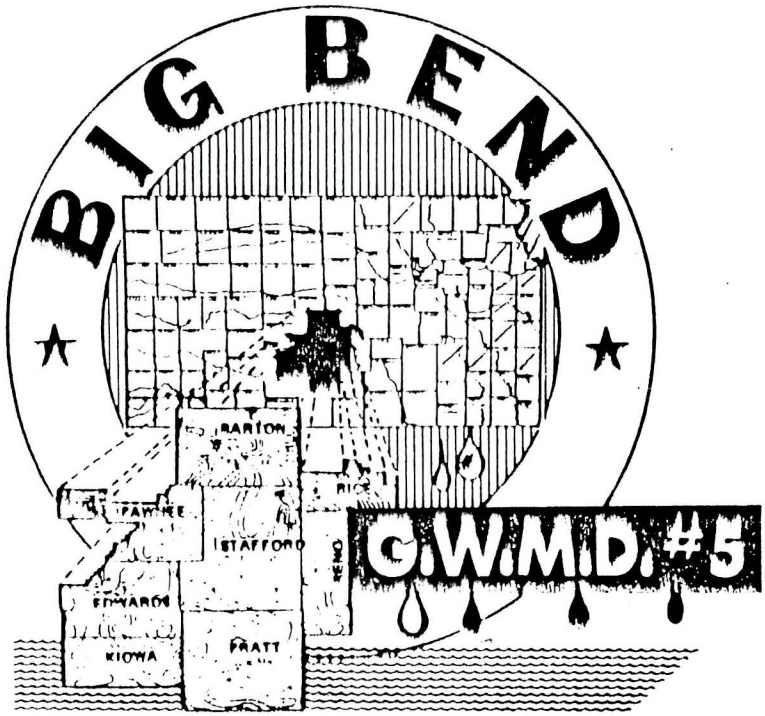
BIG BEND

GROUNDWATER MANAGEMENT DISTRICT

NUMBER 5



REVISED MANAGEMENT PROGRAM

MARCH 1988

APPROVED

This 20th day of June, 1988

David L. Pope, P.E.
Chief Engineer
Division of Water Resources
Kansas State Board of Agriculture

TABLE OF CONTENTS

List of Figures and Tables

INTRODUCTION

Water resources development in Big Bend Groundwater Management District #5 has greatly increased from the levels prior to 1960. Figures 1 and 2 illustrate the active water rights filed in the district over the period of record, 1945 to 1986. The peaks in Figure 1 can be correlated to political, technological, economical and meteorological events. Increasing demand for the use of this precious resource for a variety of needs including irrigation, municipal, industrial, and recreational has begun to exceed the available supply. As development expanded it became apparent there existed a need to properly manage the resource in terms of quality and quantity.

From the date of inception, in 1976, the district has been actively pursuing management goals and establishing management guidelines to deal with these issues. Much progress has been made but much is left to be accomplished. With the combined efforts of the people of this district any problems can be met head-on and resolved at the local level.

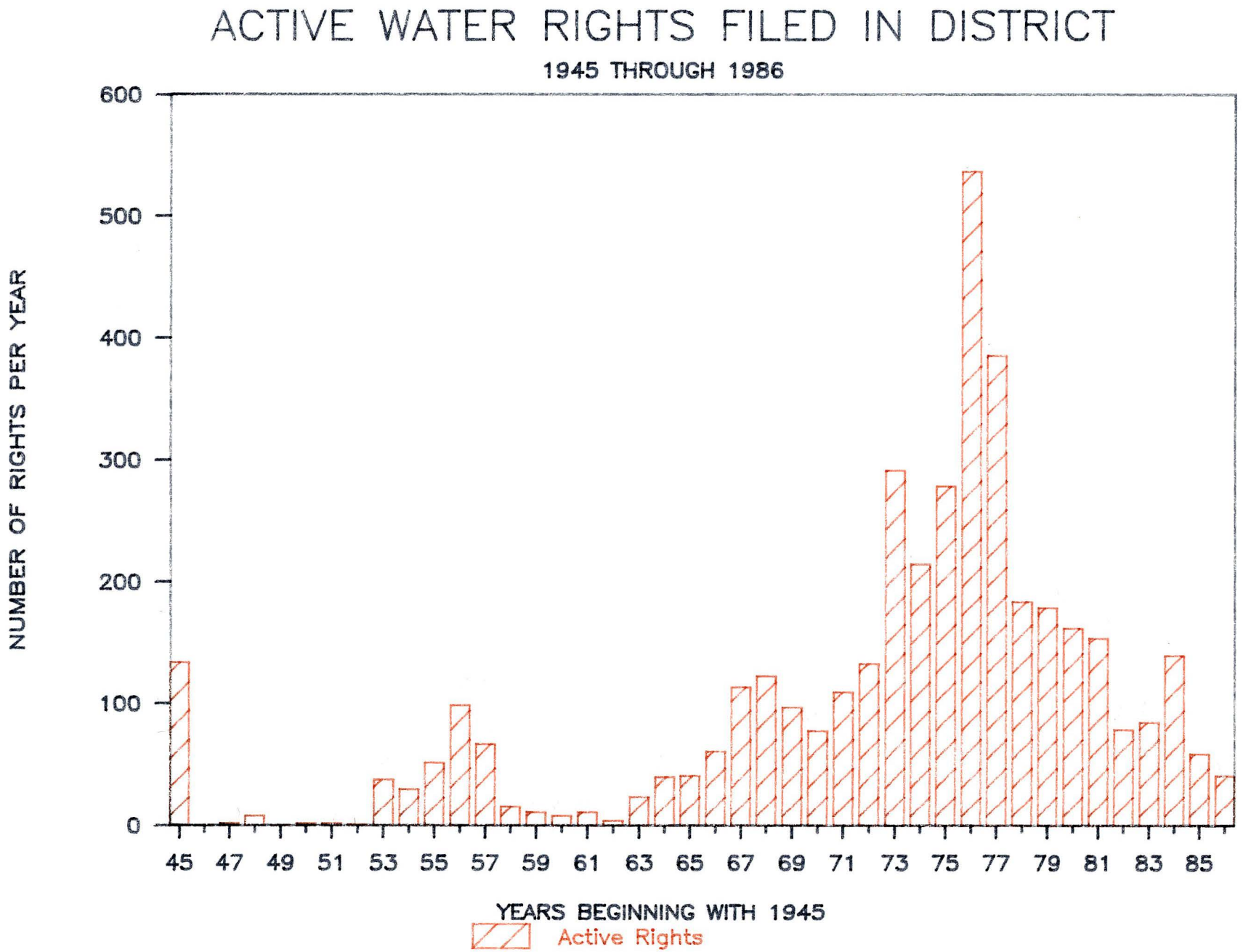
PURPOSE OF DISTRICT

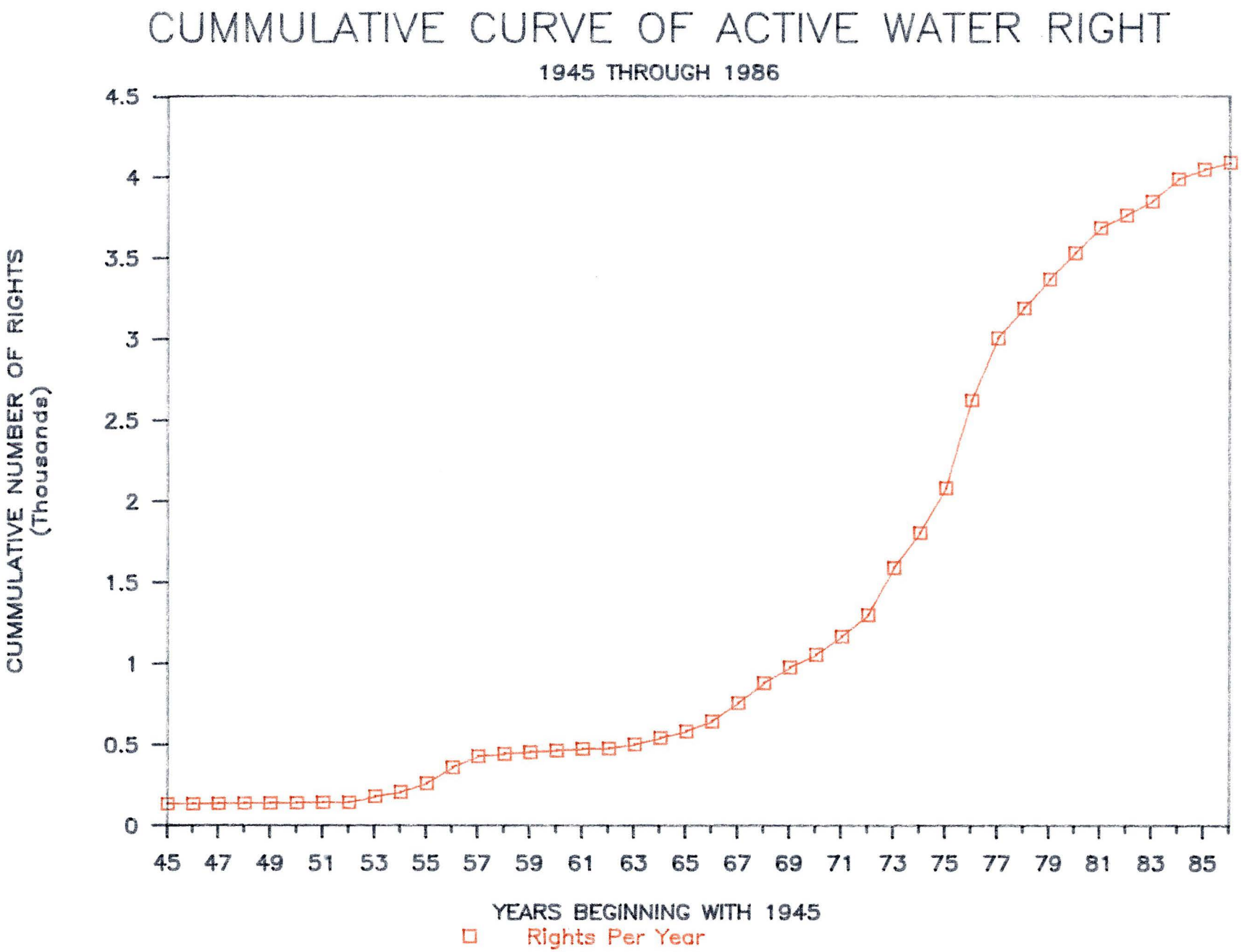
The Big Bend district was organized through the efforts of concerned citizens to conserve, promote, and manage the groundwater resource so that quality and quantity of that resource will be maintained for present and future needs. These citizens saw the need for the management of the groundwater resource at the local level, thus allowing local landowners and water users the opportunity to determine their own destiny with respect to the use of groundwater within the basic law of the State of Kansas.

FORMATION OF DISTRICT

Russell Herpich, irrigation engineer of Kansas State University, saw the potential of the Big Bend area for groundwater development in the sixties and the urgent need to conserve and perpetuate this vast natural resource.

The 1972 Kansas Legislature enacted workable legislation enabling the formation of groundwater management districts (K.S.A. 82a-1020). The Pratt County Soil Conservation District Board of Supervisors, recognizing the benefits of such a district, called a meeting October 16, 1973, to which leaders from the area counties were invited to attend. A series of informative meetings followed, and a steering committee was formed to carry out the organization of the district according to the Kansas Groundwater Management District Act (K.S.A. 82a-1020). The following steering committee began to function April 11, 1974.


