



# Rattlesnake Creek Partnership

**Second Four-Year Review of  
Management Program  
2005 - 2008**

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Basin Management Team

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**Table of Contents**

**I. Introduction ..... 3**

**II. Four-Year Evaluation of Management Program ..... 3**

    A. Precipitation..... 4

    B. Streamflow ..... 6

        January 10-Year Rolling Average of 25 cfs:..... 6

        Minimum Desirable Streamflow (MDS) at the Zenith Streamflow Gage..... 7

    C. Groundwater Level Trends ..... 8

    D. Water Use ..... 10

        Stream Corridor Area ..... 10

        Groundwater Management Area ..... 11

        Basinwide Area ..... 12

**III. Management Strategies..... 14**

    A. Water Transition Assistance Program ..... 14

        Other Purchase Programs ..... 14

    B. Water Banking ..... 14

    C. Flex Account ..... 15

    D. Conservation Practices and Irrigation Management ..... 15

    E. Voluntary Removal of End Guns ..... 16

    F. Enhanced Enforcement and Compliance..... 17

    G. Water Appropriation Transfers ..... 18

    H. Mineral Intrusion Area-Replacement Wells ..... 18

    I. Augmentation..... 19

    J. Low Head Dams..... 19

**IV. Alternative Action Management Strategies ..... 19**

**V. Recommendations for meeting Next Four Years Goals ..... 20**

**VI. Summary ..... 21**

**Figures & Tables**

Figure 1: National Climatic Data Center Precipitation Stations ..... 5

Figure 2: Precipitation for the Rattlesnake Creek Subbasin 1939-2007 ..... 5

Figure 3: January Streamflow for USGS Zenith Gage ..... 6

Figure 4: Zenith Streamflow and MDS..... 7

Figure 5: Priority Areas and Monitoring Network..... 8

Figure 6: Average Water Level Change by Priority Area..... 10

Figure 7: Stream Corridor Groundwater Use..... 11

Figure 8: Groundwater Use for Groundwater Management Area ..... 12

Figure 9: Basinwide Area Groundwater Use ..... 13

Figure 10: Groundwater Use and Precipitation..... 13

Figure 11: Average Annual Zenith Streamflow vs. Precipitation 1974-2007..... 23

Figure 12: Net Change in Water Levels 2001-2008 ..... 23

Table 1: MDS values for Zenith gage (cfs)..... 7

Table 2: Average water level change by priority area ..... 9

Table 3: GMD No.5 End Gun Checks ..... 17

Table 4: Summary of Estimated Water Conservation (\*denotes short-term savings) ..... 22

Table 5: Change in water use by Priority Area..... 24

Table 6: Authorized quantities (acre-feet) ..... 24

Table 7: Summary of Progress..... 25

## **Abstract**

The Rattlesnake Creek Management Program is reviewed by the Rattlesnake Creek Partnership, consisting of the Groundwater Management District No. 5, Kansas Department of Agriculture – Division of Water Resources, United States Fish & Wildlife Service and Water Protection Association of Central Kansas. Data analyses shows streamflow objectives being met for the current 2005-2008 review period, yet a decreasing trend persists. Groundwater levels have increased throughout much of the subbasin over the current 2005 – 2008 review period, but have declined over a foot since the August 2000 implementation of the management program. Voluntary conservation programs are well short of their conservation goals and have seen little growth in participation.

## **I. Introduction**

In 1993, the Rattlesnake Creek Subbasin Partnership formed to cooperatively develop and implement water resource solutions. The partners agreed to use a community involvement approach as the guiding principle to address the water resource concerns within the subbasin. The Partnership includes Big Bend Groundwater Management District No. 5 (GMD No. 5), Water Protection Association of Central Kansas (Water PACK), Kansas Department of Agriculture-Division of Water Resources (KDA-DWR) and the U.S. Fish and Wildlife Service (USFWS), with a Cooperative Agreement signed June 1994.

The management program is intended to reduce the total amount of water used in the subbasin through methods outlined in the management program, particularly in identified priority areas. The management program addresses water resource solutions for both the short and long-term. Active participation by water users in the subbasin is essential to achieving the objectives of reducing water use in the area.

