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USGS NATIONAL WATER QUALITY ASSESSMENT PROGRAM

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A "Cadillac Desert" is how author Marc Reisner (1986) recently described the arid lands of the West such as California, Nevada, Arizona, and New Mexico. These naturally barren areas lacked only the West's most precious resource—water—to yield a multitude of agricultural products, to create recreational opportunities, and to spawn urban growth.

For three decades starting in the 1930s, federal agencies (primarily the U.S. Bureau of Reclamation and the U.S. Army Corps of Engineers), state governments, and local conservancy districts spent billions of dollars on water development. Some of that development yielded hydroelectric power and municipal water supply. Most of it, however, was for irrigation. Irrigation brought life to the arid and semiarid lands of the Southwest; an Edsel became a Cadillac.

Then came the 1970s and a revival of the benefit-cost concept. Economical, political, and (hopefully) hydrological considerations caused the federal government to abandon several major water development projects. Water quantity—groundwater development and reservoir storage—was the primary issue in the recent past.

But times have changed....

- 1970: The U.S. Environmental Protection Agency was established by Congress.
- 1972: The Clean Water Act promulgated a non-point source pollution-control program to be implemented by each state.
- 1976: The Resources Conservation and Recovery Act was enacted.
- 1982: Large concentrations of selenium at the Kesterson Reservoir, California, were identified as the cause of waterfowl mortalities.
- 1990s: Will this be the decade of the environment?

Now water quality, rather than water quantity, is the major focus of attention. The limited (sometimes finite) quantity of "clean" water has in many areas been overshadowed by the increasing quantities of "dirty" water. It's no longer true that "the solution to pollution is dilution," but "these concentrations are an abomination to the population."

I've referred to the so-called "Cadillac Desert," the age of water development in the West, and to the evolving water-quality concerns that are now facing this state and nation. How does this relate to the specific topic of the USGS National Water Quality Assessment (NAWQA) Program? I will focus on two points:

- The NAWQA Program reflects a growing concern by Congress (i.e., the states) about the nation's water resources—specifically, the effectiveness of recent legislation aimed at improving the nation's water quality.
- The NAWQA Program provides an opportunity—a stimulus—to align federal, state, and local interests toward the common goal of identifying water-quality concerns in large, multistate river basins.

To begin, let me briefly describe the overall program. The goals of the National Water Quality Assessment Program are:

- to describe the status of, and trends in, the quality of the nation's groundwater and surface-water resources; and
- to provide a sound understanding of the natural and human factors that affect the quality of these resources. The program will involve detailed study of groundwater and surface-water quality in 60 carefully chosen basins.

Regarding New Mexico, I'm very pleased that the Rio Grande basin from its headwaters in Colorado to El Paso, Texas, is among those selected for study beginning this year. The southern High Plains unit, which underlies parts of New Mexico and Texas, will be studied later in the program.

The NAWQA Program will provide data not currently available to answer basic questions regarding the nation's water quality. From a national perspective, there are currently three major water-quality monitoring networks that contribute to the understanding of water-quality conditions and trends. These networks include the Hydrologic Benchmark Network and the National Stream-Quality Accounting Network operated by the USGS, and the National Contaminant Biomonitoring Program maintained by the U.S. Fish and Wildlife Service. These three networks address surface-water quality; there is no national equivalent dealing with groundwater quality. On a state-by-state basis supplemental data do exist. However, these frequently are collected for site-specific regulatory reasons and have little regional value, or the data do not have a level of consistency or quality assurance to be a basis for conclusive interpretation. A study of two states, Colorado and Ohio, determined that only 10 percent of the $63 million spent on laboratory analyses by federal, state, and local agencies in 1984 would be potentially applicable for regional, ambient water-quality assessment.

In addition to providing a consistent, national data base of chemical, physical, and biological information, interpretation of data in the NAWQA Program will address cause-and-effect relationships such as water-quality impacts of land use, wastewater-treatment practices, and natural conditions. The data will also address basin-specific issues such as toxic contamination, nutrient enrichment, erosion/sedimentation, salinity, and suitability for various uses.

What is the current water-quality situation in New Mexico? The 1990 report of the New Mexico Water Quality Control Commission provides much of the answer. The report identifies a number of stream reaches and aquifers that have undergone impairment or contamination. However, not surprisingly, the specific causes of these problems were not addressed, in many cases because of insufficient data.