ACTIVE WATER RIGHTS FILED IN DISTRICT
1945 THROUGH 1986
NUMBER OF RIGHTS PER YEAR
600
500
400
300
200
100
0
45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85
YEARS BEGINNING WITH 1945
Active Rights


CUMMULATIVE CURVE OF ACTIVE WATER RIGHT
1945 THROUGH 1986
CUMMULATIVE NUMBER OF RIGHTS
(Thousands)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85
YEARS BEGINNING WITH 1945
Rights Per Year

Phil Schrack, Chairman	Iuka, Ks
Nathan B. Hayes, Vice Chairman	Mullinville, Ks
Boyd Mundhenke, Secretary	Kinsley, Ks
Larry Panning	Ellinwood, Ks
Bill Ball	Sterling, Ks
Omar Schartz	Larned, Ks
Bob Wendelburg	Stafford, Ks
Don Brownlee*	Sylvia, Ks

*Don Brownlee represented Reno County even though he could not be a legal member of the committee - 7 being the maximum number on the steering committee.

A declaration of intent and a proposed map of the district was filed by the steering committee to the Chief Engineer of the Division of Water Resources, Kansas State Board of Agriculture April 16, 1974.

On October 22, 1975 the description of the lands to be included in the proposed district was certified by the Chief Engineer. A petition was then circulated by the steering committee. The petition was approved December 22, 1975 and election called for March 2, 1976, to allow eligible voters of the district the opportunity to decide if the district should be organized. Results of the election were 535 votes in favor and 211 opposed, passing by a 72% majority.

The Certificate of Incorporation was issued by the secretary of state March 9, 1976, and has been filed in the register of deeds office in each of the eight counties within the district. An organizational meeting was held March 30, 1976, at the St. John Library for the purpose of electing directors and adopting bylaws. The present directors and terms are as follows:

Tom Stejskal Edwards County, President	1990
Edwin Shultz, Reno County, Vice Pres.	1989
Greg Wellman, Rice County Secretary	1990
E. Lee Musil, Pawnee County, Treasurer	1991
Ron Arnold, Director at Large	1991
Robert Wendelburg, Stafford County	1989
Jerry Mott, Pratt County	1989
Russel Fralich, Kiowa County	1991
Larry Panning, Barton County	1990

A debt of gratitude is also extended to those individuals who have volunteered their time to make this a functional organization. Past directors and their terms are listed below:

Past Directors	Term Served
Omar Schartz, Pawnee County	1976-1979
Don Fincham, Pratt County	1976-1977
Bill Ball, Rice County	1976-1984

Ray Cudney, Edwards County	1976-1984
Eugene Horton, Reno County	1980-1984
Allen Klein, Director at Large	1979-1985
Cecil Vieux, Kiowa County	1976-1977
Bart Zongker, Reno County	1976-1980
Willard McClure, Director at Large	1976-1979
John Rosenberger, Kiowa County	1977-1982
Howard Zook, Pawnee County	1979-1986
Kenneth Keen, Edwards County	1984-1987
Kenneth Rice, Kiowa County	1982-1988
Kenneth Fenwick, Director at Large	1985-1988

Description of District

A. Location and area:

Big Bend Groundwater Management District #5 was so named because of the proximity to the large bend of the Arkansas River in south central Kansas. Portions of the Big Bend District are located in both the High Plains section of the Great Plains physiographic province and the Arkansas River Lowland section of the Central Lowlands Province. The district encompasses approximately 2,511,104 acres of land in portions of eight counties: Barton, Edwards, Kiowa, Pawnee, Pratt, Reno, Rice and Stafford (Figure 3). Table 1 lists the total acreage for each county and the number of acres that have been removed from district tax assessment.

B. Climate:

The Big Bend district is characterized by a continental type climate. This type of climate has large diurnal and annual variations in temperature. The western half of the area has been classified by Thornwaite as "dry subhumid" while the eastern most area of the district is classified as "subhumid".

Precipitation varies considerably from the western edge to the eastern edge, with 20 inches of average annual precipitation in the west to 27 inches in the east. The average for the district is approximately 24 inches per year. The precipitation occurs in the form of rain, sleet, snow, freezing rain, and hail. About 75 percent of this occurs in the period from April to September associated with cyclonic and convective thunderstorm activity.

Temperature fluctuations are large in a continental type climate. Annual variations range from -5 to -10 degrees fahrenheit to about 105 degrees fahrenheit. The growing season is sufficiently long so that frost is generally not a problem for most crops grown in the district.

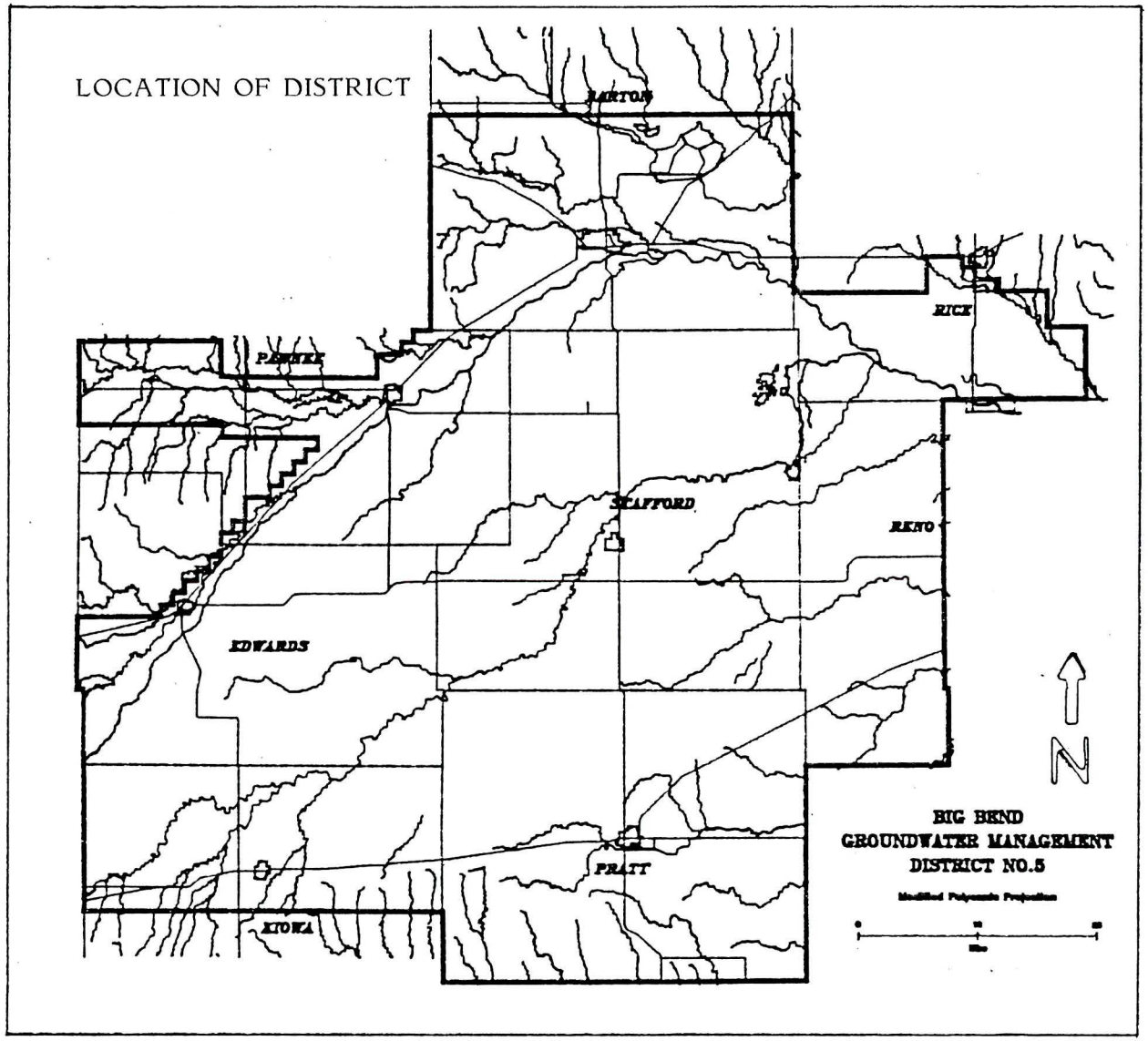

LOCATION OF DISTRICT
BARTON
RICE
PAWNEE
STAFFORD
RENO
EDWARDS
PRATT
KIOWA
N
BIG BEND
GROUNDWATER MANAGEMENT
DISTRICT NO.5

Figure 3

TABLE I

ACREAGE AND WATER USE DATA AS OF JANUARY 1, 1988

Co.	Total Area Acres	Acres* Assessed %( )	Ac's* Petitioned From Assessment %( )	Irrigated Acres %( )	Number of Wells	Total Approp Ac-Ft
BT	345,600	276,549 (80)	45,095 (13)	53,287 (15)	509	76,703
ED	314,880	271,937 (85)	37,465 (12)	135,525 (43)	910	182,149
KW	230,400	216,426 (94)	8,291 (4)	65,234 (28)	412	91,349
PN	271,360	251,529 (93)	9,822 (4)	95,675 (35)	782	134,892
PR	466,560	396,556 (85)	25,782 (6)	91,550 (20)	614	135,869
RN	232,704	209,357 (90)	4,510 (2)	17,330 (8)	126	25,705
RC	140,800	113,002 (80)	20,180 (14)	26,850 (19)	232	38,778
SF	508,800	377,928 (74)	101,954 (20)	102,350 (20)	733	139,287
Ttl For Dis.	2,511,104	2,113,284 (84)	253,099 (10)	587,801 (23)	4,318	824,732

*Acres assessed plus acres excluded does not equal total acres due to lands exempt such as Federal land, municipalities, and tracts less than 40 acres.

**Total acre-feet appropriated includes 27,740 acre-feet for municipal and industrial use in the district.

C. Soils:

The district has a variety of topographic regions ranging from the broad flat loess mantled Pawnee Valley to the active sand dunes in Edwards and Kiowa Counties. The majority of the district is characterized by low undulating dune topography on which the major drainage patterns have been superimposed. Table II lists the major soils areas in the district, these are depicted on Figure 4.

Table II
DESCRIPTION OF AREA SOILS

A. Area: These are upland, hardland areas of Barton, Pawnee, Pratt, Edwards, Rice, and Kiowa Counties. They consist of well developed silty and clayey soils. They are dominantly well drained, deep, fertile soils. Some small places of rock and shale occur on slopes. Water erosion and soil blowing are the major concerns of soil management.

B. Area: These are flood plain areas of the major rivers such as the Arkansas River, Rattlesnake Creek, South Fork Ninnescah River, and North Fork Ninnescah River. These flood plains consist of poorly drained and somewhat poorly drained sandy and loamy flooded soils. They are deep to shallow over sandy strata with a fluctuating water table. They are slightly to moderately saline. Most are frequently flooded and some small areas have salt affected spots. The main concerns of soil management are flooding and soil blowing.

C. Area: These are flood plain areas such as the Pawnee River, Walnut Creek, Blood Creek, Deception Creek, Cow Creek and Little Arkansas River. These flood plains consist of deep, silty and loamy soils and some smaller areas of clayey soils. These are mainly well drained but are flooded and generally have water tables at depths greater than 6 feet. The main concerns of soil management are flooding and soil blowing.

D. Area: These are uplands, consisting of moderately sandy, and clayey areas of Barton, Pawnee, Edwards, Kiowa, Stafford, Reno, Pratt, and Rice Counties. It is the largest area of the district. It is formed in old alluvium that has been reworked upon the surface by the wind. Soils are deep and range from clay to sand. They are dominantly moderately sandy. They are fertile and well drained except small areas are low, wet, and poorly drained and formed in clayey alluvium or sandy or loamy materials underlain by clay. Other small high areas are sand hills. The main concerns of soil

management are soil blowing and soil drainage of low areas. The slope gradient of this entire area is low or very low and suitable outlets for excess water are difficult to establish.

E. Area: These are terrace and uplands consisting of silty to clayey soil areas mainly in Barton, Rice and Reno Counties along the Arkansas River and Peace Creek. These soils are deep and slowly permeable to very slowly permeable and have varying degrees of salt accumulation layers. Saline and alkali spots are common. The main concerns of soil management are soil blowing and maintaining tilth and fertility.

