impacts the aesthetics of the riparian area.

Foam comes from detergents from washing cars, outdoor cleaning of screens and grills, cleaning restaurant kitchens, illicit discharges from sources such as dry cleaners or laundromats. It enters the river in the same fashion as hydrocarbons and also has similar negative effects as hydrocarbons. Foam can also result from the natural decomposition of organic matter.

OBSERVATION INSTRUCTIONS:
Observe your monitoring site for the presence of oil sheen (hydrocarbon residue) or foams (suds). The hydrocarbons or foams may be located in a drainage outlet pool, in the river or attached to vegetation along the banks.

If hydrocarbons or foam are present or absent, indicate this by circling the "Y" for yes or "N" for no on the river journal worksheet. Indicate whether oil sheen of foam is present. Briefly describe. State if the sample is taken from an isolated pool or river channel.

7.2 Channel

7.2.1 Sediment

Storm events can impact the riverbed and banks by erosion or deposition. Some movement of sediment in the channel is normal, but extremes in either direction are detrimental to watershed conditions. Erosion can expose sewage pipes, reduce channel stability and impair groundwater to surface water interaction. Excess deposition can damage aquatic habitat, and cause the river to shift its channel, resulting in bank erosion and property loss. In the case of the Santa Fe River urban monitoring area, erosion is a major concern. The channel is unstable in many areas, and erosion is present in the streambed and banks.

Pin and washer measurements and characterization of the monitoring site help track changes in sediment transport in the river.

PIN AND WASHER:
There will be three-12 inch pins planted into the cross section of the streambed with a washer attached around each. Measure the length from the top of the pin to the washer in centimeters to the nearest millimeter. Record the three results on journal worksheet sheet. After recording consistently month by month, the results will tell you how much the streambed has been depositing or eroding or if it is unchanged (Grant, 1999).

CHARACTERIZATION OF SITE:
The general characterization of the morphology of the streambed, banks and slope will describe where the sediment is depositing or eroding in a given area. This will be conducted on a yearly basis using surveying equipment.

7.2.2 Trash, Sewage

Trash and sewage are undesirable and the observer should identify these features at each observation and/or monitoring site. Trash includes refuse such as toilet paper, bags, food containers, beverage containers, cigarette butts, etc... Sewage consists of human or animal feces. In the river journal worksheet indicate if trash or sewage is present and describe.

7.3 Drainage Outlets

7.3.1 Additional Drainage Outlet Observations

Walk your section of the river (Arriba, Medio or Bajo) and observe the drainage outlets with reference to the map in Map 2. Use the same procedures as stated in 7.2.

Briefly state the following:

- Any unusual discharges or other activities that strike your attention at any outlet. Please provide drainage outlet number.
- Drainage outlet flow. Estimates <1gpm, 1-5gpm, >5gpm.
- Is there an isolated pool? If yes, what is the approximate depth and width.
- What is the color of the pool? Use the color chart provided in 7.1.2.
- Is there an odor to the pool?
- Is there an oil sheen or foam floating on the pool?

8.0 "WET DATA" WORKSHEET

Record all data results in spaces given below. If you encounter any unusual or special circumstances, please record them in the comments section.

BAJO REACH- City River Project-Location H

DATE______ START TIME_______ END TIME_______

Turbidity

___________**NTU**	___________**NTU**	___________**Avg. NTU**

Bacterial Pathogens
Present/Absent. (Circle one.)

Nitrate

_________ **ppm Nitrate**	________ **ppm Nitrate**	_____**Avg. ppm Nitrate**

Conductivity

____________ **uS/cm**	_____________**uS/cm**	__________**Avg. uS/cm**

Flow

__________**CFS**

9.0 RIVER JOURNAL WORKSHEET

Monitoring Reach (i.e. Arriba, Medio or Bajo): ______________________
Monitoring Location (i.e. A, B, C, D, E, F, G, H or I): ________________
River Watcher: ____
Date: ____
Time: ____

Weather: Check the following that apply.

	Now	Past 24-48 hours
Clear/Sunny		
Overcast		
Showers		
Rain (steady rain)		
Storm (heavy rain)		

(Fleming and Schrader, 1998)

Use a separate river journal worksheet for each location monitored. Please send a copy of all recorded worksheets at the end of every month to the monitoring coordinator (address of coordinator is on the telephone/address list). All collected data will be transferred into spreadsheets.

(1) WATER:

Flow

Present? Y/N (Circle one.) If N, skip to #2. If Y, how much?
Trickle/Babbling Brook/Raging Torrent (Circle one.)
Estimate width and depth.

____

pH ____

Aesthetics

Color? Use color chart provided in 7.1.2 of the river journal. Record number.

____

Odor? Y/N (Circle one.) If Y, Describe.

____

Oil Sheen/Foam? Y or N (Circle any that apply.) Describe if needed.