The information presented here on New Mexico's surface waters is from the 1990-91 National Water Summary that will be published by the USGS in 1992, the 20th anniversary of the Clean Water Act. The report will include a state-by-state perspective on water-quality trends that are based on statistical analysis of available data for the past 20 years. For New Mexico, this analysis was based on data for 17 sites (Table 1) and on the 15-year period 1975 through 1989. We will look at trends for four water-quality constituents: dissolved solids, nitrite plus nitrate, fecal coliform bacteria, and sediment.

TABLE 1. SURFACE WATER QUALITY MONITORING STATIONS IN NEW MEXICO SELECTED FOR ANALYSIS OF TRENDS

Site Number	Station Name	USGS Station Number
1	Canadian River near Sanchez	07221500
2	Rio Grande near Lobatos, Colo.	08251500
3	Rio Grande below Taos Junction Bridge near Taos	08276500
4	Rio Grande at Otowi Bridge near San Ildefonso	08313000
5	Rio Grande at San Felipe	08319000
6	Rio Grande at Isleta	08331000
7	Rio Grande at San Acacia	08355000
8	Rio Grande at San Marcial	08358500
9	Rio Grande at El Paso, Tex.	08364000
10	Pecos River near Artesia	08396500
11	Pecos River at Red Bluff	08407500
12	Tularosa Creek near Bent	08481500
13	San Juan River near Archuleta	09355500
14	Animas River at Farmington	09364500
15	San Juan River at Shiprock	09368000
16	Mogollon Creek near Cliff	09430600
17	Gila River near Redrock	09431500

As shown in Figure 1, dissolved solids concentrations as estimated from specific conductance measurements were analyzed for trends at 17 sites. Specific conductance is an electrical property related to the amount of salts that are dissolved in water. Results indicated either no trend or a decreasing trend in concentrations at almost all sites. The only increasing trend is for the Canadian River near Sanchez, which is suspected to be due in part to less precipitation and runoff during the period of analysis.