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D. Surface Water Features

Six major drainage basins and two major structural basins are defined within the boundaries of the district (Figure 3). The drainage basins are: the Arkansas River, Pawnee River, Wet Walnut Creek, Rattlesnake Creek, North Fork Ninnescah River and South Fork Ninnescah River. The two structural basins are Quivira National Wildlife area and Cheyenne Bottoms. In addition to these there are a large number of undrained areas associated with the sand dune regions in the district.

The Arkansas River enters the district south of Kinsley near the Edwards-Kiowa County line. The river makes a large bend to the northeast passing through Larned, and Great Bend. From Great Bend it makes a smooth curve to the southeast passing through Ellinwood, Raymond and Sterling. Three major tributaries, the Pawnee River, Wet Walnut Creek, and Rattlesnake Creek, enter the Arkansas River as it transverses the district.

The Pawnee River enters the district west of Burdett and travels about thirty miles to its junction with the Arkansas River near Larned.

Wet Walnut Creek enters the district west of Albert and travels about 25 miles to its junction with the Arkansas River east of Great Bend.

The Rattlesnake Creek drainage basin originates in Ford and Clark Counties. The creek enters the district west of Greensburg, crosses Kiowa, Edwards, Stafford, and Rice Counties and joins the Arkansas River near Raymond.

Both the North Fork Ninnescah River and the South Fork Ninnescah River have their headwaters located within the district. The North Fork originates in southern Stafford County and travels northeast toward Plevna where it exits the district. The South Fork originates near Cullison, travels east through Pratt and ex its the district on the Pratt-Kingman County line.

Big Bend Groundwater Management District

MAJOR SURFACE SOIL TYPES

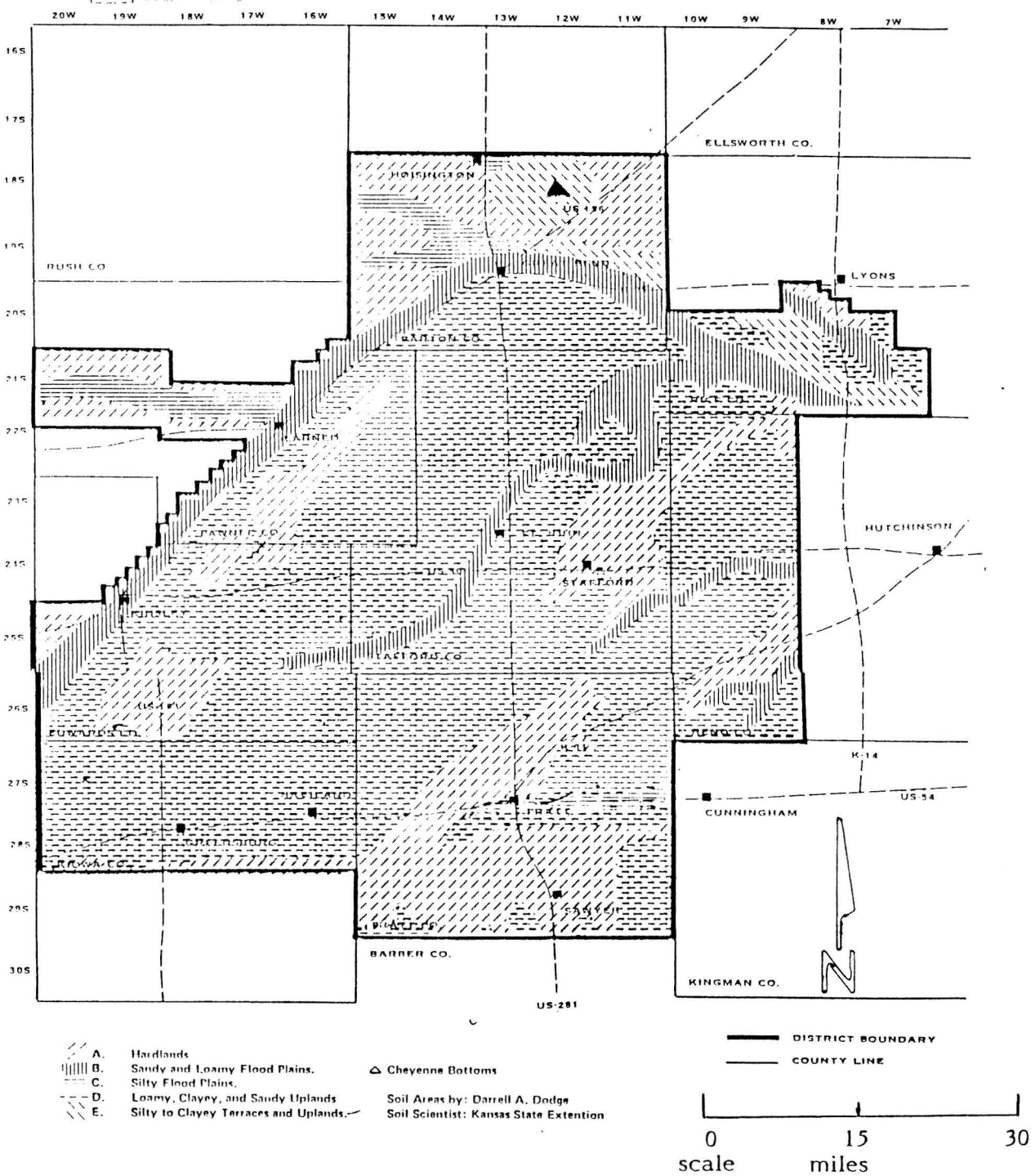

Figure 4

Cheyenne Bottoms and Quivira are both structural basins located in the district. Cheyenne Bottoms is located in Barton County northeast of Great Bend. The basin is fed by Blood Creek and Deception Creek. Naturally the area was drained by Little Cheyenne Creek, but man made drainage has been created in conjunction with the state wildlife refuge so excess water is now drained to Wet Walnut Creek.

Quivira salt marsh, a natural salt marsh area in northeastern Stafford County has also been modified by man's activity in an effort to create a federal wildlife refuge. The marsh is currently fed by a series of canals with surface water from Rattlesnake Creek.

E. Geology

The geologic units pertinent to the hydrogeology of the district range in age from Permian to Holocene. Consolidated rocks of Permian and Cretaceous age represent units that contain water of marginal quality and limited quantity. Geologic units of these ages form the bedrock surface in this region and are considered to be the base of the fresh water aquifer. The main source of good quality water is derived from unconsolidated Pleistocene sands and gravels. Some excellent quality water is obtained from Cretaceous Dakota Sandstone. However, the extent of this unit is limited in District #5.

Redbeds of Permian age underlie the eastern half of the district (Figure 5). The formations included are the Harper Sandstone, Salt Plain, Cedar Hills Sandstone, and undifferentiated Permian rocks of the Nippewalla Group and the Whitehorse formation. These formations consist of reddish-brown sandstone, siltstone, shale, salt, gypsum, anhydrite, and limestone.

There are no wells withdrawing water from these formations at the present time. This is mainly due to the highly mineralized water that occurs in the formations. The potential exists for limited development of these sources for such uses as secondary oil recovery and salt solution mining.

The western half of District #5 is underlain by rocks of Cretaceous age which lie unconformably on the Permian formations. Formations included are the Cheyenne Sandstone, Kiowa Shale and the Dakota. These consist of sandstone, siltstone, shale, and some limestone.

The chemical quality of water from the Cheyenne Sandstone formation and the Kiowa shale is very poor and renders these unfit as a source of water in District #5. The Dakota formation is used as a source of supply in Barton, Pawnee, Rice, and Edwards Counties. It is mainly used for domestic and stockwatering

BURIED BEDROCK FORMATIONS

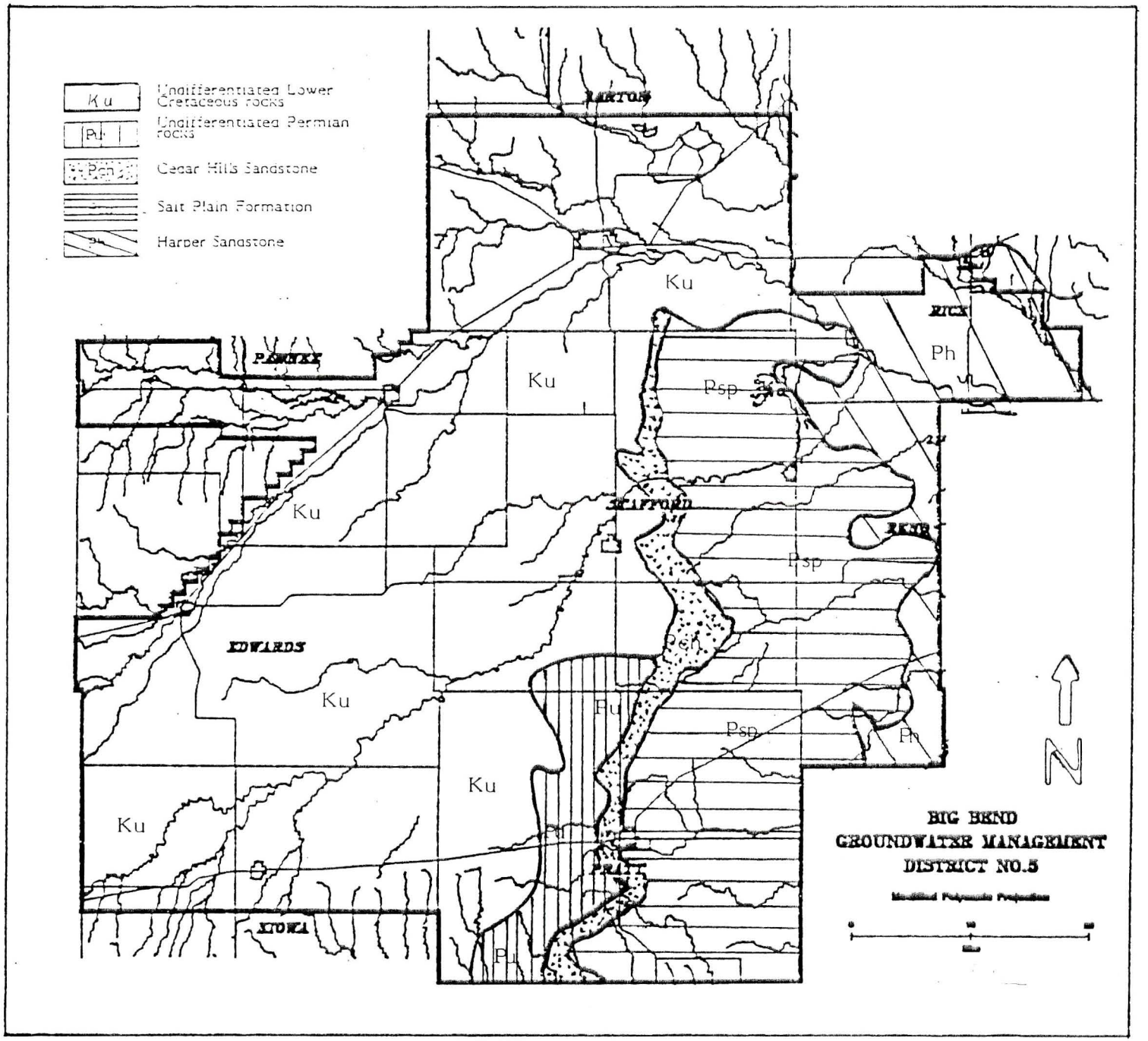

Figure 5

purposes. Wells obtaining water from this formation yield from ten to several hundred gallons per minute.

Rocks of Tertiary age lie unconformably on Cretaceous age formations in the region. These rocks are included in the Ogallala formation. The Ogallala consists of semiconsolidated sand, gravel, silt, and clay. Most of the Tertiary deposits were removed by erosion prior to deposition of Quaternary material. Some water is probably obtained from the Ogallala in the Big Bend area but it is difficult to differentiate the Ogallala from the overlying Pleistocene sediments.

