Ground Water Protection and Management Strategies for the El Paso County Area

(A Critical Area Ground Water Study)

by

John D. Estepp
Geologist

February 1990

R 93-01

Texas Water Commission

April 1993

the
Texas
Water
Commission

John Hall, *Chairman*
Pam Reed, *Commissioner*
Peggy Garner, *Commissioner*

Jesús Garza, *Executive Director*

Published and distributed
by the
Texas Water Commission
Post Office Box 13087
Austin, Texas 78711

TABLE OF CONTENTS

TABLES

FIGURES

INTRODUCTION

This report presents the final results of an investigation of potential critical ground water conditions in parts of El Paso County (Figure 1). The Texas Water Commission (TWC) is conducting this study in accordance with H.B. 2 passed by the 69th Texas Legislature in 1985. The purpose of this study is to determine if portions of El Paso County are experiencing, or likely to experience in the next twenty years, critical ground water conditions. The study is based upon interviews with knowledgeable members of local government and concerned citizens, and available hydrogeological data. If it is determined that El Paso County qualifies as a critical ground water area, a ground water management strategy will be recommended.

PUBLIC PARTICIPATION

Public participation was initially requested at a critical area public meeting held in El Paso, Texas on September 25, 1986. Approximately twenty persons were in attendance.

The bulk of this report is based on interviews with knowledgeable members of local government, the U.S. Army, and concerned citizens who reside within the study area. Candidates to be interviewed were selected to reflect the general feeling and concerns of the people within the study area. Interviews were conducted during March of 1989 in El Paso, Texas. Each interviewee was asked to respond to a series of questions concerning ground water management and protection in El Paso County. The following persons were interviewed: Mary Haynes, former county commissioner; Justin Ormsby and Mark Turnbough, Rio Grande Council of Governments; Tom Cliett and Ed Archuleta, El Paso Water Utilities (EPWU); Carmen Suarez, Bill Lewis, Mr. Rab, George Lambert, and Major Stafford of Fort Bliss; Luther Jones, El Paso County Judge; Darcey Frownfelter, local water attorney; Edd Fifer, El Paso County Water Improvement District (EPCWID) No. 1; Dorline Wonciar and John White, Texas Agricultural Extension Service, and Dr. William Cornell, University of Texas at El Paso.

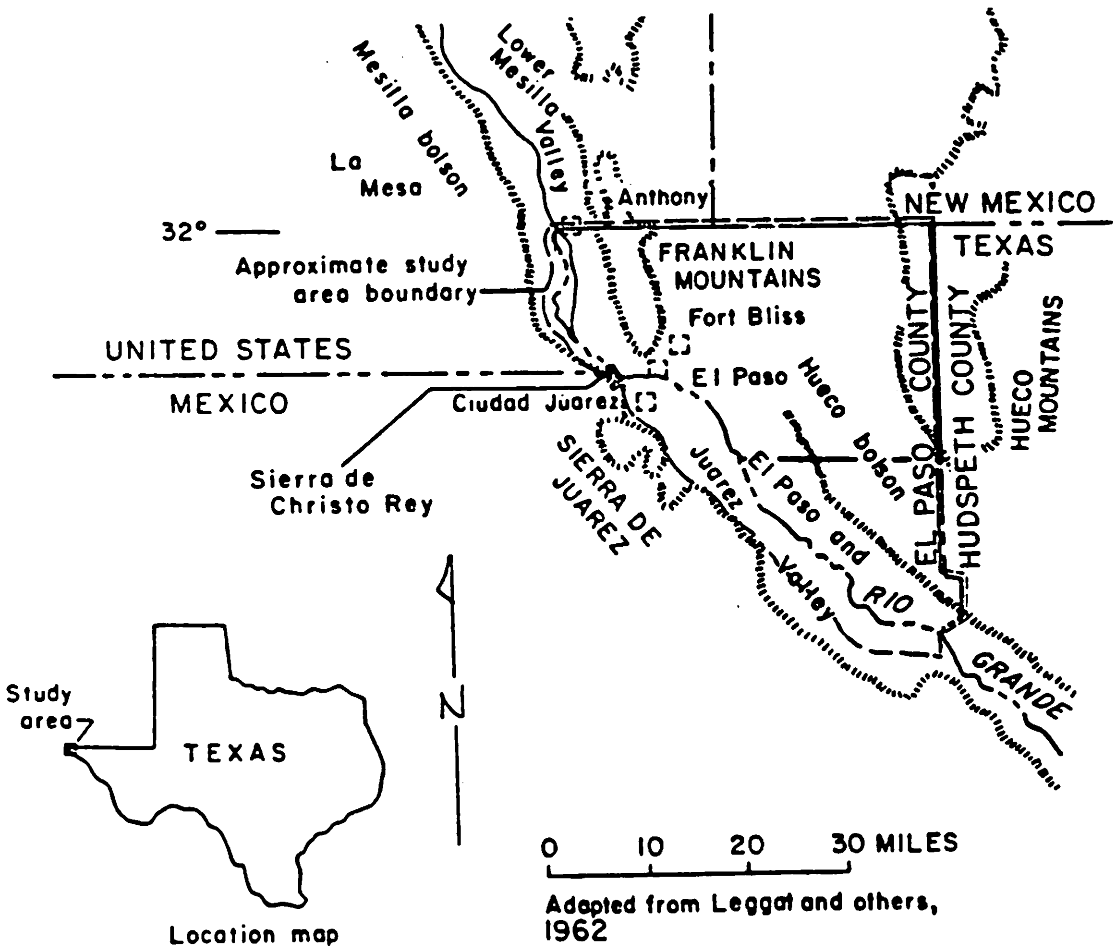


Figure 1. Location and Physiographic Map of El Paso County Critical Ground Water Study Area (Modified after White, 1987).

Upon completion of the interview process, eight prospective nominees were submitted for approval by the TWC Commissioner and El Paso County region Legislators. The following nominees were approved: Mary Haynes, Tom Cliett, Edd Fifer, Ed Archuleta, Judge Luther Jones, Bill Lewis, Justin Ormsby, and Dorline Wonciar.

The major concern expressed by the interviewees was the availability of enough fresh water to meet the needs of future growth of the city of El Paso and surrounding communities. Possible solutions to the problem suggested by those interviewed include increasing artificial recharge of treated wastewater, intensifying existing ground water conservation programs and enforcing existing septic tank regulations so as not to contaminate existing ground water supplies. Other recommendations were additional water-treatment plants for Rio Grande water, improving monitoring and enforcement of existing water conservation ordinances, improving emergency measures for prevention or cleanup of surface chemical spills, and implementation of a subdivision zoning ordinance.

Another major concern expressed by the interviewees was the proposed low-level radioactive waste disposal site located at Fort Hancock in adjacent Hudspeth County. The site is located on an eastward extension of the Hueco Bolson. There was a concern about the potential contamination of the Hueco Bolson in the event of an accident, either man-made or natural disaster (e.g. earthquake).

The establishment of a regional water planning council to develop a regional, ground water management plan was strongly advocated by most of the interviewees. This planning council would consist of representatives from all ground water related entities. It could implement the aforementioned recommendations.

The establishment of an environmental improvement fund to assist small business owners repair leaking underground storage tanks was another recommendation from the interviewees. This concern over the high cost of cleaning up the environment with regard to underground storage tanks has recently been addressed by the 71st Texas Legislature via House Bill 1588.

HYDROGEOLOGY

The principal aquifer supplying fresh ground water in El Paso County is the Cenozoic-age Hueco Bolson located between the Franklin Mountains on the west and the Hueco Mountains on the east (Figure 2). The valley-fill bolson extends northward into New Mexico and southeasterly along the Rio Grande into the Lower El Paso Valley, flanked on the west by several mountain ranges in Mexico and on the east, by the Diablo Plateau and the Finley, Maline, and Quitman Mountains.

The Hueco Bolson consists of approximately 9,000 feet of laterally-discontinuous, alternating layers of clay and unconsolidated sand or gravel gently sloping to the west. A layer of caliche, located a few feet below the surface, retards the downward percolation of water. The layer of caliche effectively reduces natural recharge of the bolson except in areas where the caliche layer is discontinuous and along the flanking mountain ranges (Knowles and Kennedy, 1956). The unconsolidated sands and gravels exhibit good porosity and permeability, as indicated by the numerous high-capacity wells completed in the Hueco Bolson (White, 1987).

The Hueco Bolson can be divided into two different geographical areas: the El Paso Valley and the Mesa area. In the El Paso Valley, fresh water is under artesian aquifer conditions. Water-table conditions occur in the Mesa area approximately 200 feet above the valley (Knowles and Kennedy, 1956). The Hueco Bolson provides 65 percent of water used by the city of El Paso (Cliett, 1989a). Wells completed in the bolson yield from 1,000 to 2,000 gal/min. Water quality of 148 wells sampled and analyzed in the United States portion of the Hueco Bolson by EPWU yielded a range of 270 to 1,500 mg/L total dissolved solids (TDS) and averaged 642 mg/L TDS. Hueco water samples across the Rio Grande in Ciudad Juarez ranged from 370 to 1,500 mg/L TDS and averaged 736 mg/L TDS. The annual rate of change in water salinity averaged about +10 mg/L TDS per year in the United States and approximately +30 mg/L per year in Ciudad Juarez (White, 1987).