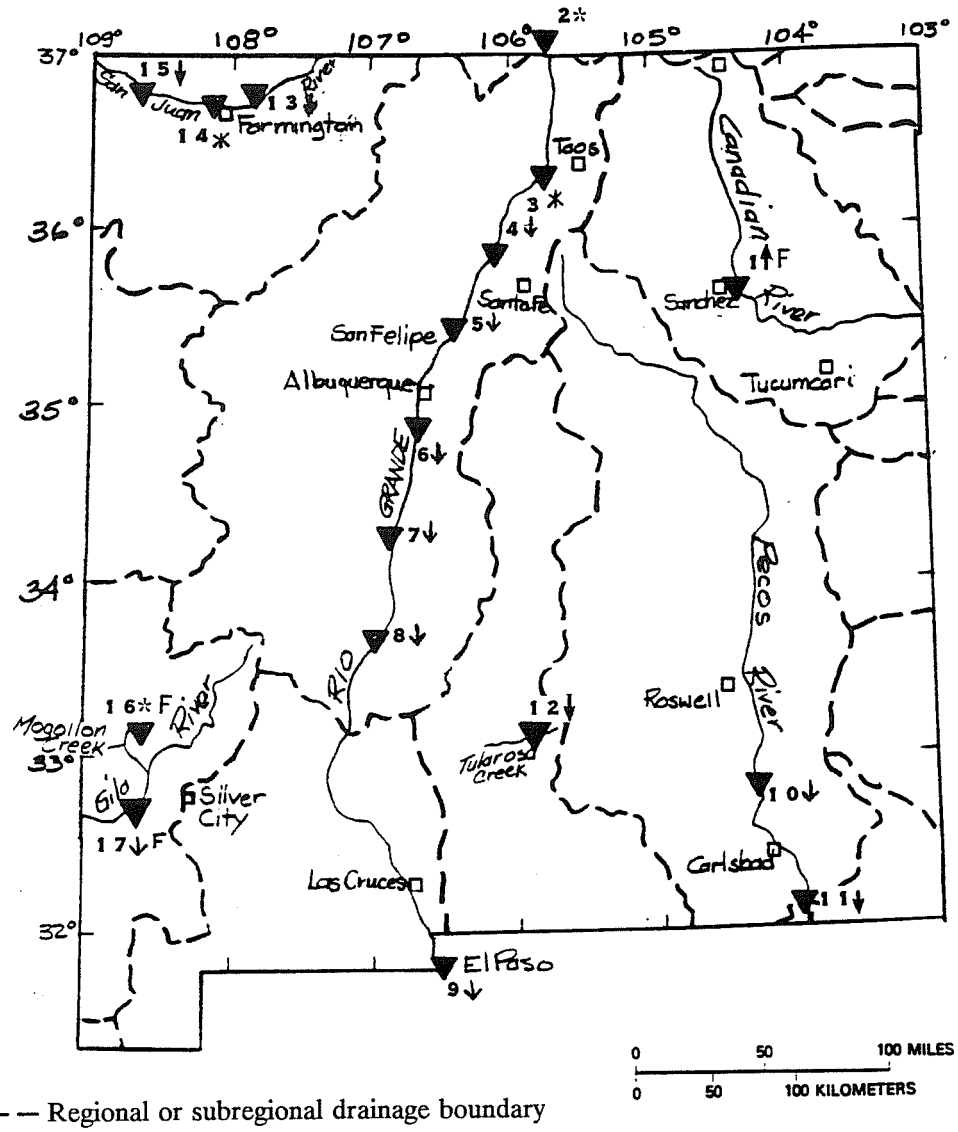

Figure 1. Dissolved solids concentration trends in water at U.S. Geological Survey surface water quality monitoring sites, water years 1975-89.

Concentration data for nitrite plus nitrate (Fig. 2) indicated no trend for eight stations, an increasing trend for one station, and a decreasing trend for two stations. The remaining seven stations had insufficient data for analysis. These data reflect improved wastewater treatment practices and suggest that non-point sources of nitrogen have not increased significantly in recent years. The one increasing trend may be attributed to increased rural development along the Rio Grande valley downstream from Albuquerque.