Deposits of Quaternary age form the major aquifer in the Big Bend District. These are composed of unconsolidated silt, sand, gravel, and clay which unconformably overlie the Cretaceous and Permian bedrock formations. The deposits range in age from Pleistocene to Holocene. The Pleistocene sediments were deposited by lateral shifting of streams during four glacial stages (Nebraska, Kansas, Illinois, Wisconsin) and four interglacial stages (Aftonian, Yarmouthian, Sangamonian, Recent). They were deposited on an erosional surface of Cretaceous and Permian bedrock which must have looked similar to the Smokey Hill River area in Ellsworth County and the exposed Permian bedrock area of Barber County. Thickness of the deposits range from 0 to 300+ feet with the average being around 120 feet (Figure 6). The glacial deposits are capped by eolian deposits of Pleistocene and Holocene age and some of the glacial deposits have been reworked by recent stream activity to form river alluviums. It is however difficult to distinguish the more recent alluvial sediments from the original Pleistocene deposits.

The Quaternary deposits are an excellent source of good quality water across most of the area. Some quality problems relating to mineral intrusion from the underlying Permian bedrock units render certain areas unuseable. An example is the area around the Big and Little Salt Marshes in northeastern Stafford County. Wells obtaining water from the Pleistocene deposits will yield from a few hundred gallons per minute to over 2000 gallons per minute, thus making these units desirable for development for all water uses.

F. Economy

The economy of the area has a dual base with agriculture topping the list and exploration for oil and gas following a close second.

The availability of plentiful and renewable supplies of good quality water has helped to make an irrigated agricultural economy a reality in the Big Bend District. The spinoff from this has bolstered the well drilling industry, irrigation service groups, and irrigation equipment dealers thus establishing many

GENERAL SATURATED THICKNESS MAP (1982 data)

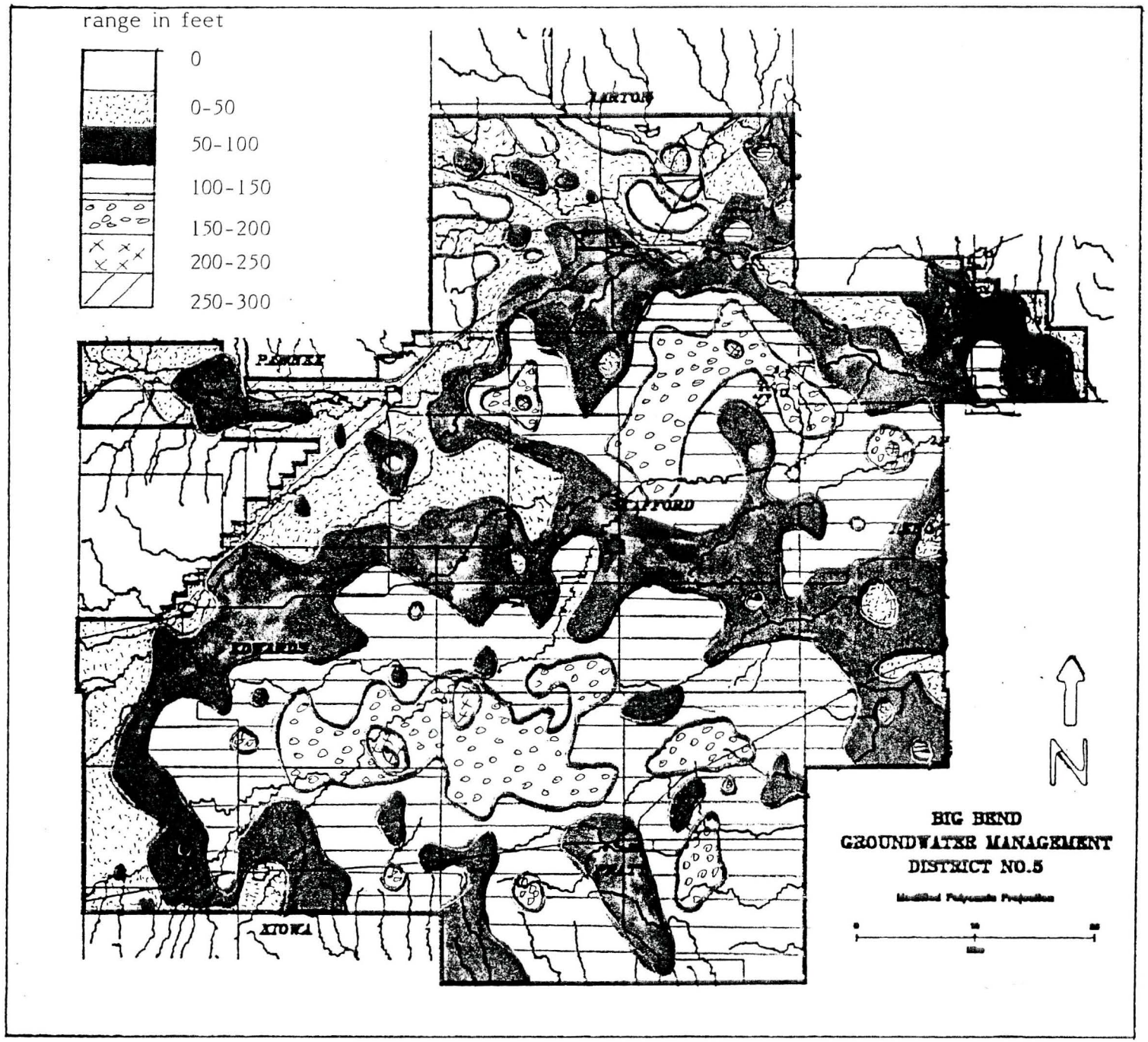

figure 6

off-farm jobs which help establish a healthy economic base for the area.

The oil and gas industry is also vitally important to the local economy and also to the irrigation industry. Without plentiful sources of economic fuel the irrigation systems could not be operated at a profit.

One of the major goals of the groundwater management district is to maintain adequate levels of good quality water so that the local economic base can be sustained rather than going through boom-bust cycles. This can only be accomplished by regulating and mandating the efficient and reasonable use of the resource.

Groundwater Supply Problems

A. Quantity

Sustainable water supplies are needed for all uses including municipal, industrial, recreational, and agricultural. Figure 1 illustrates the explosive rate of development that occurred from the mid 1960's to the present. There are currently about 824,732 acre-feet of water appropriated for beneficial use within the district (Table 1). This water is being withdrawn from the groundwater reservoir by approximately 4318 large capacity wells and is used to irrigate about 587,801 acres of land, supply industrial needs, municipal needs and recreational needs in the district. The use of water for irrigation purposes is by far the largest within excess of 95% of all water withdrawn applied to irrigated crops. Indeed the greatest increase in development has been for irrigated agriculture. This demonstrates the fantastic growth rate of irrigation in the district. This growth has helped to bolster the economy of the region but this can only be sustained if the water resource is also sustained.

It is recognized by hydrogeologists that the aquifer underlying the Big Bend District has one of the highest recharge rates in the state. Thus, its future development appears better than the Ogallala aquifer which underlies the western one third of Kansas. Recharge rates for the Big Bend District have been estimated by hydrogeologists to range from 0 to 6 inches depending on the nature of the surface soils, the depth to water, and the character of the strata between the land surface and the water level. The highest recharge rates occur in the sand dune regions. These highly permeable soils allow a high percentage of the annual precipitation to percolate into the groundwater reservoir. Recharge also occurs below ephemeral stream beds when rainfall is sufficient to cause excessive runoff.

Even with the excellent natural recharge in the district there must be limits on development. Without limits to develop ment the groundwater resource will be overdrawn and serious