____

(2) CHANNEL:

Sediment
Measure top of pin to washer in centimeters to the nearest millimeter.

North Pin: ____________________
Middle Pin: ____________________
South Pin: ____________________

Aesthetics
Trash/sewage present? If so, briefly describe.

____

(3) DRAINAGE OUTLETS:

There is one drainage outlet monitoring location in the Medio reach, Guadalupe below (E). If you have the Medio Reach, record results for the drainage outlet below. If you notice any unusual discharge from any outlet within the monitoring area, record observations below and record outlet number (1-79) from Figure 2. (Additional drainage outlet worksheets are provided for those who observe more than one drainage outlet concern within your reach.)

DRAIANGE OUTLET NUMBER: ____________________
Drainage outlet flow? Estimated <1gpm, 1-5gpm, >5gpm (Circle one.) Describe if necessary.

____

Isolated pool? Y/N (Circle one.) If Y, what is the approximate Depth? ____________. Approximate Width? ____________.

Color of pool? Use color chart provided in the River Journal in section 7.1.2. Record number.

____

Odor? Y/N (Circle one.) If Y, Describe.

____

Oil Sheen/Foam? Y or N (Circle any that apply.) Describe if needed.

____

Fill in the blank at each drainage outlet in the Arriba Reach. Below are the measurements, record observation that best applies.

Drainage Outlet (D.O.) Number	**D.O. Flow** 0, <1gpm, 1-5gpm, >5gpm	**River Flow Near D.O.** None, Trickle, Babbling Brook, Raging Torrent?	**No river flow** Then, is there an isolated pool in the river bed? (y/n) size?	**Isolated Pool below D.O.** None, ~Width ~Depth	**Color of Pool** Color chart on p.26, record #.	**Odor of D.O flow** Y/N, If so, briefly describe.	**Odor of the pool** Y/N If so, briefly describe.	**Pool oil sheen, foam, scum** If so, briefly describe.	**Additional Comments.**
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Fill in the blank at each drainage outlet in the Medio Reach. Below are the measurements, record observation that best applies.

Drainage Outlet (D.O.) Number	**D.O. Flow** 0, <1gpm, 1-5gpm, >5gpm	**River Flow Near D.O.** None, Trickle, Babbling Brook, Raging Torrent?	**No river flow** Then, is there an isolated pool in the river bed? (y/n) size?	**Isolated Pool below D.O.** None, ~Width ~Depth	**Color of Pool** Color chart on p.26, record #.	**Odor of D.O flow** Y/N, If so, briefly describe.	**Odor of the pool** Y/N If so, briefly describe.	**Pool oil sheen, foam, scum** If so, briefly describe.	**Additional Comments.**
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Fill in the blank at each drainage outlet in the Bajo Reach. Below are the measurements, record observation that best applies.

Drainage Outlet (D.O.) Number	**D.O. Flow** 0, <1gpm, 1-5gpm, >5gpm	**River Flow Near D.O.** **None,** Trickle, Babbling Brook, Raging Torrent?	**No river flow** **Then, is there an isolated pool in the river bed? (y/n) size?**	**Isolated Pool below D.O.** **None, ~Width ~Depth**	**Color of Pool** **Color chart on p.26, record #.**	**Odor of D.O flow** **Y/N, If so, briefly describe.**	**Odor of the pool** **Y/N If so, briefly describe.**	**Pool oil sheen, foam, scum** **If so, briefly describe.**	**Additional Comments**
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10.0 RIVER WATCHERS TELEPHONE/ADDRESS LIST

(Check with Monitoring Coordinator for updates to list)

NAME	ADDRESS	TELEPHONE	Monitoring Reach	"Wet Data" or River Journal
Kent Williamson	1401 Canyon Rd. SF, NM 87501	983-7796	Arriba	River Journal
Ted Williams	250 E. Alameda #814 SF, NM 87501	984-2664	Arriba	River Journal
Mark Tardiff	19 Estamble Rd. SF,NM 87505	466-2292	Arriba	River Journal
Michael Smith	240 Closson St. SF, NM 87501	995—1013	Medio/Bajo	River Journal
Neil Williams	1288 Lejano Ln. SF, NM 87501	982-5180	Arriba/Medio	River Journal & "wet data" monitoring
Kristen Kuester	1622 Paseo Conquistadora SF,NM 87501	989-7529	Bajo	River Journal
Elizabeth Farley	621 Gomez Rd. SF,NM 87501	820-2986	Bajo	River Journal
Will Barnes	322 Otero SF, NM 87501	982-8748	Arriba	River Journal
Rich Schrader	1802 ½ Agua Fria SF,NM 87501	992-0726	Bajo	River Journal & "wet data" monitoring
Paige Grant	60 Canada Rd. SF, NM 87501	982-4081	Medio	River Journal

11.0 REFERENCES

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