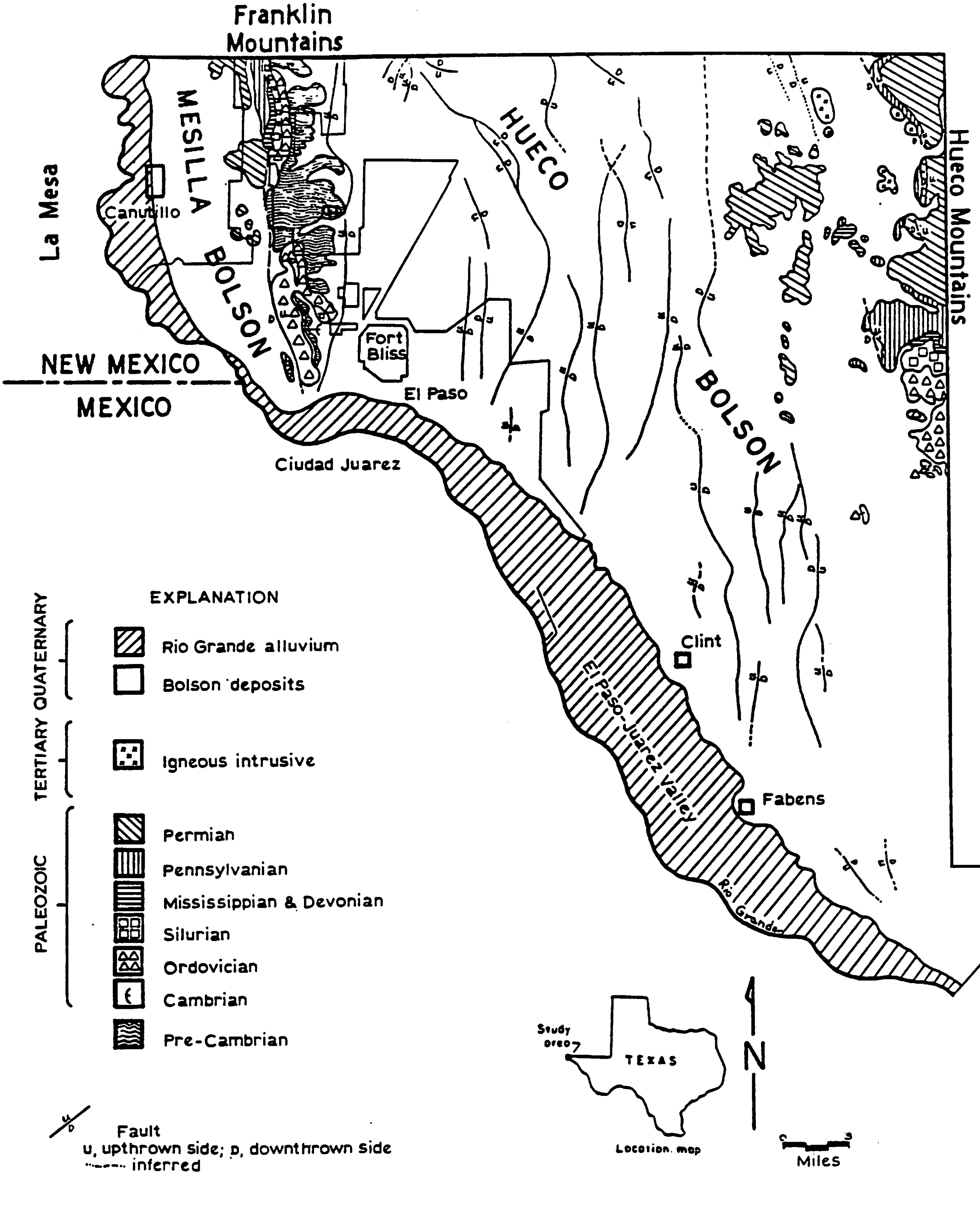


Figure 2. Generalized Surface Geologic Map of El Paso Critical Ground Water Study Area (Adapted from Van Horn - El Paso Sheet, Bureau of Economic Geology, University of Texas at Austin, 1983).

The annual recharge of the Hueco Bolson is estimated to be 6,000 acre-feet per year (Muller and Price, 1984). This low rate of natural recharge is due to the aforementioned layer of caliche near the surface. Natural recharge is limited to to the flanks of the adjacent mountain ranges (White, 1987). Withdrawals of ground water from the Hueco Bolson exceeded 108,000 acre-feet in 1984 (Muller and Price, 1984) resulting in a ground water mining condition and subsequent degradation in water quality. Ground water mining condition results when withdrawals of ground water exceeds natural recharge (White, 1987).

The Mesilla Bolson is the second most prolific aquifer supplying fresh ground water in El Paso County. The bolson extends south from the New Mexico-Texas state line into the Lower Mesilla Valley flanked by the Franklin and Organ mountains on the east (Figure 2). On the west, the Mesilla Bolson is flanked by the West Mesa in New Mexico, which is called 'La Mesa' in Mexico (White, 1987).

The Mesilla Bolson consists of approximately 2,000 feet of valley-fill clay, silt, sand, caliche, and gravel and includes equivalents of the Santa Fe Group of Miocene to Pleistocene age and Rio Grande alluvium of Holocene age (White, 1987; TWDB, 1988). Three laterally continuous zones have been defined, based on lithology, depth, and water quality (Alvarez and Buckner, 1980). The sands and gravels in the Mesilla Bolson, because of their unconsolidated nature, exhibit good porosity and permeability, as indicated by the numerous high-capacity wells completed in the Mesilla Bolson (White, 1987).

Water in the Mesilla Bolson is under water-table conditions. The bolson provides 16 percent of water used by the city of El Paso (Cliett, 1989a). Wells completed in the bolson (Canutillo well field) yield from 1,000 to 2,000 gal/min. Between 1980 and 1981, water quality in the shallowest aquifer of the Mesilla Bolson exhibited a range of 683 to 1,854 mg/L TDS and averaged 1,019 mg/L TDS. The water in the intermediate aquifer exhibited a water quality range of 328 to 741 mg/L TDS and averaged 489 mg/L TDS. The deepest of the three aquifers exhibited the best water quality with a range of 252 to 340 mg/L TDS and an average 278 mg/L TDS during 1980-81. The annual rate of change in water salinity in the Canutillo field averaged +11 mg/L TDS per year in the shallowest aquifer and +9 mg/L TDS per year in the intermediate aquifer. There were no pronounced changes in water quality in the deepest aquifer (White, 1987).

The annual recharge of the Mesilla Bolson is estimated to be 18,000 acre-feet per year (Muller and Price, 1979). This rate of recharge is three times the rate of recharge for the Hueco Bolson. The higher rate of recharge for the Mesilla Bolson is due to a larger recharge zone.

The Rio Grande alluvium is the least prolific aquifer of the three main aquifers in El Paso County. The alluvium overlies the older Hueco and Mesilla bolsons within the upper and lower El Paso Valley (Figure 2). The Rio Grande alluvium consists of up to 200 feet of valley-fill sand, gravel, clay, and silt. The alluvium was partially derived from the erosion and redeposition of the older bolson deposits. Variations in thickness of individual layers and lenses, within the alluvium, make correlations between wells difficult.

Water in the Rio Grande alluvium is under water-table conditions and is hydrologically connected with the Rio Grande (Alvarez and Buckner, 1980). Wells completed in the alluvium yield from 25 to 3,000 gal/min (TWDB, 1988). Water quality generally improves, to less than 2,000 mg/L TDS, near the Rio Grande and decreases farther from the river.

Recharge of the Rio Grande alluvium occurs from: (1) infiltration of precipitation, (2) upward leakage from the underlying bolson deposits, (3) leakage from the Rio Grande and associated canals crossing the alluvium, and (4) irrigation return flows. Approximately one-third of applied surface water percolates, or inflows, to the water table in the alluvium. Since the available surface water is not constant, a range of potential values for ground water recharge is more appropriate. Between 1968 and 1971, the estimated potential ground water recharge ranged from 74,100 to 89,330 acre-feet per year. If the alluvium is near capacity, ground water will leak from the alluvium into the Hueco Bolson below (Alvarez and Buckner, 1980).

The estimated total availability of fresh water, as of 1980, in the Hueco Bolson was 10.2 million acre-feet and in the Mesilla Bolson 0.56 million acre-feet (Muller and Price, 1979). In the Rio Grande alluvium, an estimated 1.4 million acre-feet of ground water, having less than 2,500 mg/L TDS, is theoretically recoverable (Alvarez and Buckner, 1980). These ground water availability figures are approximations and the actual available fresh water may be less as a result of saline water mixing with fresh water while fresh water is being depleted (Price, 1989).

Currently, the slightly-saline waters of the Hueco and Mesilla bolsons in El Paso County provide the nearest source of additional ground water. Additionally, limited sources of import water can be found in bolson deposits in Culberson, Hudspeth, and Jeff Davis counties of Texas. The most abundant quantity of nearby ground water is in the Mesilla Bolson north and west of El Paso County in New Mexico containing approximately 54 million acre-feet of fresh ground water (Wilson, et al, 1981). Present Texas laws do not prevent the exportation of ground water across the state line as in New Mexico. In order for the city of El Paso to use ground water from New Mexico, the New Mexico state laws will need to be changed.

The city of El Paso has been involved in litigation with the state of New Mexico for the past ten years to acquire additional rights to water in the southern part of New Mexico. Progress in acquiring these rights to water has been very slow and frustrating. Negotiations to smooth political differences between El Paso County and the state of New Mexico are needed to refocus the common need of ground water for the economic future of both regions. However, this is a very complex legal issue, and whether or not El Paso county will be able to acquire water from New Mexico is uncertain (Archuleta, 1990).