WATER LEVEL CHANGE 1944 through 1986

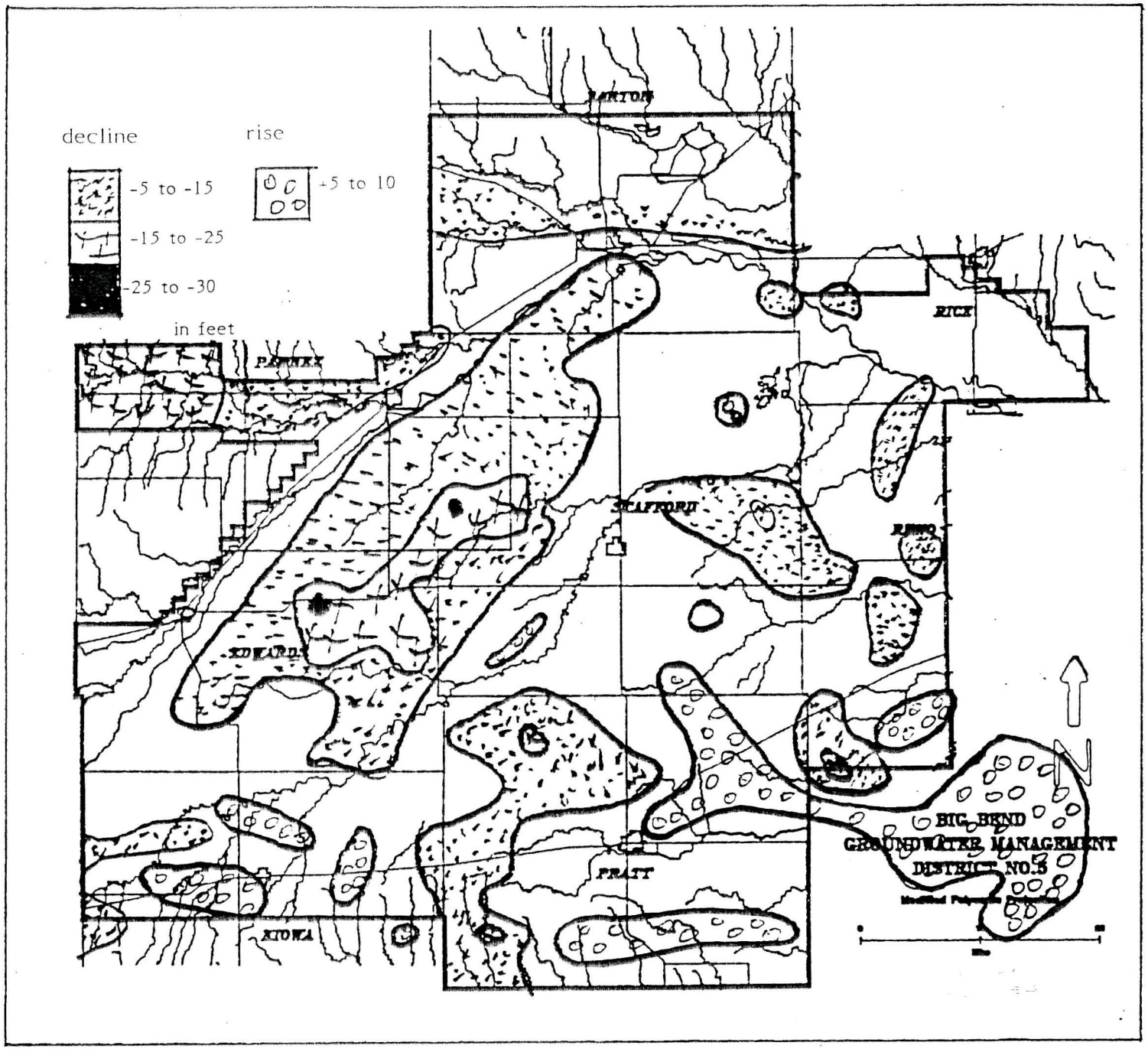

figure 7

GROUNDWATER LEVEL CHANGE 1980 through 1986

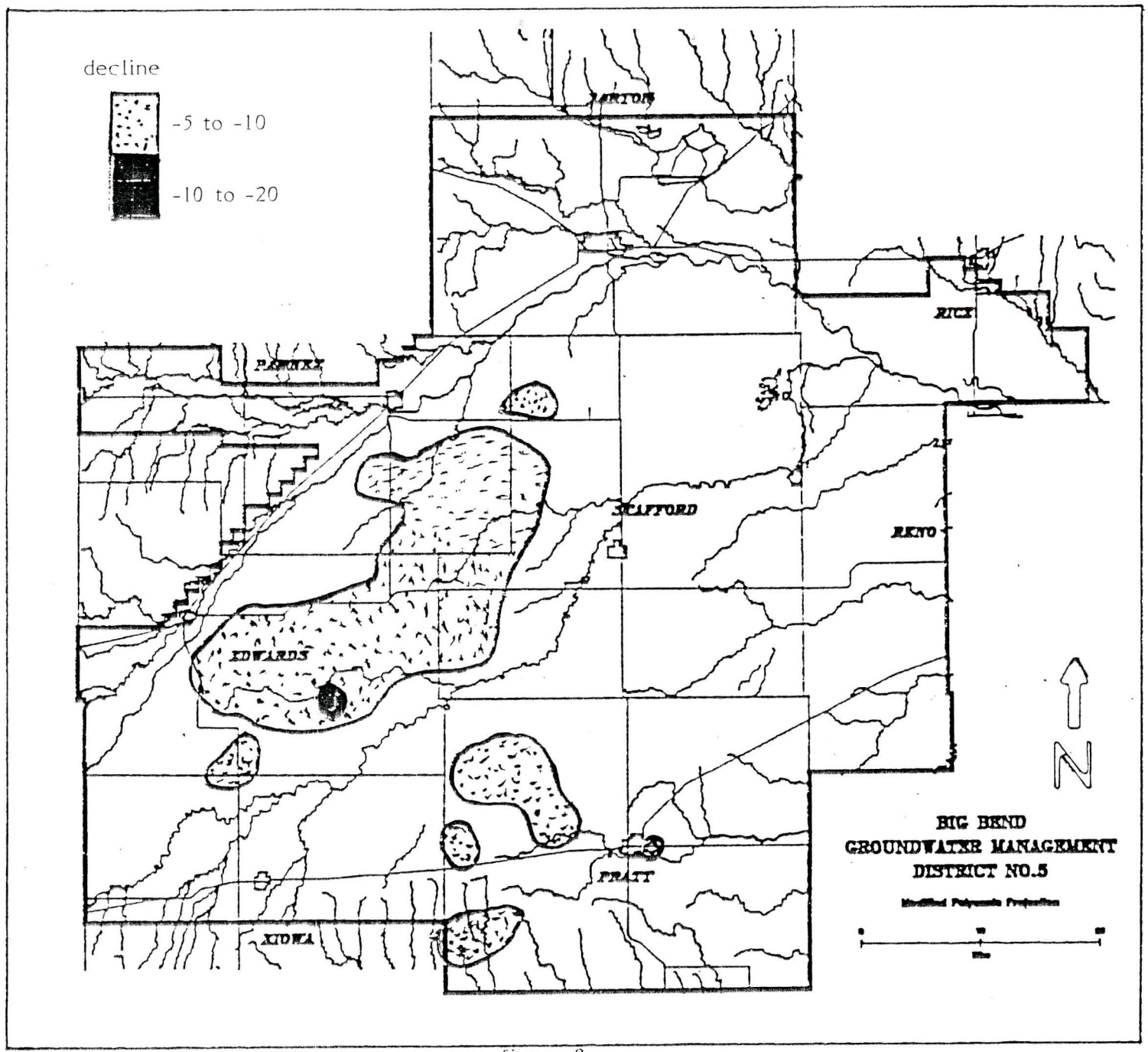

figure 8

groundwater declines will result. Mining of our groundwater resource can only lead to deterioration of the economic base established by the advent of irrigated agriculture. In fact, portions of the district are already experiencing the adverse effects of over development (Figures 7 and 8). Much of this development took place prior to the formation of the district but must now be dealt with to help slow the decline trend that has been established. This will be a much more difficult and costly task than controlling the development before it reaches this stage.

B. Quality

The quality of the groundwater resource is certainly as important if not more important than the quantity issue. If the quality of the resource is allowed to deteriorate then there is no reason for restricting development from a quantity standpoint because the water will be of little value once polluted. It is extremely difficult and costly to reverse pollution once it has occurred thus the basic objective of the district is to take a preventive posture. The problems that already exist and those that will slip through the prevention program must be remedied in an orderly manner. This can best be accomplished at the local level of government, with the support of the Kansas Department of Health and Environment (KDHE). Figure 9 illustrates those areas where water quality degradation is known to exist, based on KDHE and GMD #5 investigations.

Several quality issues must be dealt with by the district if we are to maintain, and restore the good quality water that we presently enjoy.

These include:

1. Natural mineral intrusion.
2. Pollution resulting from oil and gas production.
3. Pollution resulting from other industrial wastes (i.e. salt solution mining and leaky petroleum storage tanks.)
4. Agrichemical pollution.
5. Unplugged and improperly constructed water wells.
6. Municipal waste lagoons, animal feedlots, and landfills.

1. Natural mineral intrusion:

Natural degradation of the Pleistocene sand and gravel aquifer occurs in the eastern half of District #5 due to dissolution of salt from underlying Permian Bedrock units. This natural intrusion has rendered the lower portion of the aquifer unfit due to the high content of sodium chloride. The dividing line between areas of no mineral intrusion and excessive mineral intrusion is approximately parallel with U.S. Highway 281. West of this divide, the Permian units are overlain by shales of

MAP SHOWING BOTH KNOWN GROUNDWATER CONTAMINATION SITES AND SITES OF SPILLS WITH CONTAMINATION POTENTIAL INVESTIGATED FROM 1984 TO 1986

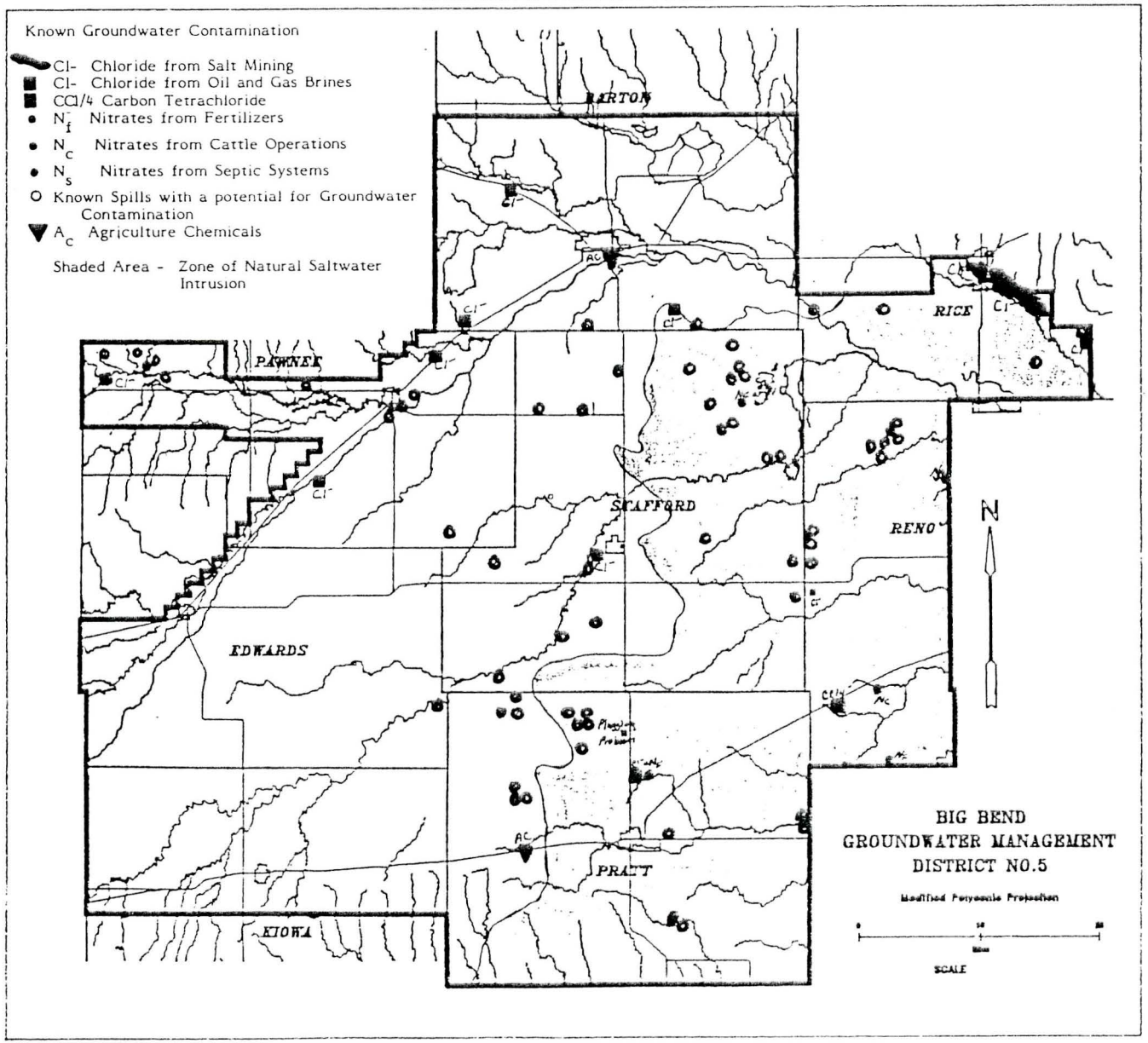

Figure 9

Cretaceous age which form a cap that does not allow the saltwater to migrate into the Pleistocene aquifer.

Extensive research is being conducted to devise a management scheme that will hold water withdrawal to a level that will not cause the poor quality water at the base of the aquifer to migrate upwards and degrade the fresh water zone in the upper portion of the aquifer.

There is also a research project currently underway to evaluate the impact of injecting oil field brine into the Cedar Hills Formation in relation to the mineral intrusion in the eastern half of the district.

2. Pollution resulting from oil and gas production:

Groundwater pollution from past and present activities of the oil and gas industry is a major problem in the district. While the district recognizes the tremendous economic benefit gained from this industry, we cannot accept degradation of the groundwater resource.

Much pollution has occurred by past activities of this industry. The practice of disposing of oil field brines in unlined pits is no longer practiced, but has created many areas where the groundwater resource is no longer usable.

Present oil and gas activities that need to be addressed include: routine inspection of brine and crude oil holding facilities to assure proper handling and disposal of waste products; the lining of drilling pits due to the high recharge rate and the contamination which has already occurred from not using lined or portable pits; the assurance that wells are properly plugged upon abandonment; and the elimination of brine used in road construction activities.

The district is working and will continue to work very aggressively with the Kansas Department of Health and Environment and the Kansas Corporation Commission to prevent these sources of pollution from becoming major problems.

Past oil and gas related pollution problems need to be rank ordered and dealt with in a systematic manner in order to remediate the groundwater resource to an acceptable level.

3. Pollution resulting from other industrial wastes:

There has been extensive pollution created by the salt mining industry in Rice County as depicted on Figure 9. The district is currently working with the parties involved and the appropriate agencies to remediate the situation that exists southeast of the City of Lyons. This problem is a prime example of what can hap-

pen if problems are allowed to continue unattended. The cost of the cleanup operation for the aquifer is in excess of $4,000,000. This is a staggering figure and could have been avoided if proper inspection and maintenance had taken place. The district feels that our participation in the water quality arena will greatly help to resolve problems in the preventive mode before they become major catastrophes such as the American Salt plume in Rice County.

An area which is currently being addressed by the EPA is underground petroleum storage tanks. This has not been documented as a major problem in the district but has been a problem in other parts of the state and should certainly be addressed before a crisis arises.

4. Agrichemical pollution:

Farming has evolved over the last several decades to a highly sophisticated industry. This industry uses a wide variety of highly toxic chemicals in order to maximize crop yield from the available land area. The use of these chemicals presents a potential pollution source. Three major areas of concern need to be addressed. The first is the proper handling, storage, and disposal of these chemicals. The practice of dumping excess chemicals and washing down trucks at the bulk storage facilities located in the district creates a very real potential for long term pollution problems. The application of chemicals through the irrigation system is another potential source of pollution. This has recently been addressed by the chemigation safety law passed by the state which mandates equipment and procedures to be followed when chemigation is practiced. This should help to prevent major problems from this potential source. The third area of concern is, what happens to the chemicals after application. This has not been fully dealt with but needs to be evaluated in greater detail. There is currently research being conducted by the state and federal government to try and resolve the many unanswered questions related to the long term application of agrichemicals.