In July 2000, the chief engineer of the Division of Water Resources approved the management program. A start date of August 1, 2000 benchmarks the beginning of a 12-year implementation schedule for the management program. The management program calls for a review of the management strategies every four years. The first review was completed in August, 2004. At that time an addendum, listing programs that the Partnership wanted to focus on in the next four years, was attached to the review. These programs included end gun removal, irrigation transition assistance program (now Water Transition Assistance Program), the promotion of tillage practices to conserve water, the Environmental Quality Incentive Program (EQIP), a conservation credit point system for irrigators, and also the amendment of the Flex Account Program.

This report focuses on the second four-year review. It includes the data analyzed and the results of those analyses. It also includes a review of the various voluntary management techniques used throughout the subbasin.

## **II. Four-Year Evaluation of Management Program**

The management program outlines the process for evaluation and for the review and evaluation conducted at least every 4 years (4, 8 and 12 years). Each four-year evaluation provides an

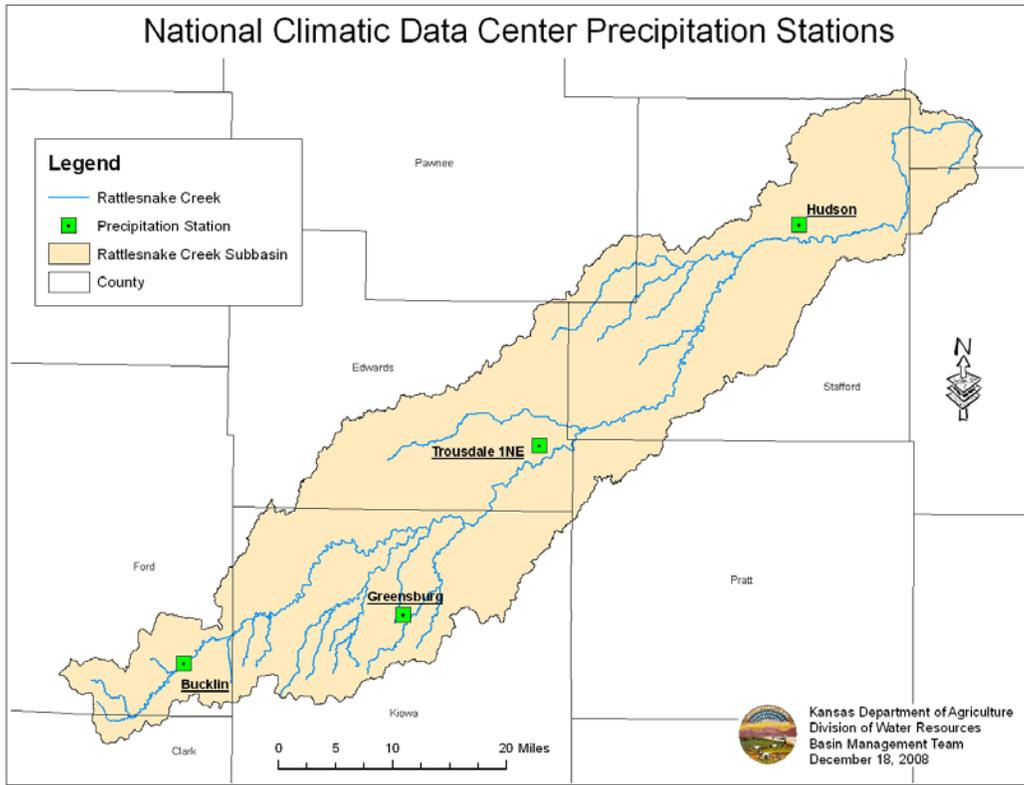
opportunity to determine the success of the new management program and allows for changes to the program to enhance the effectiveness. A review of each specific management strategy will occur to determine the effectiveness and if improvements are necessary to meet long-term goals.

