

# GROUNDWATER MANAGEMENT DISTRICT

## MANAGEMENT PROGRAMS

The number one water management item is to convert to less water intensive crops. That coupled with limited irrigation and minimum tillage along with more efficient irrigation systems, without increasing acreages, would provide for an improved water management program.

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## I. INTRODUCTION

The Western Kansas Groundwater Management District No.1 was organized because of the need to better conserve and manage the groundwater resources in this area. By the enactment of the Groundwater District act, it enabled the local people to determine their destiny as it related to the use and management of our water resources within the constraints of existing state laws.

Since the first irrigation well within the district was completed in 1907, many changes have taken place. It is the responsibility of the district to guide and regulate future water use development and to plan for future water needs. Without the input of local people, this task would not be possible. It is our firm belief that a sound program can only be achieved by the continued efforts of the local people working in cooperation with this district.

## II. FORMATION OF THE DISTRICT

The Western Kansas Groundwater Management District No.1 (WKGMD No.1) was

formed because of an urgent need to conserve and replenish the groundwater supplies in our area. Its formation was made possible by the enactment of the Groundwater Management District Act. This made it possible for local people to have a voice in the management and conservation of their groundwater supply.

In this district, an initial meeting was held on January 20, 1972 in Scott City. This was done to obtain the feeling of the people in this area towards the formation of such a district. The meeting was sponsored by the Soil Conservation District from Scott County. At this meeting, it was the feeling of those present that a district should be formed. An initial steering committee was elected as follows:

Chairman Wallace N. Robinson III Scott County

Secretary M.E. Neidens Lane County

Member Robert E. Berg Wichita County

Member Lyle Griffen Greeley County

Member Victor Rauch Greeley County

Member Dean Schemm Wallace County

Member Clyde Schinnerer Scott County

Upon election of the Steering Committee, a Declaration of Intent was filed with the Chief Engineer of the Division of Water Resources, along with a map of the proposed district. After approval was given on the Declaration of Intent, a petition was circulated, signed by fifty eligible voters, and filed with the Secretary of State. After his review and approval, the petition was submitted to the Chief Engineer for final approval. Upon receipt of the Chief Engineer's approval, the committee adopted a resolution calling for an election. The election was held on April 3, 1973 with two hundred and sixty nine votes cast. Eighty two percent of the votes cast were in favor of the district's formation, with only eighteen percent opposed.

The first formal meeting of the district was held in Leoti on August 13, 1973. The Board of Directors was elected as follows:

Chairman Wallace N. Robinson III Scott County

Vice-Chairman Lyle Griffen Greeley County

Secretary M.E. Neidens Lane County

Treasurer Robert E. Bergh Wichita County

Member Ray Welsh Wallace County

During the first year of formal organization, the district developed their management plan, and determined the best ways to accomplish the district objectives. It was the feeling that through demonstration projects, meetings, news releases and personal contacts, the district's objectives would be accomplished.

The second annual meeting of the district was held in Scott City, Kansas on August 12, 1974. Mr. Ralph Walker from Sharon Springs was elected to replace the expiring term of Ray Welsh. Due to the inconvenient date of the meeting, it was decided to change the date to a winter month. The third annual meeting of the district was held in Leoti, Kansas, February 20, 1975. Subsequent meetings are held annually at various locations throughout the district.

The Western Kansas Groundwater Management District No.1 was the first such district to be formed in Kansas. Since that time, four other districts have been formed to better manage the water resources in Kansas.

### III. HISTORY OF IRRIGATION

Scott County records some of the earliest development for irrigation. While it was not the first to have development for irrigation from groundwater sources, its development dates back as far as 1888. It is reported that by 1895, 24 individuals were irrigating a total of 40 acres. Apparently, all of these used windmills for power and more than likely, irrigated only garden size plots. It is also known that prior to this time, irrigation was being done by the Indians in what is now known as the Lake Scott State Park.

The next phase in the development of irrigation came in 1907 when Mr. E.E. Coffin installed a well. It is reported that this well was 90 feet deep with a nine-inch casing. The small centrifugal pump was powered by a 4 1/2 horsepower gasoline engine, and pumped at a rate of 120 gallon per minute. In that same year, he also installed two 15-inch wells to a depth of 23 feet. The two wells were approximately 25 feet apart and pumped at a rate of 450 gallons per minute combined. The two wells were combined through a header to one centrifugal pump and driven by an Olds 12 horsepower oil-burning engine.

Other irrigation wells were soon constructed. In 1909, Mr. J.W. Lough purchased a deep-well type centrifugal pump. It was estimated to pump at a rate of 1,000 gallons per

minute. Also in that year, Mr. W.S. Manker completed a well near the southeast limits of Scott City. The following year he again constructed a well, which became known as the "big well" which pumped an estimated rate of 1,600 gallons per minute.

In addition to these individual projects, several large financial interests were attracted by this irrigation development. From the time between 1909 and 1916, several large companies bought large tracts of land for irrigation development.

One of these companies, the Great Western Irrigation Company, made a survey in the Whitewoman Creek to bring groundwater to the surface by gravity flow, and irrigate vast areas of land. Some small construction work was done, but the flow was disappointingly small, and the project was given up. About the same time, Marks and Son of Chicago, the Garden City Development Company, and the Garden City Company purchased thousands of acres for irrigation development in the southern part of Scott County. Several irrigation wells were constructed, as well as a power line into the area.

By 1917, Mr. Lough had completed a \$75,000 electric generating plant to furnish power to his own pumping plants.

It is very difficult to estimate the amount of irrigation in the early years, however, it was noted that by 1922, 4,921 acres of land were under irrigation. The rate of development for irrigation slowed down from that time until the early thirties when interest in development once again increased. In 1945 a total of 129 wells supplied 18,400 acre-feet of water to irrigate 21,002 acres of land.