5. Unplugged and improperly constructed water wells:

Abandoned water wells that are not properly plugged and improperly constructed water wells represent a possible source of pollution. These create an avenue for a host of contaminants to enter the aquifer. The district will be inspecting and following up on these to assure that they are properly constructed and abandoned to help prevent possible contamination.

6. Landfills, Municipal waste lagoons, Animal feedlots:

These sources of potential pollution fall into similar categories. They are currently regulated by the KDHE. But the

question has arisen as to whether or not the levels of monitoring, inspection, and enforcement is adequate to assure that these will not create extensive groundwater pollution.

There are many potential sources of pollution that must be evaluated and proper guidelines established for each. The key is prevention rather than reacting to crisis and attempting remediation because the later process is far to expensive, time consuming, and uncertain. The district will take an aggressive stance to prevent pollution of the groundwater resource from any source.

Programs and Objectives

The main objective of the Big Bend Groundwater Management District is the conservation and management of the groundwater resource so the quality and quantity of the resource will be maintained and enhanced to meet the present and future needs in the district. To obtain this objective the district will strive to fulfill the programs outlined below.

1. Establish an adequate data base.
   a. measurement of groundwater withdrawal
   b. measurement of water levels
   c. determination of aquifer recharge rates
   d. establish a water quality monitoring program
   e. determination of geologic characteristics of the area
   f. determination of aquifer flow parameters
   g. collection of other pertinent data

2. Develop an educational program concerning the optimum use of water.

3. Discourage waste of water - encourage tailwater reuse systems.

4. Explore and develop methods to augment groundwater recharge.

5. Develop criteria for proposed beneficial uses of water.
   a. water rights administration in cooperation with the Kansas State Board of Agriculture, Division of Water Resources
   b. develop well spacing criteria
   c. develop guidelines for appropriation of groundwater
   d. other pertinent information

6. Exert action to prevent and remediate water pollution.

7. Conduct research to gain a better understanding of the

groundwater system.

8. Advise appropriate entities in the management of drainage problems and surface water.

It is felt that the objective of the district can best be accomplished by the combination of programs outlined above. These programs will provide for orderly and economical development, wise use and responsible management of the water available to the people of the district. The purpose of each program is briefly described below:

1. Establishment of an adequate data base.

Data collection and research of the hydrologic characteristics of the groundwater resource and the use of this resource are essential to the development of a comprehensive management program. A great deal of information has been accumulated through state and federal research and data collection programs. The district will utilize all available information, and assist with the development of additional information as needed to formulate the necessary management programs. The most pressing research and data needs are listed below. Others may arise in time and can be added as the need arises.

A. Water level measurements - utilize data from measurements collected by local, state and federal agencies and expand such data collection within the district as necessary to allow the monitoring of water levels and the preparation of water level and water level change maps.

B. Determination of recharge - utilize existing data and conduct additional research to determine the quantity, timing, and mechanics of recharge to the groundwater reservoir.

C. Determination of quantity of water withdrawn - Expand on existing data to determine more accurate withdrawal figures for use in computer modeling and management.

D. Conduct research to define other aquifer flow parameters - utilize existing data and expand where needed to better define the geologic and hydrologic parameters controlling groundwater flow in the district.

E. Water use study - update existing data and collect additional information relative to the number, location, and physical characteristics of wells within the district. These data will be used to assess water use within the district and help in the development of management programs.

F. Conduct research on the interrelationship of surface and

groundwater within the district - encourage the study of such relationships by the appropriate state and federal agencies in conjunction with the district.

G. Place added emphasis on water quality concerns - Conduct research, investigation, and monitoring of water pollution problems in the district. To locate, identify and remediate sources of pollution, whether natural or man made. To strive to prevent the occurrence of pollution and to coordinate these activities by implementing such procedures and actions as may be needed through the appropriate state and federal agencies.

H. Study the legal aspects of water use, groundwater pollution, potential management programs and related matters - Provide input into legal or legislative matters affecting the use of water within the district.

2. Research and Education on the conservation and efficient use of water.

Continuing research is needed to develop techniques of producing optimum crop yields with minimum water. The district will encourage research on the efficient and economical use of water. The district will also provide leadership in the demonstration of efficient irrigation practices and equipment.

Special items of interest include:

A. Encouraging optimum irrigation and agricultural practices to minimize water use.

B. Encouraging the wide use of water meters and other measurement devices as a management tool to assist with the proper and timely application of water. The district will assist with the selection and procurement of recommended devices, installation instruction and other matters related to their use.

C. Encourage the development and use of crops requiring less water.

D. Demonstrating methods or practices to more efficiently use rainfall and reduce evapotranspiration.

The district will compile and present information relative to the efficient use of water, preventing and abating pollution, progress of research endeavors, legal matters and other relative information to the district members. The district members will be kept informed of programs and activities through news releases, publications, newsletters and public meetings. District members are also encouraged to attend the regular monthly meetings to voice their concerns.

3. Discourage waste of water

A. The district encourages the use of tailwater reuse systems to help minimize the waste of water associated with normal irrigation practices. Studies have shown that 15% to 30% of water applied can be lost to tailwater runoff. Tailwater systems to collect and reuse this water are common in many parts of the district. The construction of the reuse system will also allow some of the water to recharge thus gaining an added benefit.

Tailwater systems offer an economical method of utilizing runoff water, improving the overall irrigation application efficiency, and improving the recharge capability of the system. The district will encourage the use of tailwater reuse systems on both surface and sprinkler type irrigation.

B. Through the development of memorandums of understanding with the Division of Water Resources, Kansas State Board of Agriculture, the Kansas Corporation Commission, and the Kansas Department of Health and Environment, immediate action will be taken to control pollution and flagrant waste of water.

4. Explore and develop methods to augment groundwater recharge.

A vitally important aspect is the collection and use of runoff. From the research which has been conducted by the U.S. Geological Survey, it has been found that vast amounts of water can be held and recharged into the aquifer. Due to the land characteristics of our district, rolling sandy pastures, the area has a high rate of recharge. The district is fortunate in this asset. The District recommends the following types of structures to facilitate recharge:

A. An embankment - type of construction should be utilized where there are natural waterways. We encourage this type of construction because of its higher rates of recharge.

B. On center-pivots and leveled ground, the construction of tailwater pits located in the lower area which could contain both irrigation tailwater and a 0.7 inch runoff as determined by the local Soil Conservation District.

A return system should be utilized in both types of construction.

The district recommends the use of both types of collection structures, open pits and embankment-type installations, on dryland to control normal rainfall which should benefit the recharging of the aquifer.

In addition, the district may assist in the development of imported water projects or construction of surface water storage structures as alternate sources of water supply.

The district will also participate in artificial recharge demonstration programs that are deemed appropriate.

5. Develop criteria for proposed beneficial uses of water.

A. Water rights administration - through an agreement with the Chief Engineer, Division of Water Resources, the district shall review all applications to appropriate groundwater for beneficial use, applications to change the point of diversion, applications to change the place of use and applications to change the type of use, filed from within the district to insure compliance with district policies. The district shall recommend to the Chief Engineer any actions or additional requirements as may be deemed necessary.

B. The district in cooperation with the Division of Water Resources, shall develop well spacing criteria to alleviate problems associated with interference of adjacent wells.

C. The district shall develop policies for the appropriation of groundwater in accordance with the Basic laws of the State of Kansas to insure that the public interest and the rights of present and future water users are being fully considered. Such policies shall take into consideration existing water rights, the safe yield of the aquifer, the recharge rate to the aquifer, the type of use made of the water, water quality and other hydrogeologic parameters of the aquifer.

D. The district shall develop criteria for the quantity of water acceptable for the intended beneficial use.

E. The district may develop other criteria that are pertinent to the administration of water rights which do not conflict with the basic laws of the State of Kansas.

6. The district shall exert action to prevent and remediate groundwater pollution. The district shall establish memorandums of understanding with the appropriate state and federal agencies to insure a proper level of protection against possible sources of contamination. The district shall become actively involved in the remediation of groundwater pollution problems within the district.

7. The district will conduct research to gain a better understanding of the hydrogeologic system. This will enable the formulation of more specific programs to deal with water appropriation and water pollution problems.

8. The district may advise and assist in the management of drainage problems and surface water to assure the proper conjunctive use of the surface water resource and the groundwater resource.

District Operation

The district will be managed from an office located at 125 South Main, Stafford, Kansas. The district shall be operated by the board of directors who shall be responsible for setting policy and objectives for the district. The district will employ such staff as necessary to carry out the programs of the district. This presently includes a district manager, assistant manager, research assistant, and part time secretary.

The board of directors recognize the need for the best possible management of the available resource. Because of this, as much local input as possible is being directed at new and improved methods of managing the water supply. This will be accomplished through research, education, demonstration projects and management guidelines.

The board of directors will meet the second Thursday each month to review activities of the district and develop programs. An annual meeting for all eligible voters will be held early each year to provide information about the district's progress and allow for input from the membership.

Policies and Standards

The district recognizes that a water right is a real property right defined by rate, annual quantity, type and place of use. Any use of water shall be within the limits of an existing water right issued by the Chief Engineer. The district will cooperate with the Division of Water Resources, Kansas State Board of Agriculture, to determine reasonable rates of diversion and annual quantities for proposed beneficial uses of water within the district to insure water users are abiding by the limitations of their water rights.

The district feels the matter of additional large capacity wells and their location within the district requires special attention to insure the proper management of the available groundwater resource. The planning of this process is essential to protect the public interest and the rights of present and future water users within the district. The following policies are hereby adopted to help accomplish this objective:

A. Allowable Appropriation:

1. Irrigation:
Applications for permit to appropriate water for irrigation shall not be recommended to the Chief Engineer for approval for a quantity in excess of one and one-half (1 1/2) acre-feet of groundwater per acre.

2. Uses that can accommodate lower quality water: Applications for permit to appropriate fresh water where waters of lower quality are available for the proposed use and the use there of is technologically and economically feasible shall not be recommended for approval to the Chief Engineer.

3. Other uses:
For other uses it must be demonstrated to the satisfaction of the board and the Chief Engineer that the quantity requested is reasonable for the proposed use, and such approval will not impair an existing right, nor unreasonably or prejudicially affect the public interest of the district.

B. Well Spacing:

1. With the exception of those wells described in subsection no. 2, the minimum spacing of all non-domestic wells described in an application to appropriate water for beneficial use shall be thirteen hundred twenty (1320) feet from all other non-domestic wells which carry an earlier priority, and six hundred sixty (660) feet from all other earlier priority domestic wells, except those domestic wells whose interests are represented by the applicant's own interests.

2. Each non-domestic well which proposes the diversion or withdrawal of groundwater solely from the dakota aquifer or any other consolidated aquifers shall be one (1) mile from all other wells withdrawing groundwater from the same formation and three hundred (300) feet from all wells withdrawing water from other zones, including the Pleistocene sand and gravel aquifer, including domestic wells, but excluding those domestic wells whose interests are represented by the applicant's own interests.

C. Appropriation of Groundwater:

The intent of the Big Bend Groundwater Management District is to develop a comprehensive groundwater withdrawal program in order to balance long term withdrawals with average annual recharge. This concept is generally referred to as safe yield.

The average annual recharge associated with the unconsolidated deposits located in the Big Bend area is substantially greater than the recharge associated with the Ogallala aquifer in Western Kansas. Nevertheless, the unconsolidated aquifer cannot support unlimited withdrawals of groundwater without eventually depleting this resource.