Each four-year review evaluation is to include at least the following criteria (see referenced section of this document in parentheses that addresses each objective):

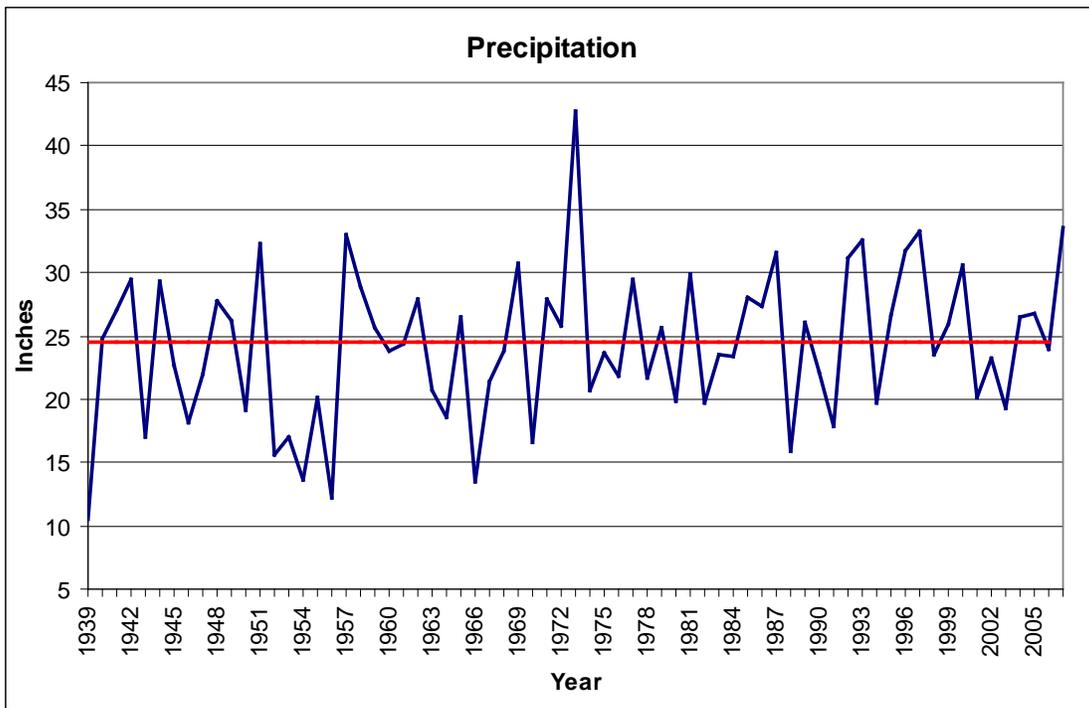
1. Determine if a January 10-year rolling average of 25 cubic feet per second (cfs) is achieved at the Zenith streamflow gage station (Section II B pgs. 6-7).
2. Evaluation of Minimum Desirable Streamflow (MDS) (Section II B pg. 8).
3. Achieve reduction of at least 4% in water use every four years with an objective of 12% by the end of the 12-year program in the Stream Corridor area (Section II D pgs.11-12).
4. Review of the 10-year rolling average annual water use and compare to target values outlined (Section II D pgs. 12-15).
5. Stabilize water levels in high decline areas (Section II C pgs. 12-13).
6. Stabilize water levels outside the groundwater priority areas (Section II C pgs. 13-14).
7. Review of each management strategy and compare to target values (Section IV pgs. 15-21):
  - A. Water Rights Purchase Program
  - B. Water Banking
  - C. Flex Accounts
  - D. Conservation Practices and Irrigation Management
  - E. Voluntary Removal of End Guns
  - F. Enhanced Compliance and Enforcement Activities
  - G. Water Appropriation Transfers
  - H. Mineral Intrusion Area – Replacement Wells
  - I. Augmentation
  - J. Low Head Dams
  - K. Alternative Actions

## **A. Precipitation**

For this analysis, data is used from four weather stations in the National Climatic Data Center network. The four stations include Bucklin in Ford County, Greensburg in Kiowa County, Trousdale 1NE in Edwards County and Hudson in Stafford County (Figure 1). Precipitation in the Rattlesnake Creek Subbasin can have large annual variation. For example in 2006, the subbasin averaged 23.94 inches, but the following year the total average precipitation was 33.60 inches. Since 1949, the subbasin averages 24.48 inches per year. In 2005, the subbasin averaged 26.74 inches which is above the average. The following year (2006) the subbasin was about a half-inch (23.94 inches) under the average (24.48 inches). In 2007, the subbasin received over 33 inches in precipitation which is nine inches higher than the subbasin's average (Figure 2).