Water use in the El Paso-Juarez Valley area is unique to both the city of El Paso area and Ciudad Juarez (Figure 3). The total volume of ground water pumped from the Hueco Bolson in the Ciudad Juarez area was 263.27 million m^3 or approximately 213,399 acre-feet. Approximately 70 percent (149,379 acre-feet) was used for agriculture, 27 percent (57,618 acre-feet) for municipal use, and 3 percent (6,402 acre-feet) for domestic, industrial, and ranching (Universidad Autonoma De Ciudad Juarez, 1987). Water-use figures in the city of El Paso area reflect inverted water-use percentages as compared to Ciudad Juarez. Using 1984 pumping amounts, 86 percent (93,335 acre-feet) was used for municipal use, 6 percent

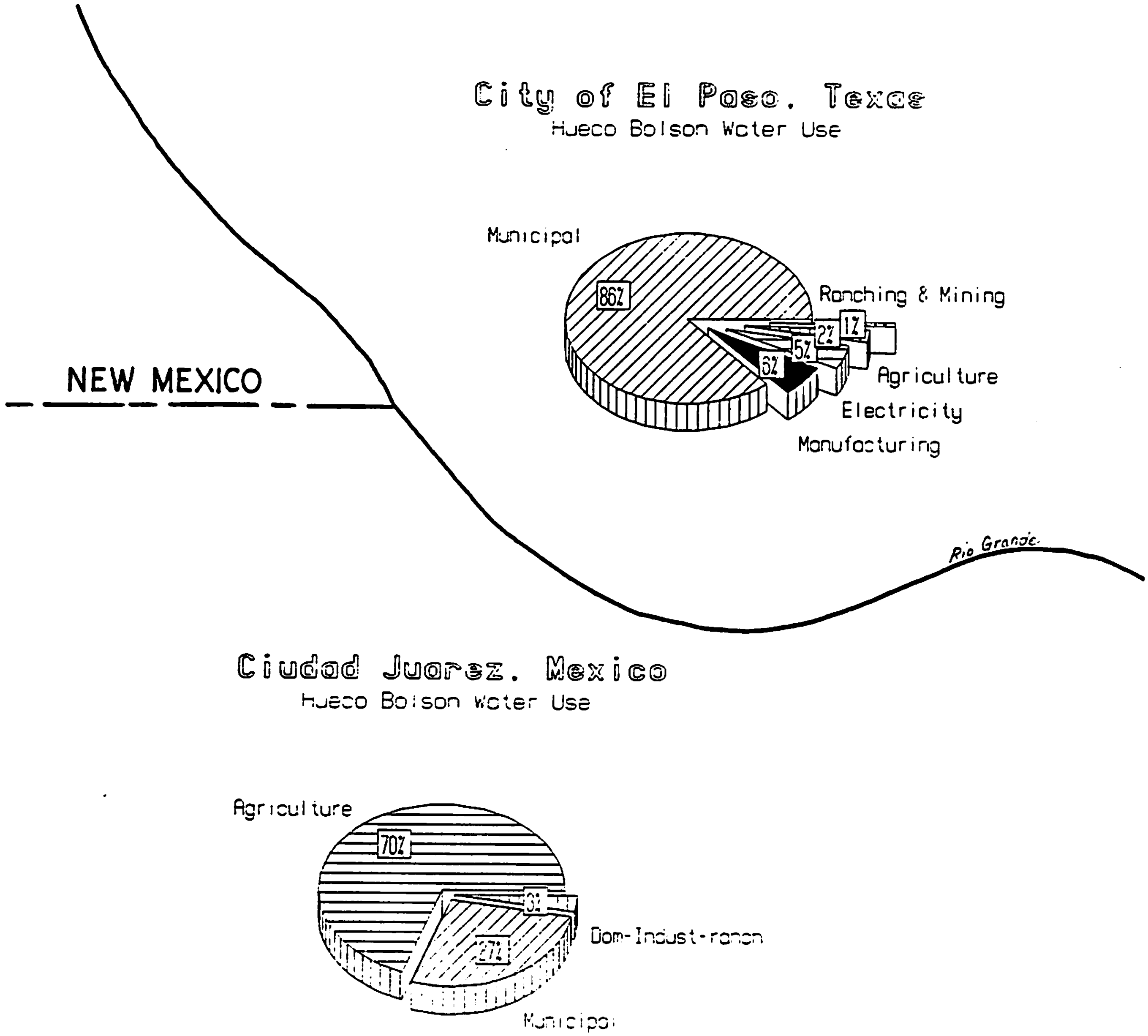


Figure 3. Hueco Bolson Water Use in the El Paso-Juarez Valley by the City of El Paso, Texas (Muller and Price, 1984) and by Ciudad Juarez, Mexico (Universidad Autonoma De Ciudad Juarez, 1987).

(6,577 acre-feet) for manufacturing use, 5 percent (5,052 acre-feet) for steam-generated electricity, 2 percent (2,422 acre-feet) for irrigation, and 1 percent (832 acre-feet) for livestock and mining activities (Muller and Price, 1984).

The principal ground water problems in El Paso County are availability and quality. Water levels in wells completed in the Hueco Bolson have declined at a rate of six to seven feet per year near the center of the city of El Paso, while further to the northeast, the decline rate is one foot per year (Figure 4). Hydrographs of selected wells exhibit this water decline rate (Figure 5). The water levels in city water wells completed in the Mesilla Bolson (Canutillo field) have risen slightly during the years 1980-1985 (Figure 6), indicating a greater recharge than pumpage (TWDB, 1988). According to the fifty-year water plan (TDWR, 1984), there was enough ground and surface water to meet the needs of El Paso County in 1980. However, since 1980, there has been an increase in demand for water that has exceeded the recharge rate of 6,000 acre-feet per year (Figure 7). The degradation of water quality in the Hueco Bolson is associated with the declining water levels (Figures 8 & 9). As the fresh water in the bolson is being depleted, the saline waters encroach and mix with the fresh water resulting in degradation of ground water quality (TWDB, 1988). Another problem associated with ground water quality is contamination of the shallow aquifers by inadequate septic systems (Haynes, 1989). Agricultural activities, fertilizer and pesticide use, in the Upper Valley and Lower Valley have the greatest potential for degradation of water quality (EPWU, 1986).

The PSB and EPWID No. 1 have jointly embarked on the development of a long-range plan for management of El Paso's water resources. The water resource consulting firm, Boyle Engineering Corporation, was retained in November, 1989, to conduct a year-long study of the regional water supply. The Boyle Study is under the guidance of a five-member Manage Advisory Committee, of which Tom Cliett, Ed Archuleta, and Edd Fifer are members. A ten-member Technical Advisory Committee (TAC) provides technical support and public relations (Draft TAC Fact Sheet, 1990). The results of the Boyle Study will be available for use in refining the recommended water management practices (Archuleta, 1989).

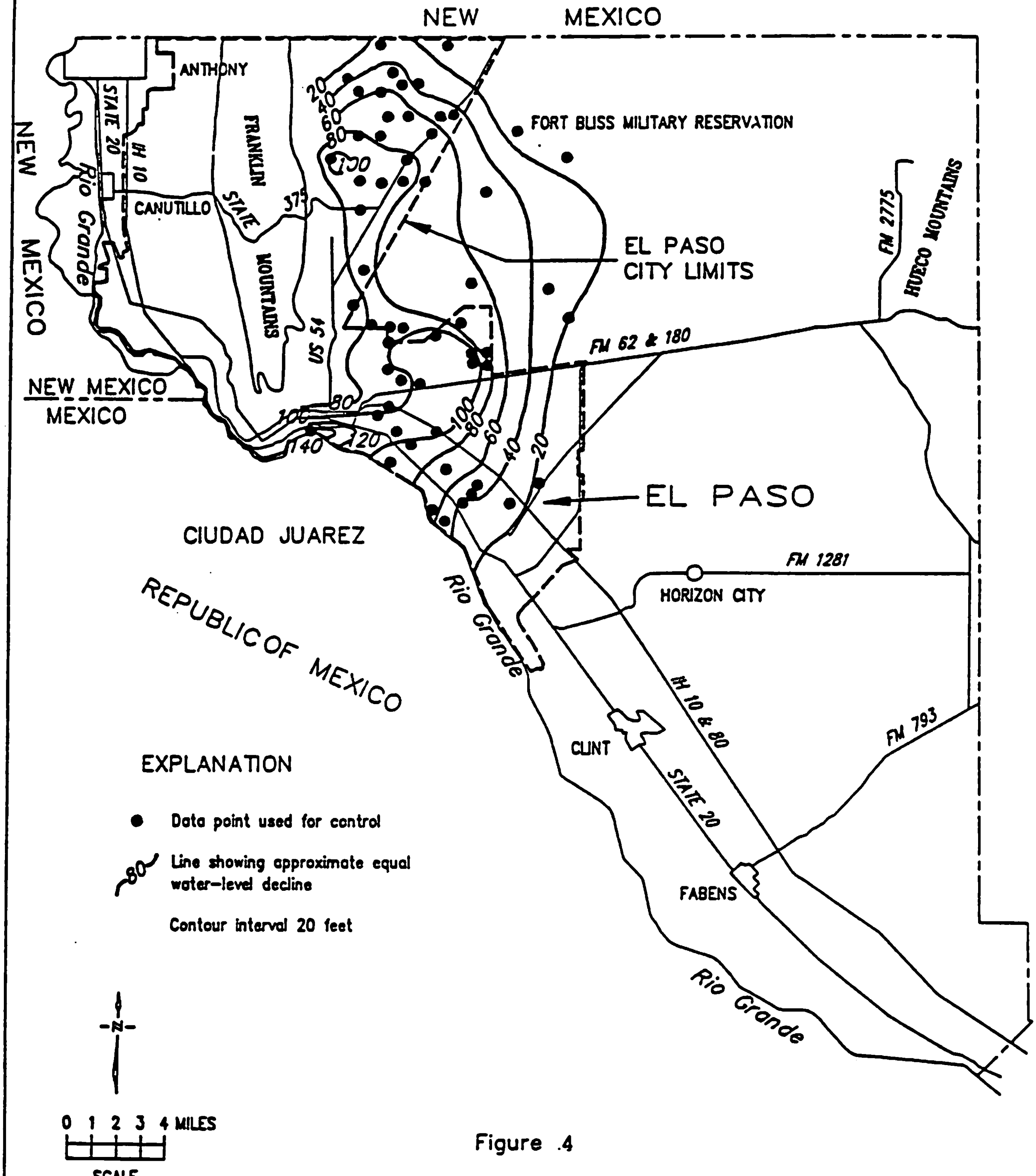


Figure 4

WATER-LEVEL DECLINE IN THE HUECO BOLSON AQUIFER FROM 1903 TO 1989

(Ashworth, 1989)