#### IV. DESCRIPTION OF THE DISTRICT

##### A. Location

The Western Kansas Groundwater Management District No.1 includes the major portion of five western Kansas counties. (Lane, Scott, Wichita, Greeley, and Wallace) (See Figure 1) 1,166,920 acres of total land is included in the district, and of this total, approximately 391,000 acres are irrigated. There are approximately 2,600 wells in the district with existing production capacities ranging from 50 gallons per minute to 1,800 gallons per minute.

##### B. Drainage

Two creeks which offer potential for recharge are located within the district. These include Ladder Creek, which originates in Colorado and flows through Wallace, Greeley, Wichita, and Scott counties, and Whitewoman Creek which originates in Colorado and terminates in the Whitewoman Basin located just south of Scott City. (See figure 2)

### C. Soils

A variety of soils exist within the district, ranging from Sandy Loam in the west-northwest to Silty Loam in the central and eastern portions of the district.

### D. Cropping

Corn, milo and wheat are the major irrigated crops grown in the district. However, a limited number of acres are devoted to the production of alfalfa, soybeans, and sunflowers. The majority of the corn, alfalfa, wheat and milo production is used to support the cattle industry within the district. The beans and sunflowers are usually shipped to places outside the district.

### E. Climate

The average precipitation ranges from 15 inches in the west to 20 inches in the eastern portion of the district. Approximately seventy five percent of the moisture occurs during the growing season from April to September. Showers account for most of the annual moisture within the district, particularly in April, May and June. Local storms occur in a scattered pattern over the area. Heavy rains may be reported in one locality, while a nearby area receives little or no rainfall.

Because of the elevation and the influence of the surrounding landmass, daily and annual temperatures vary greatly. Frequent cloudless or nearly cloudless skies and dry atmospheric air result in warm days and cool nights. Even in July, the hottest month, the nights are usually cool.

Surface winds are moderate to occasionally strong in all seasons. The period of strongest winds, on the average, is in the spring when low-pressure storm centers are most intense. During dry periods, strong winds may be accompanied by soil blowing, particularly in March and April. In recent years, however, improved soil management has reduced the amount of soil erosion.

### F. Geology

The Ogallala formation of Tertiary age is an unconsolidated deposit of silt, sand and gravel, which makes up the principle aquifer in this district. It ranges in thickness from approximately 20 feet to as much as 260 feet in the northwest portion of the district.

## V. GROUNDWATER SUPPLY AND RELATED PROBLEMS

Groundwater supplies are being depleted as a result of long-term withdrawals that exceed recharge. Declines in water levels in the Ogallala formation since

predevelopment average about 35 feet ranging to about 85 feet (KGS, Tech. Series 9, 1996) in the WKGMD No. 1. These declines represent more than 25% of the original saturated thickness and more than 50% in many areas in Wallace, Greeley, Wichita and Scott counties. Lane county declines represent more than 10% of the original saturated thickness and more than 25% on many areas. Annual declines in water levels averaged .2 ft. from 1991 through 1995, ranging from a 1.1 ft. decline in 1995 to .9 ft. increase in 1994. It is anticipated that water supplies will eventually become very limited if withdrawals continue at or near current rates. Information summarized from several publications provides some insight about the limits of the groundwater supply in the WKGMD No. 1.

#### A. Groundwater Resources

The total amount of water in storage is estimated to be approximately 7,257,600 acre-feet, but some of this total is not available for use by normal pumping methods. Several estimates of the percent of the total storage available have been made and include-- 60% (McClain, KGS, 1975), 67% (KWO, 1984), and 80% (Fader and Stullken, USGS, 1978). This would indicate between 4,862,592 acre-feet and 5,806,080 acre-feet of storage are available for use.

#### B. Recharge

Water enters the Ogallala Formation in west-central Kansas by infiltration from precipitation on the area, and by seepage losses from creeks, which cross the district. This phenomenon is known as "natural recharge". Annual recharge rates compiled from U.S. Geological Survey information (Hansen, USGS, WRI 87-4230) indicate annual recharge to be 70,000 acre-feet or less.

#### C. Depletion

Management criteria used in the development of well locations in the past have produced major aquifer depletion in WKGMD No.1. During the 6-year period 1990-1995 reported annual water use from these counties ranged from 198,200 acre feet in 1993 to 389,100 acre feet in 1990 (DWR water use reports). The average reported annual water use for these counties over the 6-year period was 292,800 acre-feet. Assuming available storage of 5,800,000 acre feet, an annual recharge rate of 70,000 acre feet, and a continued annual withdrawal of 292,846 acre feet, the groundwater would be gone in about 26 years. Assuming an estimate of available storage of 4,800,000 acre feet, that some believe is more reasonable, and the same withdrawal rate would indicate that the water supply would be gone in about 21 years. It is not likely that the withdrawals would continue at rates of the past but instead would decrease, as the saturated thickness in the aquifer decreased and wells could no longer pump at a reasonable diversion rate. However, the thickness of the aquifer and the withdrawal rates are not equally spaced throughout WKGMD No.1 so water supplies in some areas would probably be gone in less than 25-30 years and others would remain longer.

In comparing the amounts of water pumped annually, and the amount of natural recharge, one can easily see that the hydrology of the aquifer is not in balance. This balance cannot be restored unless these losses from storage are compensated for by increases in natural recharge, artificial recharge, decreases in pumpage, or water augmentation programs. In an effort to better manage remaining groundwater supplies, the WKGMD No.1 has established several goals and objectives. These include (a) control of new development; (b) the possibility of regulating existing development; (c) programs to augment existing water supplies; and (d) reduce the acres irrigated.

#### D. Future Development of Irrigation

The control of new development brings about several additional questions. These are; (1) how much additional development should be and will be allowed; and (2) how can this be accomplished in a fair and equitable way. WKGMD No.1 has adopted a methodology of a safe yield program for the district. Future new appropriations are not allowed in areas with minimal saturated thickness or significant depletion since 1950. In other areas future appropriations are limited to additional quantities that would not cause the total appropriations to exceed safe yield. The protocol for enhanced water management will focus on options for decreasing consumptive use from the aquifer.