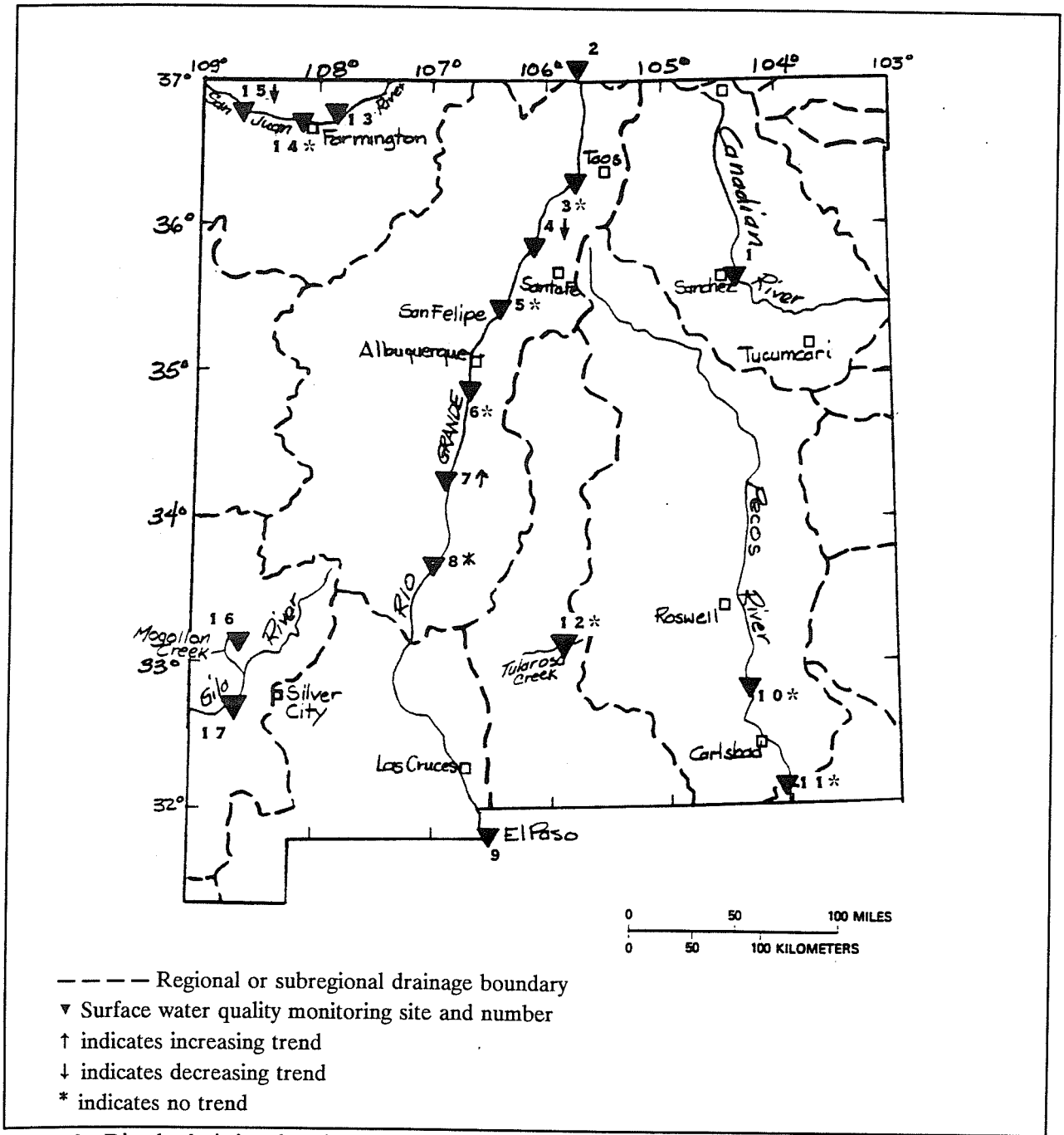

Figure 2. Dissolved nitrite plus nitrate concentration trends in water at U.S. Geological Survey surface water quality monitoring sites, water years 1975-89.

Figure 3 shows that only one of the eight stations with adequate data indicated an increasing trend in fecal coliform bacteria: the Rio Grande at San Felipe (site 5). Though this is likely due to a growing rural population upstream from the site, sites on the Rio Grande both upstream (site 4) and downstream (site 6) indicate a decreasing trend in coliform bacteria. This suggests a possible water-quality concern that may be the result of a growing rural population in the vicinity of San Felipe.