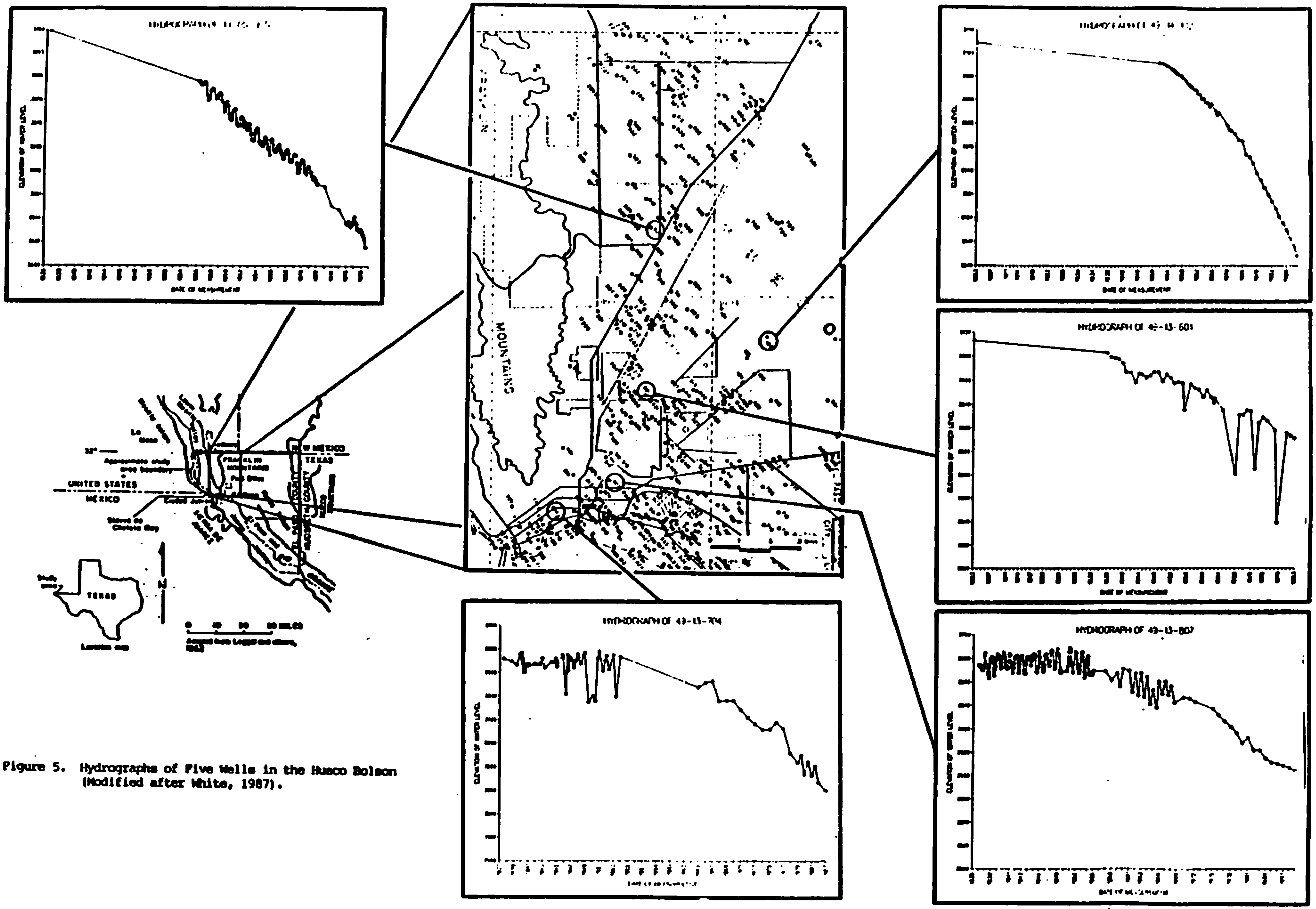


Figure 5. Hydrographs of Five Wells in the Hueco Bolson (Modified after White, 1987).

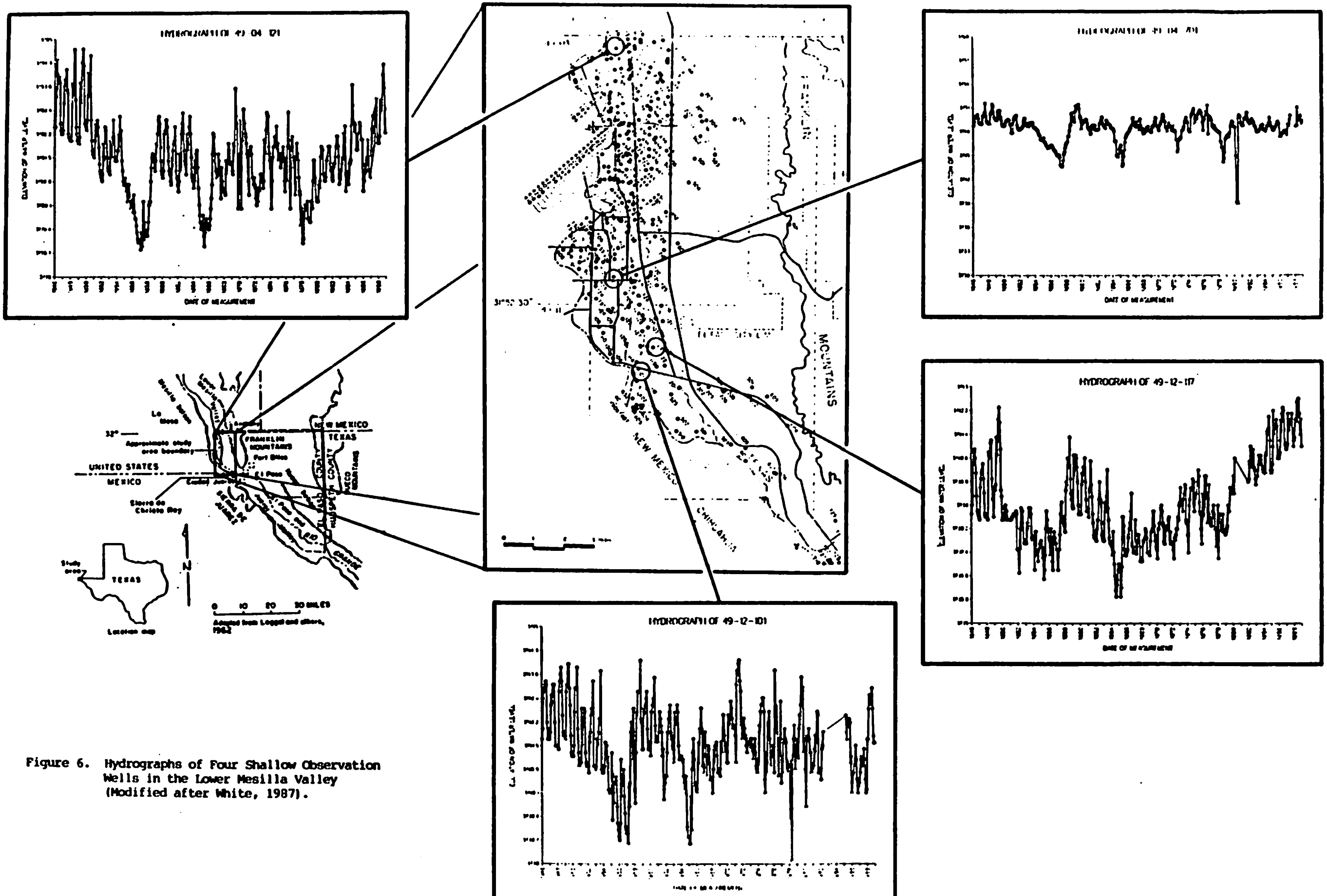


Figure 6. Hydrographs of Four Shallow Observation Wells in the Lower Mesilla Valley (Modified after White, 1987).

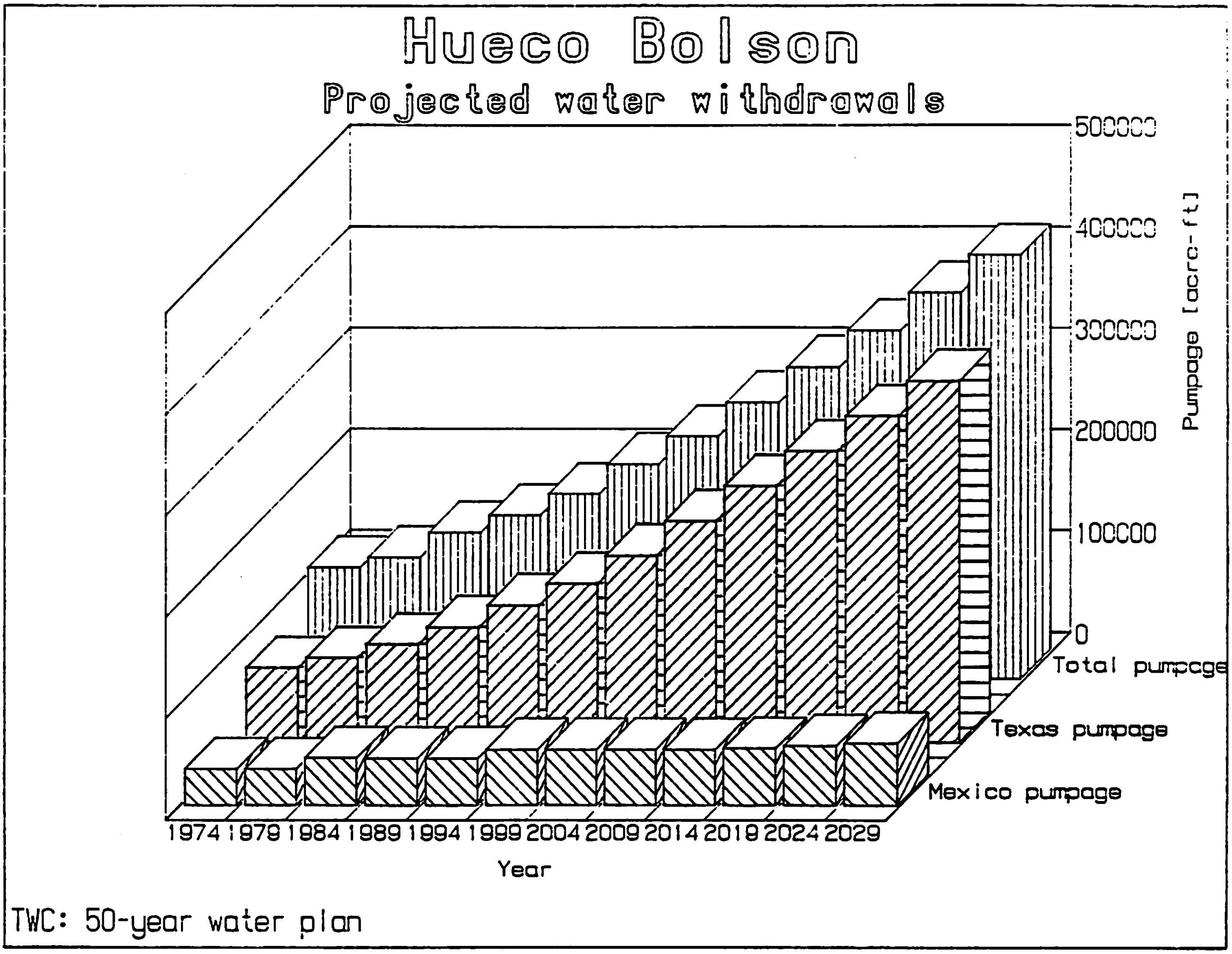


Figure 7. 50-Year Water Plan for the Hueco Bolson (TDWR, 1984).