An initial safe yield value was established for the district

in 1978. It was assumed at this time that the recharge from natural precipitation was approximately five inches per year, with an additional four inches from irrigation return flows. These values were based on the best available data at the time. The nine inch recharge value used correlated to 6000 acre feet within a two mile radius circle surrounding a point of diversion. New data has since become available which indicates that the recharge from natural precipitation is slightly less than originally assumed and that recharge from irrigation return flows is insignificant and should not be considered in the safe yield calculation. The new value for recharge from natural precipitation is approximately 4.5 inches per year which correlates to 3000 acre feet within a two mile radius circle. Under a precipitation regime averaging twenty four (24) inches per year, the 4.5 inch recharge value represents 19%.

Based upon these current best estimates, the following guidelines shall be initiated by the district to achieve the safe yield objective:

1. When an application to appropriate water for beneficial use (other than domestic) is received by the Division of Water Resources, each earlier priority non-domestic well lying within a two (2) mile radius of the proposed point of diversion shall be noted.

2. The quantities of water authorized by the vested rights, prior appropriation rights, and earlier priority applications for permits to appropriate water shall be totaled.

3. If an earlier priority application, permit, certificate, or vested right covers more than one well, but all wells do not lie within the area designated in (1), then a reasonable quantity of water shall be allocated to each well based upon best available information. If such information is unavailable, the quantities applicable to each of such wells shall be of equal proportions.

4. The limitation clause ascribed to applications, permits, or certificates which contain wells and/or land covered by prior applications, permits, or certificates shall be in force to determine the maximum quantities of groundwater which may be withdrawn under earlier priority applications.

5. The quantities of groundwater attributed to the prior rights plus the quantity requested by the application in question shall then be summed. If this total quantity of groundwater exceeds three thousand (3000) acre-feet, the application shall not be recommended for approval by the district.

6. The previous process shall apply only to non-domestic uses of water.

7. If all the land with the two (2) mile radius of the proposed point of diversion does not lie within district boundaries, then the quantity of water referred in (5) shall be reduced proportionately by the percentage of acreage lying outside of said district boundaries.

8. The quantity of water specified in (5) may be revised as future recharge data is made available to the district.

D. Changes in the point of diversion:

The location of a well requested under a change in point of diversion shall be no more than thirteen hundred and twenty (1320) feet from the point originally authorized by a vested right, appropriation right or an application to appropriate water for beneficial use. Such well shall meet the minimum spacing requirement established in section (B) except in instances when the replacement well is drilled within one-hundred (100) feet of the originally authorized point of diversion.

Applications to change the point of diversion for the purpose of adding an additional well shall be subject to Kansas State Board of Agriculture, Division of Water Resources, Administrative policy no. 85-12 effective December 19, 1985 and Administrative procedure No 85-13, effective December 19, 1985. In addition, it must be demonstrated to the board that the proposed well will not prejudicially and unreasonably affect the public interest.

E. Changes in Type of Use:

Applications filed to change the use made of the water will be considered if the current use has been certified and it is demonstrated to the board and the Chief Engineer that the proposed use is a beneficial use of water and that the quantity requested is reasonable for the proposed use, and that such approval will not impair an existing right, nor unreasonably or prejudicially affect the public interest of the district. An application shall not be recommended for approval by the district which would increase the actual consumptive use of the water.

F. Change in Place of Use:

An application to change the place of use to add additional land will, upon approval by the Chief Engineer, be required to install a flow meter if the total acreage has increased by more than 25%.

G. Appropriation of water from consolidated aquifers:

The use of the consolidated aquifers of the Big Bend district can allow additional water for beneficial use in certain areas.

Much of the water in these aquifers is of poor quality but can be used for such purposes as secondary oil recovery and salt solution mining. Applications for beneficial use of water from the consolidated aquifers of the district shall be reviewed with respect to the degree of interconnection the formation has with the unconsolidated Pleistocene sand and gravel aquifer.

Management criteria, separate from the safe yield policy (section C), shall apply to consolidated aquifers if it is proven to the satisfaction of the board and the Chief Engineer that substantial hydrologic separation exists between the intended producing zone and the Pleistocene aquifer.

In order to substantiate hydrologic separation the applicant shall submit a test log, as described in the rule and regulation (5-25-10). The applicant shall also submit data along two perpendicular lines passing through the proposed location. There shall be at least four data points, in addition to the central test log, equally spaced along each line. The data must indicate that a continuous impermeable zone exists between the Pleistocene aquifer and the intended producing zone, in a two (2) mile radius circle surrounding the proposed location. Acceptable data shall include: electric logs, test logs, radiation logs, and seismic lines.

H. Water Quality tests:

The board may require that any or all water users within the district, or those proposing the diversion of water for beneficial use, obtain a water quality analysis and submit the results of such analysis to the district. In the case of those wells proposing the use of water from one of the consolidated aquifers a water quality analysis, from the intended producing zone, will be required prior to approval.

I. Well construction and abandonment:

All wells shall be constructed in accordance with the Kansas Department of Health and Environment, Article 30, water well contractors license, water well construction and abandonment.

If a well is to be abandoned and replaced, the owner or operator shall abandon said well in accordance with the Kansas Department of Health and Environment, Article 30.

J. Access Tube:

It is recommended that all new large capacity wells, greater in capacity than 100 gallons per minute, completed within the district after January 1, 1977 shall be equipped with an access tube or other such device as approved by the district to allow the measurement of water level and drawdown in said well. Such

equipment shall meet the specifications adopted by the Kansas State Board of Agriculture, Division of Water Resources.

K. Check Valves:

All permitted wells shall be equipped with an in-line, automatic, quick closing check valve capable of preventing pollution of the source of the water supply. Such valve shall meet the specifications adopted by the Kansas State Board of Agriculture, Division of Water Resources.

L. Flow Meters:

The installation of an in-line flow meter (option I-see meter specifications section) shall be required on the diversion works of all applications to appropriate groundwater for beneficial use, except domestic and temporary permits, and all applications to change the point of diversion, received in the District office after February 8, 1984. Option II (see meter specifications section) meter installations shall not be approved for these cases.

The diversion works of all other permitted vested rights and appropriation rights for the use of groundwater for beneficial use, except domestic and temporary permits, shall install either an in-line flow meter (option I) or an electro-mechanical totalizing hour meter in conjunction with a port, for the insertion of a portable velocity meter (option II), by May 1, 1989.

It shall be the responsibility of the landowner to report annually the reading of such meter to the Chief Engineer, Division of Water Resources on forms provided by the Division.

It shall be the responsibility of the landowner to maintain the meter and insure that the equipment is in good working condition to the satisfaction of the board and the Chief Engineer whenever the diversion works are in use.

It shall be the responsibility of the landowner to furnish the district with a diagram and description of the meter installation on forms provided by the district.

In the case of Option II installations, it shall be the responsibility of the landowner to annually make and report a flow rate determination. The flow rate determination can be performed by the landowner or an approved third party. The flow rate determination shall be made with a meter approved by the district.

1. Meter Specifications:

Two options are available for the selection and installation of meters:

Option I - an in-line flow meter, meeting the specifications of the Kansas State Board of Agriculture, Division of Water Resources for quality, type and installation standards.

Option II - an electro-mechanical totalizing hour meter shall be installed in conjunction with the installation of a port.

The port shall be installed in such a way that no portion protrudes into the existing pipe, thereby minimizing any turbulence resulting from the installation. The port shall be equipped with a ball valve, plug valve, or gate valve, with a minimum inside diameter of one and one-half inch, through which a portable type velocity meter can be installed. The top of the valve shall not extend more than 8 inches above the pipe.

The port shall be placed in the line with at least five pipe diameters of straight pipe without valves, elbows, or other obstructions upstream from the port and at least two pipe diameters without valves, elbows or other obstructions downstream from the port. The port may be placed at any location in the line that meets these requirements. If it is necessary to place the port after a directional flow valve, then one port will be needed for each flow direction. If these conditions cannot be obtained, straightening vanes shall be installed in the pipe ahead of the port according to the manufacturers instructions. If the installation requirement cannot be met with straightening vanes then modification of the system will be needed to meet the above specifications.

M. Test Logs:

The district will require that a test log be submitted prior to the approval of an application to appropriate water for beneficial use. The test log shall include:

1. The legal description of the test site drilled (described as a 10 acre tract) or another acceptable description which accurately describes the test site drilled;
2. The date that test log drilling was conducted;
3. A description of strata and the depth below land surface at which those strata were encountered;
4. the static water level at the test site; and
5. the driller's estimate of the reasonable maximum rate of pumpage in gallons per minute based upon the geohydrology of the strata at the test site.

N. Waste of Water:

The waste of water in this district is not an acceptable practice. Waste of water is defined in the rules and regulations 5-25-1 (e). The district will respond to waste of water complaints and may initiate action upon its own discretion to control flagrant violations of the waste of water policy.

O. Application Filing and Review:

Through an agreement with the Chief Engineer, Division of Water Resources, copies of all new applications filed for a permit to appropriate water for beneficial use within the district will be submitted to the district for recommendation. The district may assist in the preparation of said application but it will be the responsibility of the applicant to submit the application to the chief engineer.

Each application to appropriate water for beneficial use shall include no more than one well per application.

If an applicant is requesting an exception to the policies, standards, or the rules and regulations of the district then the applicant, landowner, or a representative shall be present at a regularly scheduled board meeting to request such exception.

P. Enforcement and Inspection:

Complaints of violations of the rules and regulations, the management program, the groundwater management district act, the water appropriation act, or any complaints regarding pollution or potential pollution of the groundwater resource will be processed by the district in the following manner:

1. Upon receipt of a complaint a representative of the district shall, within thirty (30) days of the filing of the complaint make an investigation to determine the nature of the problem. The field investigation shall include:
   a) Date and time of investigation
   b) Name of investigator
   c) Detailed location of investigation
   d) Description of problem
   e) Photograph recording problem where applicable.

Upon completion of the field investigation the district shall ascertain whether or not the problem appears to be habitual. The District will also determine which state agency has statutory responsibility for the problem and will forward complaint and investigation results to the appropriate agency. The District will work in cooperation with this agency to resolve the problem.

If it is determined that a violation exists, the landowner

shall be notified.

If no violation exists, then the party making the complaint shall be so notified.

2. First violation - If the violation is a first time occurrence, the district shall give written notice to the landowner of the nature of the violation. The landowner shall have five working days in which to respond to the district indicating what corrective control measures will be implemented. Failure to implement the necessary corrective controls will result in a second violation.

Second violation - A second violation occurring in a two (2) year period shall result in a district order being issued stating the necessary corrective control measures and mandating a time frame for implementation of the corrective control measures. Failure to implement the corrective control measures in the specified time frame will result in the issuance of a third offense.

Third violation - The occurrence of a third violation in a two (2) year period shall result in the district seeking appropriate remedial measures with the assistance of the district court and/or the Chief Engineer, Division of Water Resources, and/or the Secretary of the Kansas Department of Health and Environment and/or the chairperson of the Kansas Corporation Commission. The district may also pursue other courses of action in the public interest to resolve the problem.

Q. Variances to management program and rules and regulations.

The district may recommend exceptions to the policies embodied in the management program and the rules and regulations on an individual basis to the chief engineer provided that it is proven to the board of directors that such exceptions neither will impair a use under an existing right, nor prejudicially and unreasonable affect the public interest.

R. Water Conservation Planning Policy

1. It shall be the policy of GMD NO. 5 to use water conservation planning to bring about a higher level of groundwater use efficiency for all use types withdrawing water from within the district. The following cases shall require development and implementation of such a plan:

a. All new applications for groundwater rights.

b. All irrigation groundwater applications for change in

place of use exceeding twenty five percent additional land, or use made of water, as long as the proposed change represents an actual change in operation, and not simply an administrative change.

c. All water users who receive a third violation of the waste of water policy within any two year period.