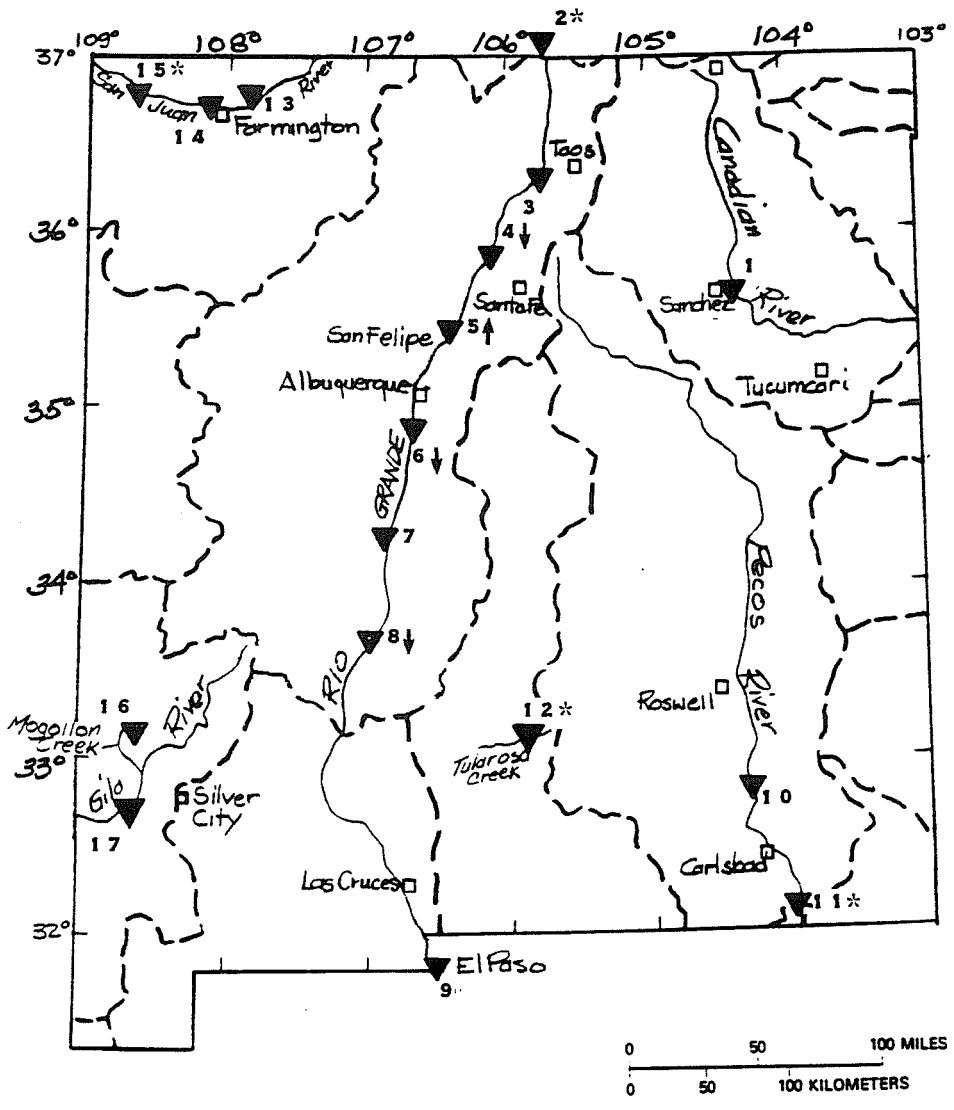

Figure 3. Fecal coliform bacteria trends in water at USGS surface water quality monitoring sites, water years 1975-89.

Lastly is suspended-sediment concentrations. The trend analysis for this constituent (Fig. 4) indicated no trend for 10 stations, a decreasing trend for 2 stations, and an increasing trend for 2 stations. Improved rangeland conditions related to increased precipitation during water years 1979-87 resulted in more vigorous vegetative cover that tended to reduce rangeland erosion during this particular period. The increasing trend at Mogollon Creek was caused by increased erosion because of a larger number of rain storms, and the increasing trend on the Pecos River site may be the result of dam construction for Brantley Lake during 1986-88.