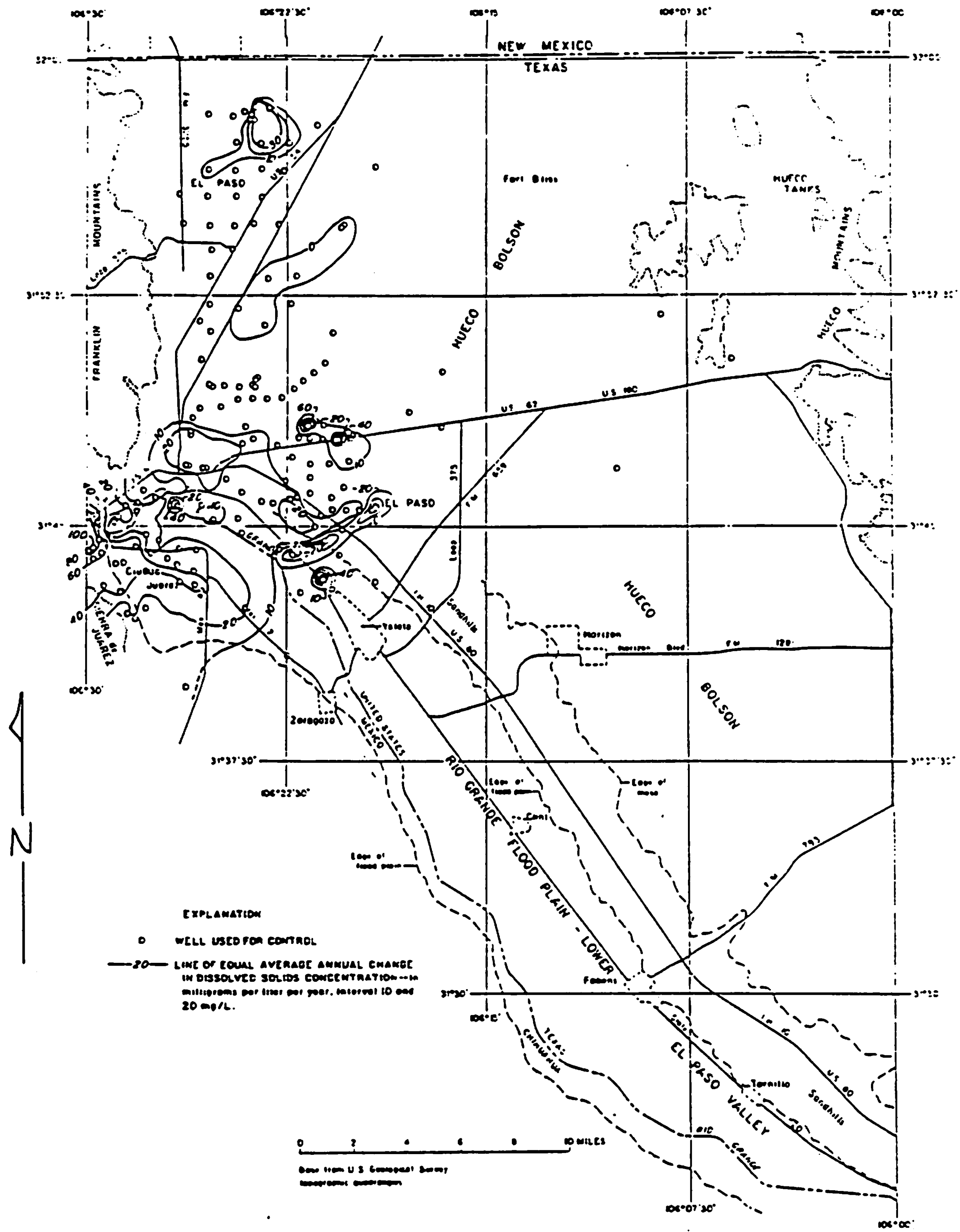


Figure 8. Average Annual Change in Dissolved-Solids Concentrations in Samples From Wells in the Hueco Bolson Metro Area (White, 1987).

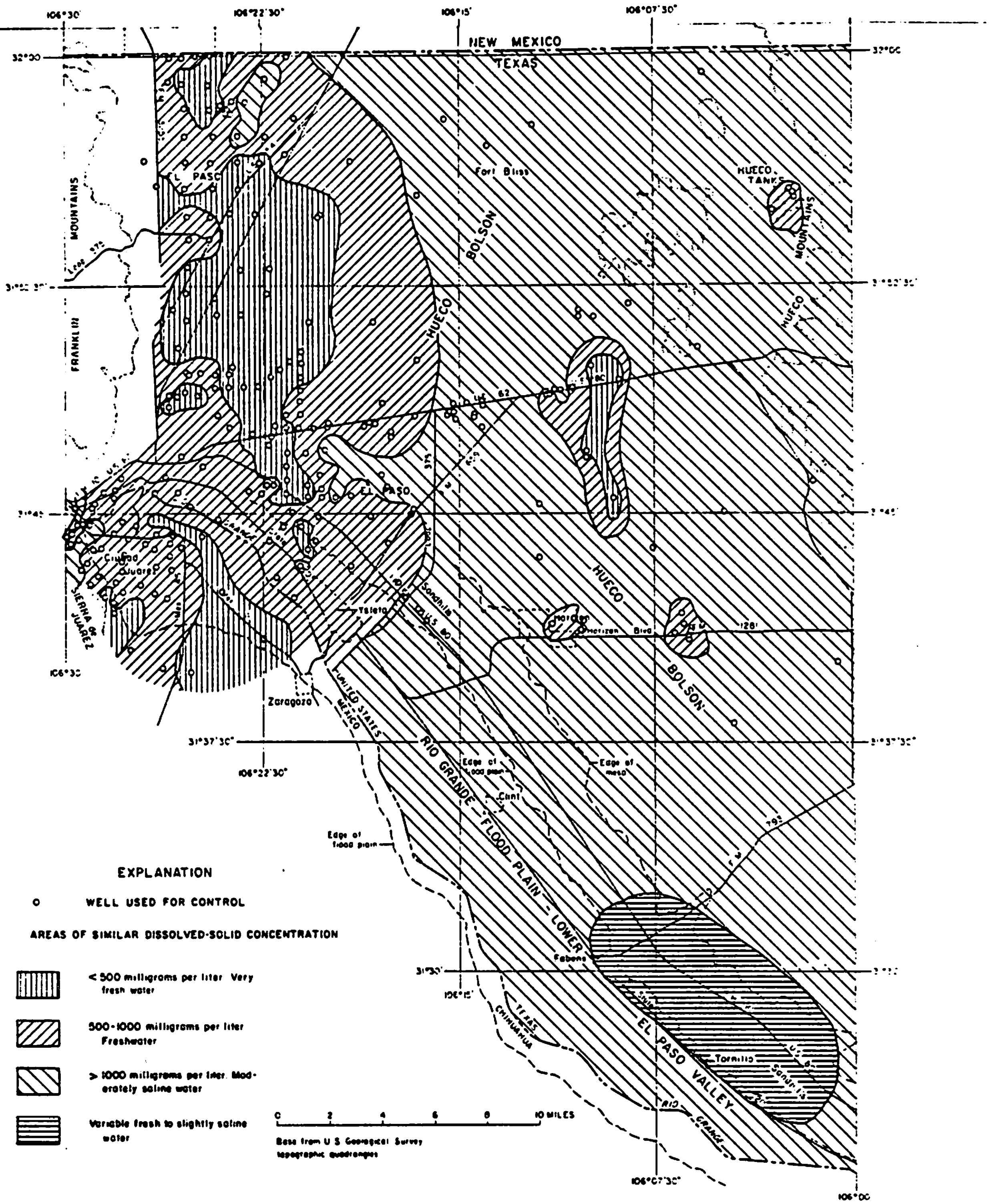


Figure 9. Areas of Similar Dissolved-Solids Concentrations in Samples From Wells in the Hueco Bolson, 1979-81 (White, 1987).