#### E. Tailwater Control

Another problem, which is of prime concern in our district, is the wastage of irrigation tailwater. It is estimated that approximately twenty percent of the water applied through flood systems, runs off the ends of fields as tailwater. This water, if collected and re-used, could mean a dramatic savings in the total amount of water withdrawn annually. Most of this tailwater is allowed to remain in barrow pits or lagoon areas where it is subject to very high evaporation rates and slow infiltration.

Current regulations state that it shall be unlawful to allow any water applied to leave the land under the water user's direct supervision and control. With the application of this regulation, the twenty percent of the water applied is contained for re-use rather than being allowed to run off of the land.

#### F. Public Education

The concept of local control for this district hinges entirely on the input from the people in this area. Keeping local people informed and soliciting their concerns is an extremely difficult task. WKGMD No.1 will, through the use of newsletters, public meetings, and personal contacts, inform people of the goals and objectives of this district.

#### G. Energy

The cost of energy necessary to pump water in this area is of primary concern. There has been a great deal of discussion regarding the abandonment of wells due to the high cost of pumpage. To date however, there have not been a substantial number of wells

abandoned. A related problem, created by the cost of pumping irrigation wells, is the non-use of these wells and their temporary abandonment. Care must be taken not to leave abandoned wells open to allow possible pollution of the aquifer and also as a safety hazard to the public.

## VI. GROUNDWATER MANAGEMENT PROGRAM AND OBJECTIVES

### A. Data Collection

This district is involved in many areas of data collection. These include such things as water levels, discharge measurements, well locations and information obtained through the conduct of our weather modification program. A combination of all of this information will provide a better database on which the WKGMD No.1 can set decisions and policies.

### B. Monitoring Groundwater Levels & Discharges

Annual water level measurements are taken each winter through a cooperative program between the Division of Water Resources, Kansas Geological Survey, and the U.S. Geological Survey. Those measurements are taken annually, generally during the middle of January to determine annual declines or increases in our water levels. In addition to this, individual measurements are taken by WKGMD No.1 to assist water users in determining individual water levels.

Upon making a request to the WKGMD No.1, well discharge measurements are taken to assist water users in determining how much water their individual wells are pumping. This information can be used to increase the operation efficiencies of the system and better manage and conserve groundwater resources. These measurements also provide a means for the water user to comply with WKGMD No.1's metering program.

### C. Pilot Groundwater Recharge Project

In 1975 the district began working on projects to test artificial recharge of the groundwater resources in selected areas. Those projects were completed with the assistance of local landowners. A cooperative program with the U.S. Geological Survey was initiated to provide the instrumentation on the sites. The largest project completed was an earthen fill structure, which was constructed under the pilot recharge program of the State of Kansas. This program has been completed and has provided the assurance that water can be recharged if a supply is available.

### D. Review of Applications to Appropriate Water for Beneficial Use

Through an agreement with the Division of Water Resources, the district receives all new applications to appropriate water for beneficial use and all applications for change

in point of diversion, place of use, or use made of water. This gives the district an opportunity to determine the applications compliance with their local regulations and policies. After their review, a recommendation is made to the Chief Engineer of the Division of Water Resources to either approve the application as filed, deny the application or perhaps modify it to meet the policies of the WKGMD No.1.

The WKGMD No.1 will also provide assistance in the preparation of applications. It will however, be the responsibility of the applicant to file their application with the Division of Water Resources.

#### E. Water Use Reports

In addition, the district will continue to assist water users in the preparation and filing of annual water use reports. This will give the district an opportunity to assess the rate and quantities of water being annually withdrawn.

#### F. Water Conservation Plans

In 1986, the Kansas Legislature amended K.S.A. 74-2608. The Act among other things requires the Kansas Water Office to develop and maintain guidelines for water conservation plans and practices. The Act also requires the Kansas Water Office, when developing such guidelines, to consider existing guidelines of Groundwater Management Districts and the cost to benefit ratio of any plan.

The Kansas Water Office developed guidelines in December of 1986 for Irrigation, Municipal and Industrial water users.

In addition to this, the Water Appropriation Act was also amended to allow the Chief Engineer, Division of Water Resources the authority to require an applicant for a permit to appropriate water to adopt and implement conservation plans and practices.

It shall be the policy of the WKGMD No.1 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. As part of the WKGMD No.1's responsibility to manage it's groundwater resources, the District will assist the water users in the district in the preparation of the required conservation plans. This assistance shall apply to the following applications:

- a. All new applications to appropriate water for beneficial use where the district development program can be met.
- b. All non-emergency applications to change the place of use or the use made of water as long as the change is consistent with the districts regulations.

In developing these plans, the requirements in the Kansas Water Office guidelines will also be met. These guidelines include:

- 1) Not prejudicial or unreasonably affect the public interest;
- 2) be technologically and economically feasible for each water user to implement;
- 3) be designed to curtail the waste of water;
- 4) consider the use of other water if the use of freshwater is not necessary;
- 5) not require curtailment in water use, which will not benefit other water users or the public interest;
- 6) not result in the unreasonable deterioration of the quality of the waters of the state;
- 7) consider the reasonable needs of the water user at the time;
- 8) not conflict with the provisions of the Kansas water appropriation act and the state water planning act;
- 9) be limited to practices of water use efficiency except for drought contingency plans for municipal users;
- 10) take into consideration drought contingency plans for municipal and industrial users.

In order to assist the water users, the WKGMD No.1 will request assistance from the local Conservation Districts in the preparation of these plans. This may be done through a memorandum of agreement between the districts. In addition, plans may be prepared by private contractors or by the WKGMD No.1 staff.