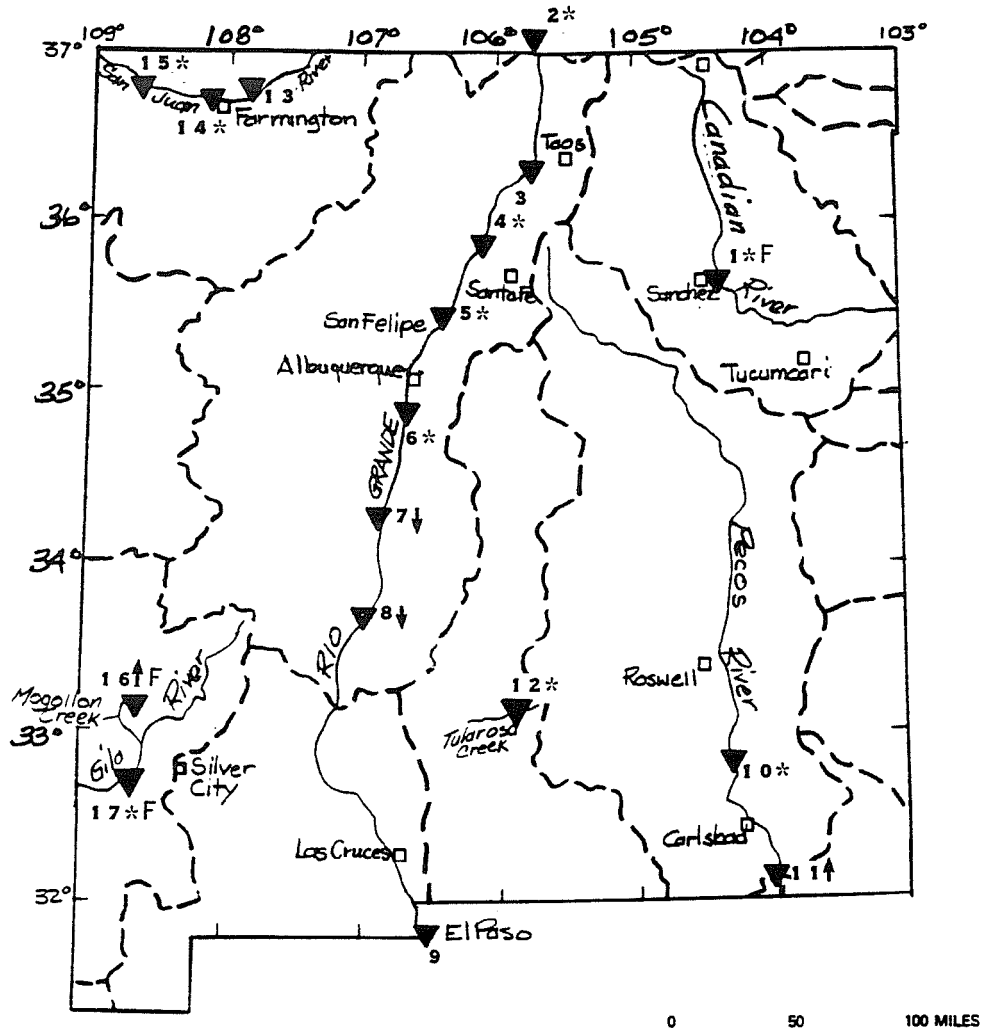

Figure 4. Suspended-sediment concentration trends in water at USGS surface water quality monitoring sites, water years 1975-89.

Hopefully, the digression to water-quality conditions and trends here in New Mexico highlights the deficiencies of a relatively sparse, fixed-station monitoring network that is characteristic of most states. This approach, particularly if areal coverage is inadequate, makes cause-and-effect determinations difficult.

To achieve consistency in the data base for the program, NAWQA will require sampling for a list of both national target constituents and regional target constituents. The regional constituents will be developed by the project team after consultation with appropriate state and local agencies. Support data such as land use, soils, and point sources will be collected to assist in later interpretations.

NAWQA will include a combination of an expanded fixed-station network and an extensive synoptic-sampling program. The purposes of fixed-station sampling are to:

- estimate transport and mass balances between stations;
- determine long-term trends; and
- estimate frequency distributions of concentrations of selected constituents.

Synoptic sampling, on the other hand, provides a "snapshot" of water-quality conditions in a specific area at a specific time. This approach assists in the detection of sources of water-quality problems and the identification of problem areas requiring further study.

In addition to a fixed-station network and synoptic sampling, a third component of the NAWQA Program will be intensive studies. Intensive studies will focus on small areas where severe water-quality problems have been identified. Special sampling or hydrologic modeling may be used, and the areas will be revisited throughout the program to document changes (improvements) and to better understand system response.

As previously mentioned, the study of groundwater quality will be an important aspect of NAWQA. NAWQA groundwater activities will:

- determine the distributions of trace elements, organic compounds, and other chemical substances in the aquifer system;
- identify aquifers that have or are likely to have water-quality problems;
- where possible, identify the relative susceptibility of aquifers in the unit to future water-quality degradation;
- examine cause-and-effect relationships in the system;
- identify problems requiring more intensive investigations; and
- establish a data base for future assessment of long-term trends in groundwater quality.

Regarding groundwater sampling, emphasis will be placed initially on shallow systems. However, "deep" groundwater will be included where it is a source or potential source of water supply or subject to possible contamination from shallow aquifers.

As previously mentioned, the NAWQA Program will be characterized by simultaneous study of groundwater and surface-water systems. For the Rio Grande basin, the overall study plan is expected to consist of 1 planning year (fiscal year 1991), 1 year of available data analysis (fiscal year 1992), 3 years of intensive data collection and interpretation (fiscal years 1993-95), and 1 year of report preparation (fiscal year 1996). There will then be about 4 years of low-intensity sampling (fiscal years 1997-2000), after which detailed analysis and intensive sampling will resume beginning in fiscal year 2001. This cycle is planned to continue indefinitely.

The NAWQA Program can provide an impetus, a stimulus, an opportunity for us to work together toward a common goal: forging water-quality partnerships. The next two years will be devoted to working with the many federal, state, and local agencies concerned with the water resources of the Rio Grande basin to develop a comprehensive work plan for this long-range program. It was a wise man who said: "Learn from the mistakes of others—you can never live long enough to make them all yourself." We want to do it right the first time (or have lots of company to share the blame if something goes wrong).

I'm excited about the NAWQA opportunity. I sincerely hope NAWQA will bring the water-resource community closer together, and make more effective use of our limited financial resources but abundant expertise. If this is a "Cadillac Desert," we must begin now to work as closer water-quality partners to assure the Caddy doesn't rust out in the future.

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