POLLUTION POTENTIAL ASSESSMENT

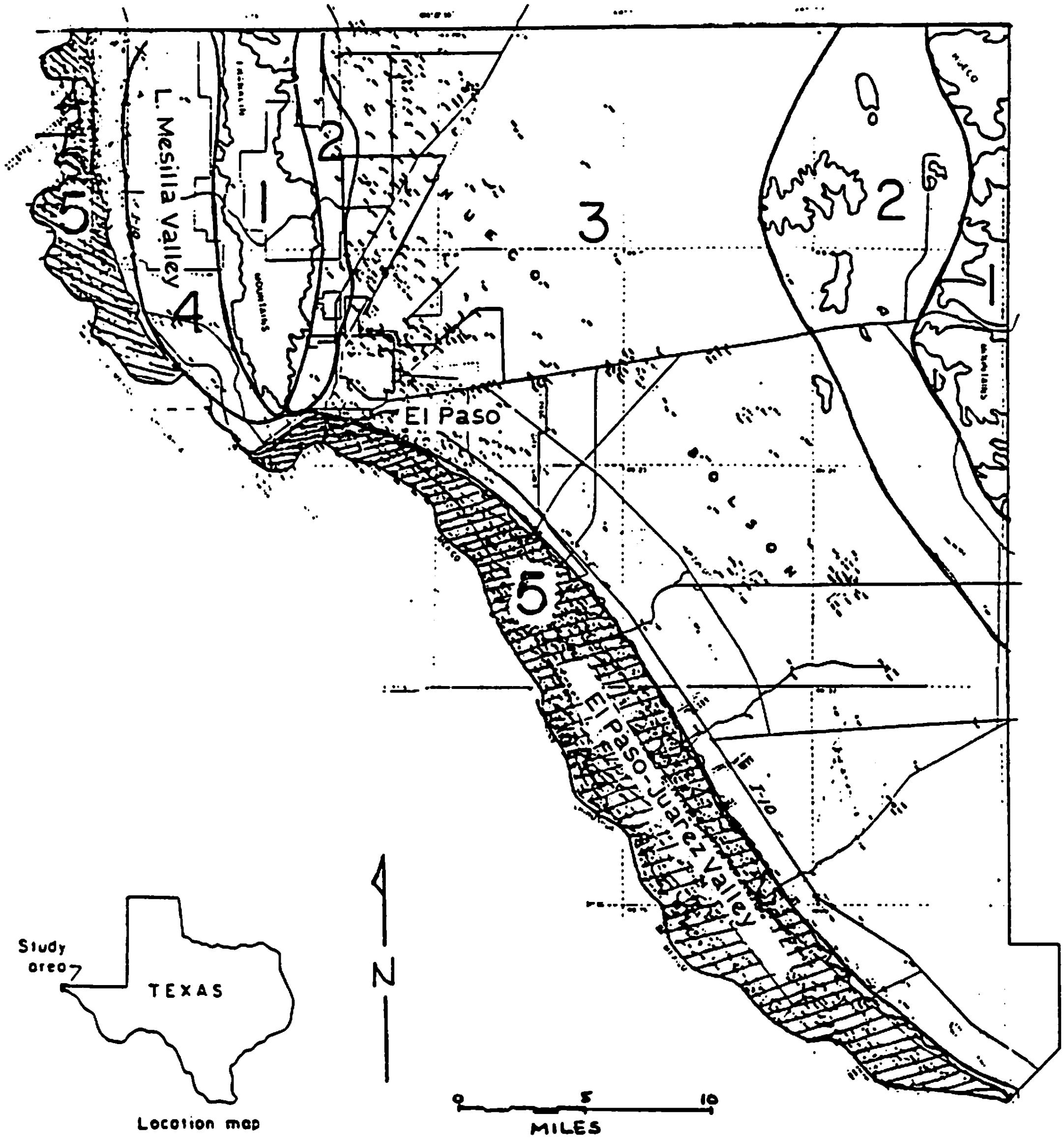
The shallow, unconsolidated nature of the Rio Grande alluvium and the Hueco and Mesilla bolsons make them vulnerable to surface pollution. As part of its statewide ground water assessment program, the TWC adopted a methodology to delineate sensitivity to ground water pollution known as DRASTIC. This methodology was developed in the mid-1980's by a group sponsored by the National Water Well Association and the Robert S. Kerr Environmental Research Laboratory.

DRASTIC is a systematic process for assessing the ground water vunerability of different hydrogeologic settings. Two pollution potential, or index, numbers are generated for pollution from municipal-industrial and agricultural sources. A high number refers to a high pollution potential for a given hydrogeologic setting. Conversely, a low index number refers to a low pollution potential.

In El Paso County, five hydrogeologic regions were defined (Figure 10). The five hydrogeologic regions include the Franklin and Hueco mountain ranges, Hueco bolson recharge zone along the flanking mountain ranges, Hueco bolson with caliche layer percolation barrier, Lower Mesilla Valley, and Rio Grande alluvium.

DRASTIC pollution index numbers within the study area ranged from a minimum of 65 to 79 in the mountain ranges to a maximum pollution index number greater than 155 in the Rio Grande alluvium (Figure 11). The Hueco bolson recharge zone and Mesilla Valley had intermediate pollution index numbers. Both the municipal-industrial and agricultural pollution source maps suggest the most pollution-sensitive area within El Paso County is in the Rio Grande alluvium. The Mesilla Valley and the Hueco Bolson recharge zones would rank second in pollution sensitivity.

The DRASTIC maps of the critical ground water study area can be used in conjunction with a wellhead protection program. Other applications could be in urban planning and recharge enhancement projects along the flanks of the Hueco Bolson. In addition, improved septic tank regulations could be adopted for each hydrogeologic region to minimize ground water pollution.



Hydrogeologic Regions:

1 - Franklin & Hueco Mountains
2 - Hueco Bolson Recharge Zone
3 - Hueco Bolson with Caliche Layer
4 - Mesilla Valley
5 - Rio Grande Alluvium

Figure 10. DRASTIC Hydrogeologic Regions of El Paso County Critical Ground Water Study Area (TWC, 1989b).

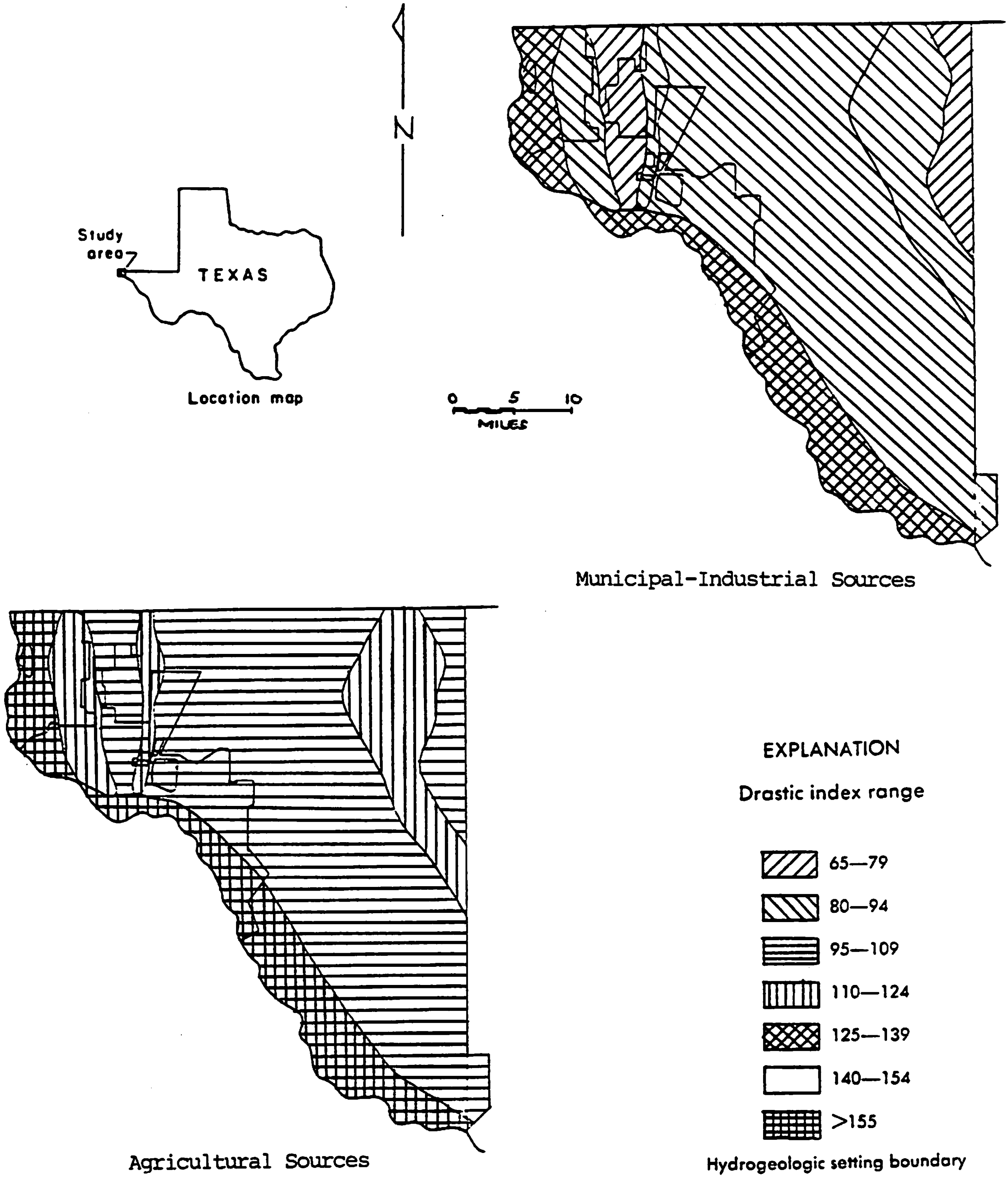


Figure 11. DRASTIC Pollution Index Maps for Municipal-Industrial and Agricultural Pollution Sources of the El Paso County Critical Ground-Water Study Area (TWC, 1989b).

EFFICIENCY OF EXISTING GROUND WATER REGULATORY INSTITUTIONS

In El Paso County, there are several types of entities which are involved in ground water production and use. They include the city of El Paso's Public Service Board (PSB), Fort Bliss military reservation, and between 50 and 100 water supply corporations. Each of these entities have different levels of regulatory power.

Currently, the city of El Paso, through the PSB, regulates the number of water wells drilled and spacing within the city limits. Well spacing regulations have been in place since circa 1903. An inverted price structure, in which the cost of water increased as more water was used, was implemented in 1980-81 to promote water conservation. In 1988, the PSB implemented an eight-point water conservation plan that includes: (1) replacing old and leaking pipes, (2) lining concrete reservoirs, (3) promoting native vegetation for landscaping, (4) a plumbing code that requires 'water-saving' commodes and shower heads in all new homes, (5) blending brackish water with better quality water to extend fresh water reserves, (6) using the maximum amount of surface water that treatment facilities or allotments will permit, (7) treating sewage effluent to drinking-water standards for recharge of the Hueco Bolson in northeast El Paso County, and (8) adopting a more restrictive inverted water-rate schedule for all customers serviced by EPWU (EPWU, 1986). These activities have been estimated to save at least 31,600 acre-feet of water per year (Cliett, 1989b). In addition to these water-conservation measures, the TWC is working with EPWU to set up a wellhead protection program for all of their public supply wells (Cross, 1989).