Once a plan is prepared, it will be reviewed by the WKGMD No.1 and submitted by the applicant as part of the application process to the Chief Engineer, Division of Water Resources. Irrigation plans will be prepared to include a generalized topographic survey of the land to be irrigated along with the proposed point of diversion. It shall also include a listing of structural measures that may be required to meet the guidelines prepared by the Kansas Water Office utilizing the procedures and criteria outlined in the Kansas Irrigation Guide. Municipal and Industrial Water Conservation Plans should specify the age and condition of their distribution network.

Cognizance will be taken of being technologically and economically feasible pertaining to the implementation of the plan.

## G. Water Quality Protection

Although groundwater depletion has been recognized as the districts number one priority item, the quality of the remaining supply must be given a great deal of consideration. Data on groundwater quality is showing contamination from man-made sources is present as well as increasing. The primary contaminants in Kansas have included chlorinated organic solvents, petroleum products, chloride, metals, and pesticides. Although most contamination incidents have been a result of petroleum industry activities, contamination of groundwater by agricultural chemicals is a growing concern. The WKGMD No.1 has six sites of contamination and an additional 20 sites under investigation in the five county area.

The WKGMD No.1 recognizes that most of the legislative authority and responsibility of administering water quality protection programs rest with the Kansas Department of Health and Environment and the Kansas Corporation Commission. However, the district believes it should assist these agencies in their efforts to maintain water quality.

The WKGMD No.1, in an effort to become more involved has established the following water quality objectives and goals:

- 1) Develop a memorandum of understanding with the appropriate state agencies to establish a cooperative working relationship.
- 2) Establish a program to conduct water analysis with the private sector or in conjunction with the State.
- 3) Establish an observation well network in areas considered to be a potential pollution hazard.
- 4) Develop procedures for remedial action with the appropriate state agencies as it pertains to water quality.
- 5) Serve as a central reporting point for possible violations and referral to the appropriate state agency.

## H. Irrigation Management

In an effort to promote improved water use efficiencies throughout the WKGMD No.1, a demonstration program was conducted in Wichita County. Items included in this program were such things as: Metering discharge rates and quantities; evapotranspiration studies; soil moisture monitoring; open ditch loss studies; pumping plant efficiencies; aquifer modeling; and water use efficiencies. A great deal of information was obtained and has been published through our cooperative program with

the U.S. Geological Survey.

One of the primary goals of WKGMD No.1 is the efficient use of our remaining groundwater supplies while reducing the consumptive use of our water supply. Through a program of promoting the use of more efficient water use crops, and the proper efficiency levels in the pumping and application of that water, an improved level of management will result. Again, one of the key elements is the reduction in the total irrigated acres throughout the district.

### I. Municipal Water Use

This district encourages the wise use and conservation of our water resources by our municipal users. There are many programs, which can be implemented to better conserve municipal waters in Kansas. A better understanding of water conservation programs by all users would result in a substantial reduction in the total use and consumption of our water supplies. The average water use in WKGMD No.1 for the past five years is 250 gallons per capita per day. The average usage for the area communities for the period of 1991 thru 1995 is as follows:

Dighton 216 GPCD Lane Co RWD 238 GPCD

Horrace 136 GPCD Leoti 220 GPCD

Scott City 256 GPCD Sharon Springs 221 GPCD

Tribune 235 GPCD Wallace RWD 268 GPCD

The five-year average for all of the above communities and the area average is basically the same. There is however, a considerable difference between the high of 268 and the low of 136 GPCD throughout this area. There appears to be a number of things, which affect the amount of water used. Those are the amount of outside watering, the cost of the water, and the amount of summer rainfall.

### J. Industrial Water Use

Like any other type of use, the quantity of water used by industry could also be reduced. By using recycled water or finding processes which require less water, a significant savings would result.

### K. Operational Weather Modification

In 1975 this district began the first operational weather modification program in Kansas. It was the feeling of the board of directors that if seeding clouds could induce additional rainfall, it would reduce the stress being imposed on our groundwater resources. It was

also felt that hail suppression had to be included as a major part of this program. This program has been conducted annually for the past thirty years in most all of southwest Kansas. The program was enlarged in 1997 to include the area of the Northwest Kansas Groundwater Management District No.4, and the eastern full township of Yuma county, Colorado. After four years of operation, the area was reduced back to what it was originally. The WKGMD No.1 now owns nine aircraft plus the radar facility in Lakin. From the evaluation which has been done by the Kansas Water Office, it has shown that the program is achieving its objective. The overall reduction in hail losses since 1979 have shown a 27% reduction, while the period of 1987 through 1994 has shown a 46% reduction in hail damages. Because of these findings, this program has now been included in the Kansas Water Plan, and is eligible for state assistance from the Water Plan Fund. A recent study conducted for the U.S. Air Force Research Laboratory states that programs such as ours helps prevent tornadoes in supercells, when seeded to reduce hail.

#### L. Importation of Water

There have been several studies which involve the transportation of water from areas north of Kansas through the western side of the High Plains states. One of these such studies is the NAWAPA water collection and distribution system. This study, which was conducted by the North American Water and Power Alliance, involves the construction of a 500-mile long storage reservoir in Canada, in what is known as the Rocky Mountain Trench. This water would then be distributed from Canada through the United States and on into Mexico. Water deliveries in our area would be made to the Platte, Arkansas, Canadian, Rio Grande and Pecos Rivers. Aqueducts would then deliver water to the states of New Mexico, Texas, Colorado, Kansas, Nebraska and Oklahoma. This study did not however, deal with the estimated cost, but only the project benefits.

Another project was one developed by R.W. Beck and Associates to divert water from the Missouri River below Fort Randall to the northwestern part of Nebraska. This would be done by the construction of eleven dams and lift stations along the northern side of Nebraska. Water would then be delivered through eastern Colorado, western Kansas, Oklahoma and Texas through 940 miles of canals. The estimated cost of this project in 1967 was 3 to 3.5 billion dollars.