2. A water conservation plan shall basically consist of the following:

a. Irrigation - A description of the proposed system including: irrigation system design, tailwater control methods, cropping patterns, field layout, topography, any necessary land treatment, soils types and slope information, water right application number, and any other pertinent information deemed necessary by the board. All plans shall be designed to meet the latest target water application efficiency listed in Table I of the Kansas Water Office, Water Conservation Planning Guidelines. All plans shall conform to the procedures and criteria outlined in the Kansas Irrigation Guide USDA, SCS or similar standards.

b. Municipal - A description of the proposed system including: the age and condition of distribution lines, wastewater collection and handling, drought contingency plan, conservation plans, monitoring methods, projected needs, and other information deemed necessary by the board.

c. Industrial - A description of the proposed system including: The age and condition of distribution lines, wastewater collection and handling, monitoring methods, equipment specifications and efficiency and other pertinent information deemed necessary by the board.

d. All other uses - A description of the proposed system including: project layout, wastewater collection and handling, and other pertinent information deemed necessary by the board.

3. Required water conservation plans will be handled in the following manner:

a. The district shall notify the applicant of the requirement to submit a water conservation plan.

b. The plan can be developed independently or in coopertion with any private or governmental entity.

c. All completed plans shall be filed with the Groundwater

Management District, who shall review, process and adopt or deny the proposed plan.

d. In the case of irrigation plans the County Conservation District may review any required plan and offer an evaluation of the plan to the Groundwater Management District Board of Directors.

e. The Board of Directors may seek the advice and assistance, in the review of water conservation plans, from any local, state, federal or private person or group.

f. The board - approved water conservation plan shall be forwarded to the Division of Water Resources as part of the proposed application for permit to appropriate water and shall be fully implemented prior to the operation of the system or within the time outlined in the plan.

g. A board - denied water conservation plan shall result in a district recommendation for denial of the pending water right application.

4. Enforcement of this policy shall be in accordance with the Groundwater Management District Policy (N) concerning enforcement and inspection, and regulation 5-25-9, procedure for non-compliance with rules and regulations.

Appendix A

Rules and Regulations:

5-25-1. Definitions. As used in these rules and regulations, unless the context clearly requires otherwise, the following words and phrases shall have the meaning ascribed to them in this section. (a) Aquifer means a geologic formation capable of yielding water.

(b) Board means the board of directors constituting the governing body of the big bend groundwater management district no. 5

(c) District means the big bend groundwater management district no. 5.

(d) Safe Yield means that quantity of groundwater withdrawn from a given area which approximately equals the average annual recharge to the same area.

(e) Waste of water means: (1) Groundwater which has been diverted or withdrawn from a source of supply which is not used or reapplied to a beneficial use on or in connection with land authorized as the place of use by a vested right, an appropriation right or an approved application for permit to appropriate water for beneficial use;

(2) any act or omission causing the unreasonable deterioration of the quality of water in any source of supply thereby causing impairment of a person's right to the use of water;

(3) groundwater which an irrigator permits to escape and drain from the authorized place of use;

(4) groundwater applied to an authorized beneficial use in excess of the needs of such use; and

(5) failure to recycle or reuse groundwater on or in connection with the authorized place of use whenever reasonably possible for all the beneficial uses of water.

(f) Well means any excavation that is drilled, cored, bored, washed, driven, dug or otherwise constructed, either by nature or by man, when the proposed use of such excavation is for the acquisition, diversion, or artificial recharge of groundwater.

(g) Consolidated aquifer means consolidated rocks that will yield water in sufficient quantity to supply pumping wells and springs, including the cretaceous Dakota, the cretaceous Cheyenne sandstone and the Permian Cedar Hills sandstone aquifers.

(h) Consolidated rocks means mineral particles of different sizes and shapes that have been welded by heat and pressure by the chemical reaction into a solid mass, commonly referred to as bedrock, which may, or may not, contain water. (Authorized by K.S.A. 82-a-1028(o); implementing K.S.A. 92-a1028(n); effective May 1, 1980; amended May 1, 1987.

5-25-2. Well regulations. (a) With the exception of those wells described in subsection (c), the minimum spacing of all wells other than those used for domestic use described in an application to appropriate water for beneficial use shall be thirteen hundred and twenty (1320) feet from all other wells which carry an earlier priority, and six hundred and sixty (660) feet from all other earlier priority domestic wells, except those domestic wells whose interests are represented by the applicant's own interests.

(b) The location of a well requested under a change in point of diversion shall be no more than thirteen hundred and twenty (1320) feet from the point originally authorized by a vested right, appropriation right or an application to appropriate water for beneficial use. Such wells shall meet the minimum spacing requirement established in section (a) except in instances when the replacement well is drilled within one hundred (100) feet of the originally authorized point of diversion.

(c) Each nondomestic well which proposes the diversion or withdrawal of groundwater from the dakota aquifer or any other consolidated aquifer shall be one (1) mile from all other wells withdrawing groundwater from the same formation, including domestic wells, but excluding those domestic wells whose interests are represented by the applicant's own interests.

(d) If a well is to be abandoned and replaced, the owner or operator shall abandon such well in accordance with Kansas department of health and environment regulations when the replacement well is completed.

(e) Each application to appropriate water for beneficial use shall include no more than one well per application.

(f) Exceptions to these well regulations may be recommended to the chief engineer provided that it is proven to the satisfaction of the board of directors that such exceptions neither will impair a use under an existing right, nor prejudicially and unreasonably affect the public interest. (Authorized by K.S.A. 1979 Supp. 82a-1028(n) and (o); effective May 1, 1980).

5-25-3. Allowable appropriation. Applications for permit to appropriate water for beneficial use shall not be recommended for approval for a quantity in excess of one and one half (1 1/2) acre feet of groundwater per acre of land irrigated. For other

uses, it must be demonstrated to the satisfaction of the board and the chief engineer that the quantity requested is reasonable for the proposed use, and that such approval will not impair an existing right, nor unreasonably or prejudicially affect the public interest of the district. (Authorized by K.S.A. 1979 Supp. 82a-1028(n) and (o); effective May 1, 1980.)

5-25-4. Safe yield. (a) Except for domestic use, wells proposing to withdraw water solely from a consolidated aquifer, and applications for a change in the point of diversion for which the diversion works have been completed under the original approved application, the approval of all applications for a permit to appropriate water for beneficial use and applications for change in point of diversion shall be subject to the following criteria:

(1) The proposed appropriation, when added to the vested rights, prior appropriation rights and earlier priority applications within a two mile radius circle whose center is the location of the proposed well shall not exceed 3,000 acre-feet. It shall be assumed, for purpose of analysis, that all prior applications, permits, certificates and vested rights are being fully exercised and all limitation clauses listed on permits and certificates shall be in force;

(2) If part of the area within the two mile radius circle about the proposed well is outside the district boundary, the 3,000 acre-feet quantity of water referred to above shall be reduced proportionately by the percentage of acreage lying outside of the district boundaries. Only the vested rights, prior appropriations and earlier priority applications ascribed to wells within the portion of the circle within the district shall be considered;

(3) If wells authorized under a vested right or an application are by the circumference of the circle, then a reasonable quantity shall be allocated to each well or wells based upon the best available information; and

(4) Each analysis for an application for a change in the point of diversion, referred to above, shall include all applications with a priority earlier than the priority established by the filing of the application for change.

(b) If the applicant proposes to drill a well in a consolidated aquifer, the applicant shall submit sufficient data to substantiate that a continuous impermeable zone exists between the pleistocene sand and gravel and the proposed consolidated source of supply within the two mile radius circle surrounding the proposed point of diversion. Each applicant shall also submit a water quality analysis from the proposed source of supply.

(c) Exceptions to this regulation may be granted if it is proven to the satisfaction of the board and the chief engineer that such exceptions will not impair a use under an existing right, nor prejudicially and unreasonably affect the public interest. (Authorized by K.S.A. 82a-1028(o); implementing K.S.A. 82a-1028(n); effective May 1, 1980; amended May 1, 1981; amended, T-86-4, March 22, 1985; amended May 1, 1986; amended May 1, 1987; amended May 1, 1988.)

5-25-5. Well equipment. Whenever the district requires that a water meter, gauge, or measuring device, be installed on the diversion works for a well, it shall be the responsibility of the owner or water user to: (a) insure that the water meter, gauge, or measuring device is properly installed as recommended by the manufacturer; and

(b) maintain the water meter, gauge, or measuring device, and insure that the equipment is in good working condition to the satisfaction of the board and chief engineer whenever the diversion works are in use.

Each meter, gauge, check valve, or other device shall meet minimum specifications adopted by the board as to type, quality, and installation standards.

All diversion works for groundwater shall be equipped with an in-line, automatic, quick-closing check valve capable of preventing pollution of the source of the water supply. The board may also require the installation of other devices to prevent the pollution of the groundwater supply. (Authorized by K.S.A. 1983 Supp. 82a-1028(o); implementing K.S.A. 1983 Supp. 82a-1028(l) and (n); effective May 1, 1980; amended May 1, 1985.)

5-25-6. Reporting water use. The board may require any or all water users to file a report of water use for each well or water right during each calendar year on forms provided by the district. Such reports shall include such information deemed necessary and reasonable by the board, and shall be received by the district no later than ninety (90) days following the end of each calendar year. (Authorized by K.S.A. 1979 Supp. 82a-1028(l), (k) and (o); effective May 1, 1980.)

5-25-7. Water quality tests. The board may require that any or all water users within the district, or those proposing the diversion of water for beneficial use obtain a water quality analysis and submit the results of such an analysis to the district. The precise nature of the test, and all other factors relevant to this test shall also be determined by the board. (Authorized by K.S.A. 1979 Supp. 82a-1028(k) and (o); effective May 1, 1980.)

5-25-8. Waste of water. No water user shall waste water as

is defined in these rules and regulations. (Authorized by K.S.A. 1979 Supp. 82a-1028(n) and (o); effective May 1, 1980.)

5-25-9. Procedures for non-compliance with rules and regulations. The district, its board or manager, any eligible voter or any person eighteen (18) years or older residing within the district may file a written complaint with the district alleging a violation of these rules and regulations, the management program, the groundwater management district act (K.S.A. 82a-1020 et seq.), the water appropriation act (K.S.A. 82a-701 et seq.) or any acts amendatory thereof or supplemental thereto. The written complaint shall be filed at the district office.

Within thirty (30) days following the filing of the complaint, a representative of the district designated by the board shall investigate the complaint. If the representative of the district finds that a violation exists or did exist, the representative shall issue a written directive to the violator to come into compliance with these rules and regulations within a reasonable period of time.

If the violator fails to comply with the directive of the representative within a reasonable period of time as determined by the board, the district may: (1) seek to enjoin the violator's use of water by suitable action in district court until such time as the violator complies; or

(2) seek the assistance of the chief engineer and attorney general of the state of Kansas to enjoin the violator's use of water until such time as the violator complies; or

(3) pursue other courses of action in the public interest. (Authorized by K.S.A. 1980 Supp. 82a-1028(o); implementing K.S.A. 1980 Supp. 82a-1028(n); effective May 1, 1980; amended May 1, 1981.)

5-25-10. Test log drilling. Before any application for a permit to appropriate groundwater, except for domestic use and temporary permits, may be considered in proper form for further processing, a test log shall be submitted which includes the following information: (a) The legal description of the test site drilled (described as a 10 acre tract) or another acceptable description which accurately describes the test site drilled;

(b) the date that test log drilling was conducted;

(c) the drilled footage;

(d) a description of strata and the depth below land surface at which those strata were encountered;

(e) the static water level at the test site; and

(f) the driller's estimate of the reasonable maximum rate of pumpage in gallons per minute based upon the geohydrology of the strata at the test site.

Exceptions to this regulation may be made by the chief engineer and the board for good cause shown by the applicant. (Authorized by K.S.A. 1981 Supp. 82a-1028(o); implementing K.S.A. 1981 Supp. 82a-1028(n); effective May 1, 1983.)

5-25-11. Determination of distance between wells. When a question arises as to whether a well is located within some prescribed radius of the applicant's proposed well site, the burden of proof remains upon the applicant to show to the satisfaction of the chief engineer and the board whether that well is located outside of the prescribed radius from the applicant's proposed well. (Authorized by K.S.A. 1981 Supp. 82a-1028(o); implementing K.S.A. 1981 Supp. 82a-1028(n); effective May 1, 1983.