On Fort Bliss, the U.S. Army has stronger regulatory powers than the city of El Paso. Water-conservation measures, similar to those by EPWU, have been implemented except for an inverted water-rate schedule. In addition, a water-recycling program has been implemented in the motor pool vehicle wash area that has minimized the loss of fresh water (Lewis, 1989).

The efficiency of the PSB's management of ground water resources has been rated by the persons interviewed as fair to good with average being the most common response. The fair ratings were due to concerns that PSB's water-rate schedule was too liberal, promoting waste. On the other hand, the PSB was given an average to good efficiency rating for its implementation of the eight-point, water-conservation program previously described.

The lack of a regional, coordinated, long-range planning effort, between the PSB and other water supply corporations, to best manage the limited ground water resources in El Paso County was a major concern expressed by most of the persons interviewed. Another point of concern expressed by some of the persons interviewed dealt with the PSB's water-conservation efforts being short-circuited by the City Planning Board of El Paso. The Board was planning to build man-made lakes and additional golf courses--both high-volume water users.

ADMINISTRATIVE FEASIBILITY AND ECONOMIC IMPACT OF RESTRICTING WITHDRAWALS OF GROUND WATER

As previously stated, the city of El Paso regulates the number and spacing of water wells drilled within its city limits. Restricting withdrawals of ground water on a regional basis can be accomplished by two methods: self-limitation on a voluntary basis and by the formation, under authority of Chapter 52 of the Texas Water Code, of an underground water conservation district (UWCD).

The voluntary, self-limitation method of restricting withdrawals of ground water can be effective in areas of large areal extent with a few major ground water producers. A positive aspect of the voluntary method is the lower cost from using existing ground water producing entities. On the negative side, the voluntary method requires cooperation from a majority of the ground water producers in order to be successful. Enforcement powers are weak to non-existent when dealing with uncooperative members of a voluntary ground water conservation program.

An UWCD, on the other hand, has the power to impose and enforce restrictions on withdrawals of ground water. This is a positive aspect of an UWCD in the event of a proposed ground water conservation region having uncooperative ground water producers. An UWCD also provides long-range ground water management, perform studies and research, implements permitting and registration of water wells, educates the public, and provides a liaison between local and regional ground water producers and state and federal agencies concerned with ground water. Additional benefits of an UWCD include water-quality monitoring programs, investigation of water quality complaints, and establishment of ground water protection guidelines, including the newly formed wellhead protection program, for municipalities in the UWCD. The proper construction of water wells, to prevent surface pollution of ground water, is a very important water-quality enforcement power of an UWCD. On the negative side, an UWCD requires a source of operating funds such as ad valorem taxes. This will add another layer of governmental regulations which may not be desirable in some areas where ground water conservation measures are already in place.

The economic impact of restricting withdrawals of ground water in El Paso County is two-fold in nature, according to the persons interviewed. Increasing the cost of water using an inverted rate schedule will promote conservation. As a result of conservation, the economic life of the Hueco and Mesilla bolsons will be extended. A moderate, inverted rate schedule implemented in 1980-81 has reduced the average water use per person from 200 to 194 gallons per person per day. The general feeling concerning the long-term availability of ground water is that the restriction of ground water withdrawals will not have as much of an economic impact as running out of ground water.

CONJUNCTIVE USE OF GROUND AND SURFACE WATER

The increased conjunctive use of ground and surface water is very much needed in El Paso County. Approximately 80 to 85 percent of the water supply for the city of El Paso is from ground water; of which 65 percent is from the Hueco Bolson and 16 percent from the Mesilla Bolson. Currently, about 15 percent of water used by the city of El Paso is surface water from the Rio Grande. All of the persons interviewed expressed the need for more dependence upon surface water than ground water.

FINANCING MANAGEMENT AND PROTECTION ACTIVITIES

Underground water conservation districts (UWCDs) have several methods available for financing operations which include water-use fees, ad valorem taxes, permit fees, and other miscellaneous methods such as bonds, interest on time deposits, grants, and sales of materials and water. Of the above listed methods for financing UWCDs, the water-use fee was the primary choice by the persons interviewed. Ad valorem or property taxation was the second choice for financing an UWCD. Currently, the maximum ad valorem tax rate for the operation of an UWCD is $0.50 per $100.00 of assessed property value. To date, the highest ad valorem tax rate assessed has been less than $0.05 per $100.00 of assessed property value (Table 1). Assuming an UWCD covered all of El Paso County, excluding Fort Bliss, with a 1986 taxable value of $11,203,235,633 before exemptions (Dallas Morning News, 1987) and using a tax rate of $0.01 per $100 value, approximately $1,120,323 could be generated.

Currently, Chapter 52 of the Texas Water Code does not include water-use fees as a method to finance an UWCD. Authorization for such fees requires special legislation. If a water-use fee was available, the amount of revenue generated would depend upon the amount of ground water pumpage. According to Muller and Price (1984), the ground water pumped in El Paso County in 1984 was approximately 108,218 acre-feet or 35,279,068,000 gallons. For example, assuming an assessed water-use fee of $0.0065 per 1,000 gallons of ground water, an estimated $229,314 could be generated.

CONCLUSIONS

The study area has experienced and continues to experience ground water overdraft and quality degradation in the Hueco and Mesilla bolsons. The degradation in water quality is significant and is the result of pumpage greater than natural recharge which causes mixing of available fresh water with saline water. Over the next 20 years, the demand for water for the city of El Paso is expected to increase by at least 50 percent. A moderate increase is projected in manufacturing use and other miscellaneous water uses. On the basis of these conclusions, portions of El Paso County qualify as a critical area.

The city of El Paso, through the PSB, is striving to acquire additional sources of ground water in the Mesilla Bolson in southern New Mexico. In addition, an eight-point, water-conservation program has been implemented by the PSB. The U.S. Army at Fort Bliss, has implemented similar, but stronger, water-conservation measures. With these efforts by the PSB and Fort Bliss, there is still not a regional water plan to coordinate ground water conservation efforts between these entities and the numerous water supply corporations utilizing the Hueco Bolson.

There are no entities which have the authority to comprehensively manage ground water on a regional basis in El Paso County. Fort Bliss, being a military installation, has powers to enforce water-conservation programs. A coordinated effort between the civilian and military portions of El Paso County would effectively extend the limited ground water of the Hueco Bolson.

Ground water quality and quantity problems with the Hueco Bolson in El Paso County are also being experienced by Mexico south of the Rio Grande. Since the bolson crosses the border into Mexico, an international, cooperative effort to minimize ground water quality degradation and extend the availability of fresh to slightly-saline waters (less than 3,000 mg/L TDS), would be beneficial for the communities on both sides of the Rio Grande.

RECOMMENDATIONS

Critical ground water conditions exist in portions of El Paso County. Therefore, it is recommended that the TWC Commissioners designate the region of El Paso County delineated on Figure 12, as a critical area. In addition, a regional water management plan is needed in El Paso county. The current level of concern for potential ground water shortages suggest that a voluntary ground water management plan may be feasible. This regional ground water management plan should include the areas overlain by the Hueco and Mesilla bolsons and the Rio Grande alluvium in which critical ground water conditions currently exist, or likely to experience within the next twenty years (Figure 12).

Further ground water conservation measures will need to be implemented to minimize the rate of water-level decline as increasing population of the county will place increasing demands upon the aquifers in the areas of:

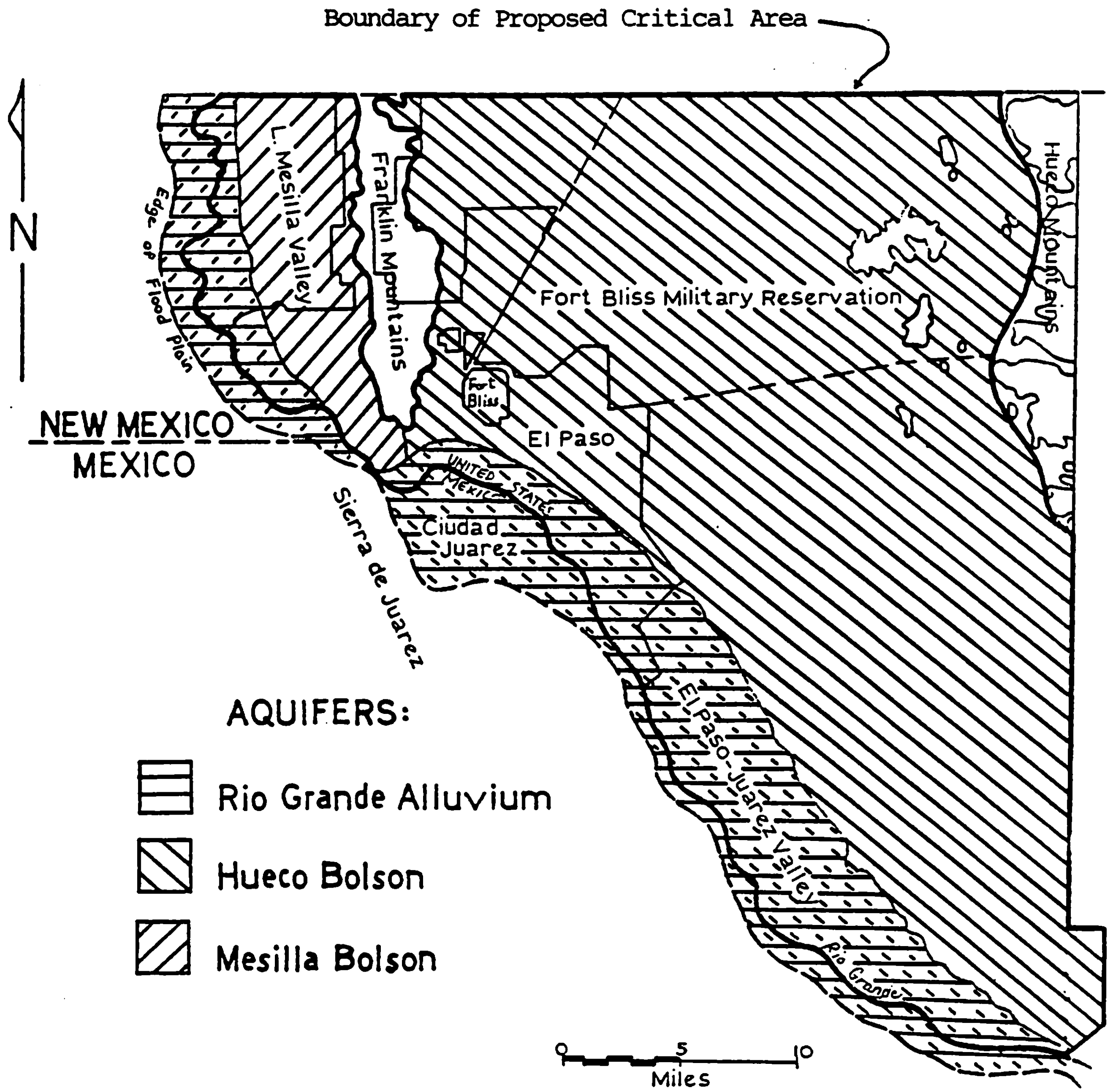


Figure 12. Proposed Boundary of Critical Area for the Greater Portion of El Paso County (Base map modified after Alvarez and Buckner, 1980).