The district does look at these studies with a great deal of interest, but unless the states themselves take enough interest to promote and push for a federal program of this type, the cost would be prohibitive. If at some time the importation of water does become a reality, this district would take an active roll in the distribution, allotment and water charges.

## VII. STANDARDS AND POLICIES

### A. Board of Directors

This district is operated by a board of directors, which is elected at each of its annual meetings. The terms are for a period of three years with not more than two members being elected any one year. There are five members on the WKGMD No.1 board. An attempt is made to select one member from each of the five counties included in the district. Among themselves they annually elect a president, vice president and secretary-treasurer.

## B. Development Policy

In an effort to control the development of the water resources in west central Kansas, the board of directors has proposed the following policy in the WKGMD No.1.

The approval of all applications for a permit to appropriate water for beneficial use from the Ogallala aquifer, except for domestic use, temporary and term permits, shall be subject to the following criteria.

1) The proposed appropriation, when added to the vested rights, certified rights, and prior appropriations shall not exceed the allowable safe-yield amount for the area under consideration within a two-mile radius (approximately 8,042 acres) of the proposed well.

The allowable safe yield amount shall be calculated using the formula:

AR

12

Where A is the area within the two mile circle or 8,042 acres.

Where R is the annual recharge rate of 0.5 inches per year.

$8042 \times 0.5 = 335$  acre feet

12

2) For the purpose of calculating the available water, all vested rights, certified water rights and prior rights shall be considered as fully used. If wells authorized under a vested right, certified water right or a permit to appropriate water are divided by the circumference of the radial area, the authorized quantity of water shall be assigned to each well. If specific quantities are not authorized for each well, a proportional amount shall be assigned to each well.

3) If part of the two-mile area falls outside of the WKGMD No.1 boundary, it shall be included in the depletion analysis. All areas where the Chief Engineer has determined no groundwater exist, will not be included in a depletion analysis.

4) The areas in which applications may be considered are those in which the total depletion since 1950 has been less than 15% of the 1950 saturated thickness, and the current saturated thickness is at least 40 feet.

5) The wells spacing requirement for wells which meet the depletion criteria, shall be a minimum of 2,640' from all wells, other than domestic. The well spacing from domestic wells shall be 1,320', unless a waiver of spacing requirement is granted by the Chief Engineer. A request for such a waiver includes a written statement from neighboring well owners indicating no objection to the reduced spacing. If the well is considered a battery as defined in section 5-5-1 (e) of the DWR Rules and Regulations, all wells in the battery must meet the spacing from domestic wells and other permitted wells as set forth above.

6) The relocation of a replacement well under an existing water right is limited to a 300-foot radius of the existing well, or not to exceed 1,320 feet from the originally authorized point of diversion, as long as the move does not violate the minimum spacing criteria, and is approved by the Chief Engineer. If the relocation is outside of the 300 foot radius and closer than 2,640 feet from a neighboring well, the actual distance between the wells must be maintained.

7) The WKGMD No.1 will review all applications which meet the above stated policy and may in addition, review applications on the basis of whether or not the application is in the public interest.

8) The board also adopts the policy that any well installed to divert water from the Dakota Formation must be at least two miles (10,560 feet) from any other well (other than domestic) located in the same formation, and constructed such that any over or underlying formations are sealed off from the water producing zone and no vertical migration of water between formations is allowed.

### C. Nonuse Policy

K.S.A. 82a-718 states that every water right of every kind shall be deemed abandoned and shall terminate when without due and sufficient cause no lawful, beneficial use is henceforth made of water under such right for five (5) successive years. The Division of Water Resources has further defined due and sufficient cause for nonuse of water in section 5-7-1 of their rules and regulations item (4). This section states that due and sufficient cause for non-use includes the instance when the purpose for which water is used is temporarily discontinued for a definite period of time to permit soil, moisture and water conservation. This must be documented by:

(A) furnishing to the chief engineer a copy of a contract showing that land which has been lawfully irrigated with a water right which has not been abandoned is enrolled in a multi-year federal or state conservation program which has been approved by the chief engineer:

(B) enrolling the water right in the water right conservation program pursuant to K.A.R. 5-7-4; or

(C) any other method acceptable to the chief engineer which can be adequately documented by the owner in advance.

The WKGMD No.1 promotes responsible management of groundwater supplies. In over appropriated areas the district encourages water right holders to enroll the water right in the water right conservation program if no water use is planned, preventing the termination of the water right for non-use. Over appropriated areas are defined as areas in which the groundwater levels are depleted in excess of fifteen (15) percent of the 1950 static water levels, the total saturated thickness is less than forty (40) feet, or the amount of water authorized exceeds the defined annual recharge as set forth in K.A.R. 5-3-11, which averages approximately .5 inches over the WKGMD No.1.

#### D. Metering Policy

All wells located within the boundary of the Western Kansas Groundwater Management District No.1 which withdraw water from any aquifer, other than domestic, shall be equipped with an acceptable metering device.

A representative of the district shall have the right to read the meter whenever deemed necessary. (Authorized by K.S.A. 1980 Supp.82a-1028(o); implementing K.S.A. 1980 Supp.82a-1029(1); effective May 1, 1981)

##### (a) In Line Flow Meter

An in line flow meter may be installed meeting the specifications of the Division of Water Resources for quality, type and installation standards. This is the preferred option since it is considered more reliable and accurate, particularly for wells which experience significant seasonal water table decline and non-uniform operating conditions during the season.

##### (b) Hour Meter

If the landowner believes the inline flow meter option is infeasible, they may request a waiver of the inline flow meter option and request to install an hour meter of acceptable specifications to the WKGMD No.1. If the District grants a waiver the landowner shall:

- 1) Install the hour meter on a stand or post adjacent to but separate from the pumping plant base. The wiring must be enclosed in conduit from the pumping plant to the hour meter. The hour meter must be enclosed in a weather proof box with cover, and wiring of 16 gauge installed from the meter to the pumping plant and all electrical connections associated with the proper function of the hour meter must be firmly attached.

- 2) Furnish to the WKGMD No.1 a certified test of the flow rate of the well. This test must

have been conducted under actual operating conditions of the project during one of the previous five pumping seasons. If these conditions differ significantly due to water table declines or different types of delivery systems, a flow rate measurement must be made under each condition.

The WKGMD No.1 will certify individuals capable of testing wells within the District. These certified testers will be required to attend a WKGMD No.1 approved testing program and furnish their own District approved test meter.

In GMD #1 the Chief Engineer shall not require a water flow meter on existing diversion works or delivery systems if the following 3 conditions are met:

the normal operating diversion rate is less than 200 gpm.

the diameter of the existing pipe is too large for the normal operating flow rate which results in the pipe flowing partially full or the existing diversion works and delivery system would not allow proper installation of an inline flow meter that would accurately measure flow rate.

the owner agrees in writing to notify the GMD #1 whenever the diversion works and or the delivery system, at the point of diversion, is modified and that they will install a water flow meter at that time unless a waiver is given by the Chief Engineer.

#### E. Sub-basin Delineation

The 2001 Kansas Water Authority report to the Governor and State Legislature recommended the development of state policy that serves to sustain the replenishable portions of the State's groundwater, provide transitional guidance when the groundwater starts to become exhausted, and delineates the Ogallala portion of the High Plains aquifer into subunits.

The Western Kansas Groundwater Management District No.1 has been directed by the Ogallala Aquifer Management Advisory Committee to develop an aquifer protocol to delineate the aquifer into aquifer sub-units. The purpose behind this is their feeling that the GMD's have focused mainly on conservation and education issues and need to develop a more sophisticated management approach. This committee and the Technical Advisory Committee were formed by the Kansas Water Office to provide options and recommendation to the Kansas Water Authority for inclusion into the State Water Plan.

This district was selected by the TAC as an area to test different approaches to delineate aquifer sub-units. It was the feeling of the TAC that a geo-statistical clustering method would provide the best data. A number of different clustering parameters were used ranging from five to fifteen. As a part of this District's protocol, this clustering methodology will be utilized.

As a first step in defining the protocol to be used in this district, we will work with the Kansas Geological Survey in determining which clustering definition will be used. It is anticipated that the clustering exercises will focus on current saturated thickness, current changes in the water table, and existing water right development (average reported use and authorized quantities). Other secondary data parameters may also be included such as the distribution of vested water right development and other aquifer characteristics. Once that has been done, sub-basins will be delineated based on similar hydrologic conditions. It is planned that this will be completed by November 2004. The results of the clustering analysis will be used by the District to define aquifer subunits of appropriate size to successfully implement enhanced and focused water management. The threshold values will be based on the amount of water remaining, the rates of decline, and the actual usage within the defined areas. A secondary consideration may be areas, which have difficulty providing domestic water needs.

The next step in this process will be to group these sub-basins into similar areas. The areas will be based on the premise of comparing the current amount of available water in storage, the rates of decline and the existing water demands as well as programs that may assist in the reduction of the consumptive use in the area. When completed, the Management Program of the district will be modified to reflect this information. This should be accomplished by early 2005. Once the areas have been designated, additional verification of data will need to be made prior to goals being established. One of the reasons for this is that the bedrock contours are made on fifty-foot intervals. This very easily could allow for a significant variation in our saturated thickness in areas of bedrock fluctuation. The accuracy of a measurement at a specific well for a specific point in time is highly accurate. The water table however, moves under the influence of atmospheric pressure, and continues to recover until the next pumping season. In addition, wells are pumped during the winter months, which tend to make finding the actual static water level very difficult. Because of this, we are using an average of three years to develop our data. There are also areas that no data is available.

After the verification of data has been completed, the board will hold public meetings in each of the designated areas to advise, listen and develop water use goals. Once the goals have been established, the Management Program will again have to be revised to include the programs selected. Some of the options to be discussed will include:

- a) Enforcement of the existing water appropriation act
- b) Water right buy-back or some other retirement program
- c) Mandatory flow meter requirement of all wells
- d) Intensive Groundwater Use Control Area, or some other special management option developed by the local stakeholders, to limit the consumptive use
- e) Assistance in the transition to dryland farming

#### f) Tax incentive programs

It is anticipated that this might be accomplished in 2006 unless additional time is required

to verify aquifer data. Once the goals have been selected and the data verified the board should be able to begin the implementation process. One of the primary concerns will be the socioeconomic impact this program will have on these areas. Quick action to reduce groundwater withdrawals could have a devastating effect on the local economy as well as the tax base of the area. In the alternative, doing nothing could also be detrimental, however at a slower pace. The social-economic impacts of the enhanced water management options will be compared for each area. At some point in time, a water budget needs to be developed to see if we are achieving our goals.

It should be kept in mind that as the information changes or is updated, the priorities may change as well as the time frames for completion.

#### F. Battery of Wells

Within the boundaries of the WKGMD No.1, a new application or an application for a change of point of diversion from one well to a battery of wells shall not be approved unless the application meets the following criteria:

- (a) it is a "battery of wells" as defined in K.A.R. 5-1-1(e);
- (b) that if the change application has been filed pursuant to an appropriation right, the certificate shall be issued prior to approval of the change application;
- (c) that the maximum annual quantity and maximum instantaneous diversion rate approved shall not exceed the maximum annual quantity and the maximum instantaneous diversion rate actual used during any one of the three consecutive full calendar years prior to the application; and
- (d) the application meets the district's criteria for safe yield and that all wells in the battery meet the minimum spacing from all other wells

#### G. 15 Acre Foot Exemption

In any area of the WKGMD No.1 which is not closed by regulation or an intensive groundwater control area order by the Chief Engineer to new non-domestic, non-temporary permits and term permits for five years or less, applications to appropriate groundwater must meet the following criteria;

- (1) the sum of the annual quantity requested by the proposed appropriation and the total annual quantities authorized by prior permits allowed because of an exemption pursuant

to this requirement does not exceed 15 acre feet in a 1/2 mile radius surrounding the proposed point of diversion;

(2) well spacing in the area have been met;

(3) the approval of the application does not authorize and additional quantity of water out of an existing authorized well with a non-domestic permit or water right, which would result in a total combined annual quantity of water authorized from that well in excess of 15 acre feet; and

(4) all other criteria for processing a new application to appropriate water at that location have been met.