1. Increased use of slightly-saline water in blending with fresh water and desalination.

2. Establishment of a county-wide, well-head protection program to minimize potential ground water contamination.

3. Promote use of native vegetation in residential and commercial landscaping.

4. Promote industries that use a minimum volume of water in their operation and recycles water for reuse.

5. Solicit help from the International Boundary and Water Commission to attempt to get cooperation from Mexico in the conservation and protection of ground water.

The following three surface-water management practices, recommended by the TWDB (Ashworth, 1989), have been carried out to some degree and their continuation should help increase the availability of the current surface-water supply:

1. Continued modernization of the Rio Grande Project conveyance system by lining the canals and ditches with concrete and, when feasible, replacing with pipe to minimize the amount of water lost to deep perculation.

2. Removal of phreatophytes along waterways to reduce water loss by transpiration.

3. Continued reuse of sewage effluent for irrigation.

In addition to the above surface-water management recommendations, the development of man-made lakes for recreation, or any other purposes, is not recommended. The low humidity and high temperatures in the El Paso County region results in an average gross lake evaporation rate of about 80 inches per year which is 10 times the average annual rainfall.

The current inverted water pricing schedule should be increased to reflect the true value of the water in El Paso County. The current price of water is low in respect to the cost of production of an ever-decreasing volume of fresh to slightly-saline water in the Hueco Bolson. The net effect of increasing the price of water to reflect its true value is to extend the life of the Hueco Bolson by promoting water conservation through economics.

The proposed low-level, radioactive waste disposal site, located near Fort Hancock in Hudspeth County, lies upon the southeast extension of the Hueco Bolson. If the site is approved by the Texas Department of Health, it is recommended that engineered disposal methods exceed minimum standards to ensure the safety of the bolson.

Finally, it is recommended that a two-stage, regional ground water management plan be implemented. Stage one would be voluntary, regional ground water management for five years. Stage two would be the consideration of an UWCD if stage one was unsuccessful in attaining its goals.

Stage one would be voluntary, consisting of the formation of a regional ground water planning council. Members of this council would come from the city of El Paso's PSB, Fort Bliss, water supply corporations, and other local government entities. The number and percent representation should be worked out by the Critical Area advisory committee and the TWC.

A 50-year water-use plan should be developed by this planning council. For the next five years, this voluntary restriction of ground water would be used to attain the following goals:

(1) Reduce the current per capita use of water from the current level of 190 gallons per person per day (gal/person/day) to 175 gal/person/day by 1995 and 160 gal/person/day by the year 2000. The 160 gal/person/day water use is comparable to other arid regions of the United States (e.g. Phoenix, Arizona).

(2) Increase the percent of reclaimed water used by commercial and industrial plants by 25 percent by 1995 and 50 percent by the year 2000.

(3) Increase the percent surface water treated compared to surface water used by 25 percent by 1995 and 50 percent by the year 2000.

(4) Report status of ground and surface water reserves in an annual report to the TWC. The progress of the above three goals in addition to changes in regional ground water management strategy should be included in the annual report.

The aforementioned water management recommendations are general recommendations. The completion of the previously described Boyle Engineering Study (page 10 of this report) in November, 1990, will be very useful in the drafting of a voluntary, regional water-management plan acceptable to the Commision and the residents of El Paso County.

In 1995, at the end of the five-year period (stage 1), the effectiveness of the voluntary restriction of ground water will be evaluated by the TWC. If it is decided that the voluntary method of restricting ground water withdrawals is not effective enough, then stage two will be implemented. Initially, stage two could consist of public hearings to determine if an UWCD would be beneficial to El Paso County.

TABLE __

TAX RATE, USE FEE, AND REVENUES
UNDERGROUND WATER DISTRICTS (TWC, 1989a)

District	Tax Rate/Use Fee	Revenues/Budget[2]
Anderson County UWCD	No Tax Rate	None to Date
Barton Springs-Edwards Aquifer CD	$0.25/1,000 gals.	$ 300,000[1]
Coke County UWCD	$0.0108	$ 25,415
Collingsworth County UWCD	No Tax Rate Approved	None to Date
Dallam County UWCD	$0.00	$ 3,100
Edwards UWD	$0.0097	$ 4,053,000
Evergreen UWCD	$0.005	$ 97,500
Fox Crossing WD	No Tax Rate	None to Date
Glasscock County UWCD	$0.02	$ 90,676
Harris-Galveston Coastal Subsidence District	$0.0065/1,000 gals.	$ 1,116,998
Hickory UWCD	$0.044	$ 117,800
High Plains UWCD	$0.008	$ 976,300[1]
Hill Country UWCD	$0.0125	$ 81,000[1]
Hudspeth County UWCD	$0.02	$ 5,179
Irion County WCD	$0.03	$ 113,819
Lipan-Kickapoo WCD	$0.00[3]	(?)
Martin County UWCD	$0.02	$ 69,750[1]
North Plains UWCD	$0.0107	$ 325,000
Panhandle GWCD	$0.00412	$ 85,537
Plateau UWC and Supply District	No Tax Rate	$ 571
Sterling County UWCD	$0.03	$ 52,000[1]
Sutton County UWCD	$0.01	--

[1] Tax rate is per $100 property valuation and use fee per 1,000 gallons of water pumped
[2] Annual budget shown when revenue information unavailable; most recent available data 1986-88
[3] Voters approved taxing authority not to exceed $0.50 but Board has not set a rate

SELECTED REFERENCES

Alvarez, H.J. and Buckner, A.W., 1980, Ground-Water Development in the El Paso Region, Texas, With Emphasis on the Resources on the Lower El Paso Valley: Texas Department of Water Resources Report 246, 346 pp.

Archuleta, E., 1989, Personal Communication at first Critical Area Advisory Committee Meeting, El Paso, Texas, September 25, 1989.

____________________, 1990, Personal Communication at second Critical Area Advisory Committee Meeting, El Paso, Texas, January 10, 1990.

Ashworth, J.B., 1989, Evaluation of Ground-Water Resources in El Paso County, Texas, Texas Water Development Board Draft Report, 38 pp.

Bureau of Economic Geology, 1983, Geologic Atlas of Texas, Van Horn-El Paso Sheet, The University of Texas at Austin, 1 sheet.

Cliett, T., 1989a, Personal Communication, Geologist, El Paso Water Utilities, March, 1989.

_________, 1989b, Personal Communication to John Ashworth, TWDB.

Cross, B.L., 1989, Personal Communication, Geologist, Ground Water Conservation Section, Texas Water Commission, March, 1989.

Dallas Morning News, 1987, 1988-1989 Texas Almanac and Industrial Guide, 640 pp.

EPWU, 1986, El Paso's Comments on Ground Water Resources, El Paso Water Utilities, 5 pp.

Haynes, M., 1989, Personal Communication, former county commissioner, El Paso County, March, 1989.

SELECTED REFERENCES - CONT'D.

Knowles, D.B. and Kennedy, R.A., 1956, Ground-Water Resources of the Hueco Bolson, Northeast of El Paso, Texas: Texas Board of Water Engineers Bulletin 5615, 265 pp.

Lewis, B., 1989, Personal Communication, Manager, Fort Bliss Water Plant, March, 1989.

Muller, D.A., and Price, R.D., 1979, Ground-Water Availability in Texas--Estimates and Projections through 2030: Texas Department of Water Resources Report 238, 77 pp.

Muller, D.A., and Price, R.D., 1984, Ground-Water Availability Data on Computer Printout.

Price, R.D., 1989, Personal Communication, Geologist, Water Rights and Uses Division, Texas Water Commission, April, 1989.

Technical Advisory Committee (TAC), Bolye Engineering Study, 1990, El Paso Undertakes Development of Master Plan for Long-Range Management of its Water Resource, draft, January 23.

Texas Department of Water Resources, 1984, Water for Texas, A Comprehensive Plan for the Future: Vol. 1 & 2, GP-4-1.

Texas Water Commission, 1989a, Underground Water Conservation Districts, A Report to the 71st Legislature, 52 pp.

______________________, 1989b, Ground Water Quality of Texas, An Overview of Natural and Man-Affected Conditions, Report 89-01, 197 pp.

Texas Water Development Board, Ground-Water Unit, 1988, Ground-Water Conditions in Texas, 1980-1985: Report 309, 53 pp.

Universidad Atonoma De Ciudad Juarez, 1987, Evaluacion Geohidrologica Del Acuifero De La Zona Urbana De Ciudad Juarez, Chihuahua, 136 pp.

White, D.E., 1987, Summary of Hydrologic Information in the El Paso, Texas, Area, With Emphasis on Ground-Water Studies, 1903-80: Texas Water Development Board Report 300, 75 pp.

Wilson, C.A., White, R.R., Orr, B.R., and Roybal, R.G., 1981, Water Resources of the Rincon and Mesilla Valleys and Adjacent Area, New Mexico: Prepared by the U.S. Geological Survey for the New Mexico State Engineer, Report 43, 514 pp.