Exceptions to this regulation may be granted on an individual basis by recommendation by the board in conjunction with the approval of the Chief Engineer. The applicant may be required by the board to submit information necessary in order to make the determination.

#### H. Tailwater Control

In an effort to control and prevent wastage of water, WKGMD No.1 has established regulation 5-21-2, which states in part "No water user shall allow water which is pumped or diverted from any aquifer to leave the land under the water user's direct supervision and control."

The policy of WKGMD No.1 to enforce this regulation is to allow an investigation to be conducted by a staff member. If a violation is occurring, a letter is sent to the water user informing him of the violation and requesting some corrective action be taken. The district follows this procedure for the first two times a complaint is made or received. The third time a complaint is received, the board member from the county the violation is originating and a staff member both investigate the complaint. At that time, all of the information collected to date is submitted to the districts attorney for the filing of a petition for a permanent injunction.

#### I. Records Inspection

The official custodian of the WKGMD No.1 records shall be the manager of the district. Records shall be open for inspection during regular business hours of 8:00 a.m. to 5:00 p.m. Monday through Friday except for state holidays and at other times the staff may be required to close. An hourly charge may be made for computer time and staff time needed to produce, supervise the inspection of and the replacement of records.

### VIII. MANAGEMENT OPERATIONS

#### a. headquarters and Staff

The WKGMD No.1 headquarters is located in Scott City, Kansas. It is operated by a staff of the district manager, administrative assistant, technicians, chief pilot and our project manager/meteorologist which is headquartered in the project office in Lakin. In addition to this staff, the district also contracts for pilots to fly in our weather modification program.

### IX. DISTRICT PROJECTS

#### A. Water Level Monitoring

Annual water level measurements are taken each year through a cooperative program between the Division of Water Resources, U.S. Geological Survey and the Kansas Geological Survey. From this information, maps of WKGMD No.1 are developed to determine both the percent decline in our groundwater levels and the remaining saturated thickness. If there has been a significant change during the past years, new maps are adopted by the board for use in the management operations of the district. The district in addition to this, measures select wells each year at the request of the landowners to provide them with their individual information.

#### B. Demonstration Programs

The WKGMD No.1 sponsored a cooperative program in 1976 through 1978 between Kansas State University; the U.S. Geological Survey and local water users in a concentrated water management program. A great deal of information was obtained in this program and published by the U.S.G.S. in three reports. U.S.G.S. Water Resources Investigations 79-105, 80-39 and 80-91. One of the more interesting items learned in this program was the higher than expected efficiency level of the application of water and their concern for improved water management techniques.

The area which was selected represented an average saturated thickness for the district and was located in Northeast Wichita County. All wells were metered and select fields were equipped with soil moisture monitoring equipment to determine when and how much water should be applied. Evapotranspiration studies were also conducted to show the water loss by different crops and to determine their water needs. Solar radiation measurements were taken daily in Scott City and furnished with the other necessary parameters to the evapotranspiration lab in Manhattan, Kansas. In addition to this, each well was monitored to determine the amount of energy per unit of water pumped and to find the efficiencies of each pumping system. At the conclusion of the two-year study, the U.S.G.S. conducted an aquifer-modeling program to show the effects of pumpage as well as the longevity of the aquifer under differing management schemes. There were five different management plans used in the modeling of the study area. These included reducing the withdrawal in half as well as allowing an increase in pumping.

This data is available upon request of the district office.

### C. Pilot Recharge Projects

One of the programs which WKGMD No.1 initiated when it was formed was to attempt to artificially increase the recharge rates in specific areas throughout the district.

This program was initiated on both dryland and irrigated land in the district. After several years of monitoring both surface flows, and groundwater levels, it was found that recharge quantities could be improved if a sufficient quantity of water was available.

In 1981, the WKGMD No.1 began a pilot recharge project in conjunction with the Kansas Water Office to attempt to determine what kind of structures would be the best suited, as well as what impact these structures would have on our groundwater resources. Each of the five groundwater districts constructed different types of systems to evaluate their impacts. This district constructed an earthen fill structure and contracted with the U.S.G.S. for the instrumentation. It was found that the earthen fill structure was probably the most cost effective method of recharge. Relatively large amounts of water can be recharged into the aquifer with a properly constructed facility, but in west-central Kansas, the main limiting factor is the availability of surface runoff water.

### D. Western Kansas Weather Modification Program

Another program which WKGMD No.1 sponsors is an operational weather modification program. This program was initiated in 1975 in an attempt to increase the natural rainfall and reduce crop-damaging hail in Western Kansas during the growing season. After following the experimental work, which was done in the early 70's in Northwest Kansas, it was the feeling of the district that we could perhaps reduce the stress being imposed on our groundwater resources. This program has been conducted each year since that time. Due to the interest received from other counties, this program has enlarged to include most all of Southwest Kansas. The original headquarters for the program is located at the Kearny county airport in Lakin, Kansas, where the project manager/meteorologist and radar are located. Effective in 1997, the program has again enlarged to include a portion of an additional nine counties in Northwest Kansas located within the boundary of the Northwest Kansas Groundwater Management District No.4. A second radar facility was installed at the municipal airport in Colby, Kansas to service this area. In 2001, the target area was again changed back to the original area in west central and southwest Kansas.

In 1994 the Kansas Water Office conducted an evaluation to see what effects could be found from this program. In comparing six counties, which had continuously participated in the program each year, and eight counties in Northwest Kansas, which had never been involved in seeding, they found a twenty seven (27) percent reduction in crop damaging hail. Since 1987, when the seeding agent was modified, they found hail reductions approaching fifty (50) percent. The analysis for rain increase was unable to

show any positive results. Because of their findings, a position paper was developed to include weather modification in the Kansas Water Plan. This then provided an avenue to secure a limited amount of funding from the Kansas Water Plan Fund. It made available an additional ten thousand dollars for each of the approved counties if they participated in the program. In addition, the Kansas Water Office will also match any funding for the program which is paid by the WKGMD No.1 as long as matching funds are available.

Seeding at cloud base is conducted for both rain increase and hail suppression by injecting silver iodide into the cloud updrafts. The on-top aircraft is utilized to inject carbon dioxide (dry ice) into the tops of the building cloud turrets. Both of these seeding agents are effective when the cloud temperature is 32 degrees Fahrenheit or colder. Introduction of such materials into the supercooled region of the cumulus formation causes the liquid cloud droplets to freeze. With millions of repetitions of this freezing action in the cloud, a great amount of heat is produced. This heat of fusion makes the cloud more buoyant, thrusting it higher, helping it grow larger and enabling it to produce more rain for a longer period than it would have without seeding.

Hail is formed in massive cumulonimbus clouds, which have particularly strong updrafts. Since these "hailers" are cold clouds, attempts to suppress hail involve introducing somewhat larger quantities of silver iodide and carbon dioxide into specific areas within these clouds. The addition of these artificial freezing nuclei increases the competition for available supercooled cloud droplets within the cloud. As a result, the hailstones cannot grow very large because their growth depends upon availability of liquid water. If the hailstones are small enough, they will have time to melt as they fall from cloud to ground level.

Several evaluations have been conducted on this program throughout the years. The first evaluation was conducted by Colorado International Corporation of Boulder, Colorado. Their limited work indicated that the program was achieving its objectives of reducing hail and increasing rainfall. The second evaluation was conducted by the Illinois Department of Energy and Natural Resources for the National Science Foundation. This evaluation covered the period of 1975 to 1979. The evaluation was done to determine what techniques should be utilized in evaluating a weather program. The results of our program were compared with the evaluation of a Texas program and showed a significant reduction in hail of 48%, based on the hail insurance loss/cost values. The third evaluation conducted on this program was done by the Bureau of Reclamation, Engineering and Research Center. Their final report indicated, "The absence of any significant effect on seasonal rainfall is in agreement with a study of the Kansas project by Hsu and Chen (Illinois Department of Energy and Natural Resources), using data through 1979. The results are not in conflict with the findings by Huff et al. that seeding may have caused small rainfall increases on days when seeding was conducted primarily to stimulate rainfall rather than to suppress hail. The natural variability of rainfall from large storms, some of which were seeded for hail suppression, could easily mask changes in rainfall from smaller storms seeded to stimulate rainfall". The evaluation further states that "The suggestion that seeding may have led to

decreases in hail damage in the eastern part of the target area of as much as 50 percent is in line with Hsu and Chen and with analyses of several other hail suppression programs in the Great Plains". An evaluation was later conducted by Emporia State University on the rain increase phase of the program. They found an eleven percent increase in rainfall in the target area.

As was mentioned above, the newest evaluation was the one completed by the Kansas Water Office in 1994. Because of these evaluations, it is the districts feelings that the program is indeed obtaining our goals and objectives. This has now been increased by the recent evaluation done for the U.S. Air Force Research Laboratory on tornado prevention as stated above.

#### E. Well Measurement Program

The WKGMD No.1 also has a program to assist the water users in our district in the better use and management of our water resources. This program includes technical assistance to conduct well discharge measurements on individual wells. These measurements are generally done after the wells have been pumped for a period of time to allow for the drawdown of the water in the well. With the knowledge of precisely how much water the user has to work with, an improved irrigation management plan can be developed. In addition to this, the district also offers assistance in the determination of static groundwater levels. This program is conducted during the early part of the year when our groundwater levels are relatively stabilized.

#### F. Soil Moisture Monitoring Program

Since the conclusion of the WKGMD No.1's demonstration program, the district has offered assistance to water users in the installation and use of soil moisture monitoring equipment. This gives the water user the capability to schedule irrigation applications based more closely on the needs of the crops. This program has not been very widely accepted during recent times.

#### G. Water Quality Monitoring

In order to keep aware of the groundwater quality throughout the WKGMD No.1, a network of wells should be established to monitor water quality. These wells should be located in areas where there might be a threat of possible pollution. An agreement has been made with a private laboratory to conduct the water analysis. Results of this analysis will be made public through the districts newsletters. Another concern throughout the district is the elevated nitrate levels. Some think this is due to stockwater pollution ponds not being required to be sealed, but rather to allow 1/4 inch per day infiltration. Through an agreement with the Kansas Department of Health and Environment, any problem areas will be reported directly to them. Other water quality problems include leaking underground fuel storage tanks and grain fumigants coming in contact with the public water supplies. This has occurred in almost every community in the district.

## H. Well Location Program

In the past the WKGMD No.1 has had a cooperative program with the U.S.G.S. to survey the well locations throughout the district. For the past several years the WKGMD No.1 has begun surveying the well locations ourselves to determine the wells, which we considered being active and those which appeared abandoned. We also have been looking at each meter installation, whether it is an hour meter or flow meter, to insure that the water users have complied with the meter program. The compliance has been extremely good and the most recent survey data is still being compiled. The principal work remaining are the discharge measurements on each well equipped with an hour meter. These are to be completed every five years. An effort is made to test these wells late in the pumping season or after the wells have been used fairly extensively to obtain as reasonable a test as possible. We do not conduct tests on wells which have just recently began pumping.