**Figure 1: National Climatic Data Center Precipitation Stations**



**Figure 2: Precipitation for the Rattlesnake Creek Subbasin 1939-2007**

## B. Streamflow

### January 10-Year Rolling Average of 25 cfs:

The management program establishes a goal to meet and maintain a 10-year rolling average of 25 cfs at the Zenith United States Geological Survey (USGS) streamflow gage during the month of January. Average January streamflow has declined since its peak in 1998. As a result, the 10-year rolling average has declined since 2002. Looking at the years under review, 2005 and 2006 each maintained very similar rolling averages above 25 cfs. The rolling average in 2005 was 31.2 cfs and the following year averaged 30.3 cfs. The year 2007 showed a drop in rolling average streamflow to 27.3 cfs, yet still above the goal. The rolling average dropped to 25.0 cfs in 2008 equal to the 25 cfs goal at the Zenith gage (Figure 3). The original Rattlesnake Management Program states, “By achieving 25 cfs on average during January at the Zenith gage, base flows should be restored to Rattlesnake Creek...If the average January streamflow reaches 25 cfs, the reduction in water use should be adjusted even if the amount of water use is not 29,284 acre-feet on average, as the streamflow is the goal and the change in water use is only a means to achieve it. Analysis of streamflow data should be used to evaluate whether the trend in streamflows has moved to a positive trend or not.” (4). As the data shows, the rolling 10-year average of 25 cfs goal has been met from 2000 through 2008; however, a positive trend has not been evident for the past seven years.

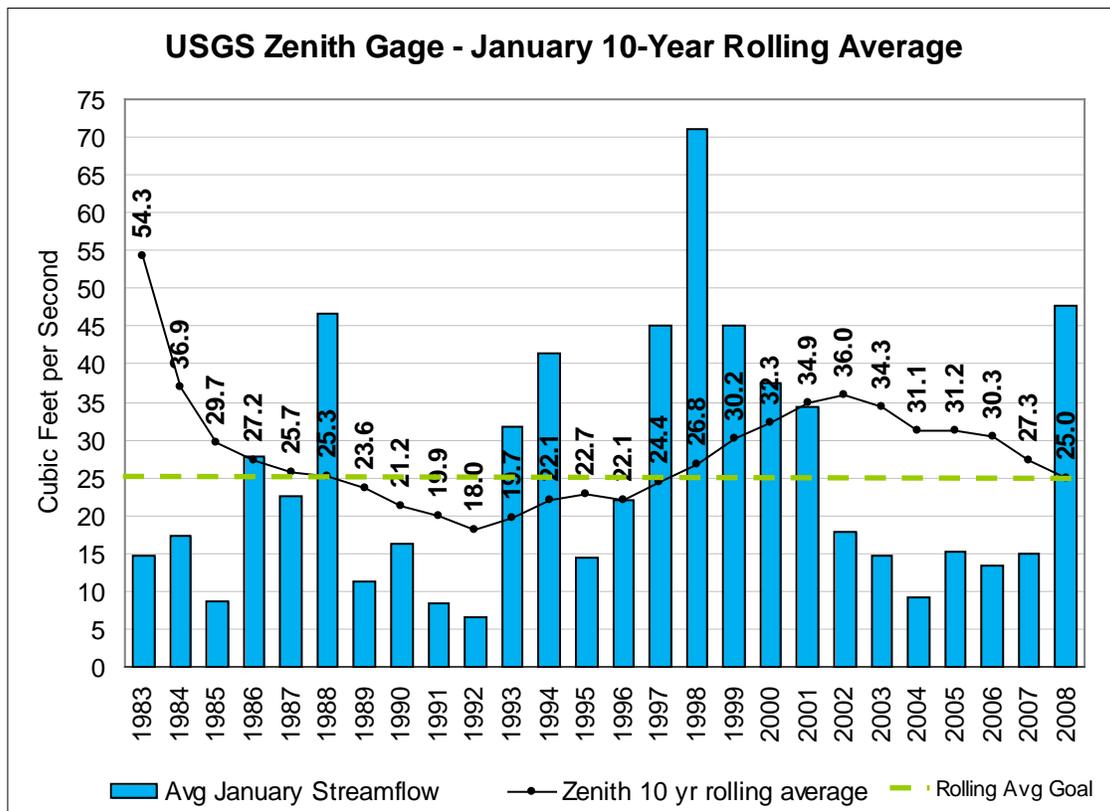


Figure 3: January Streamflow for USGS Zenith Gage

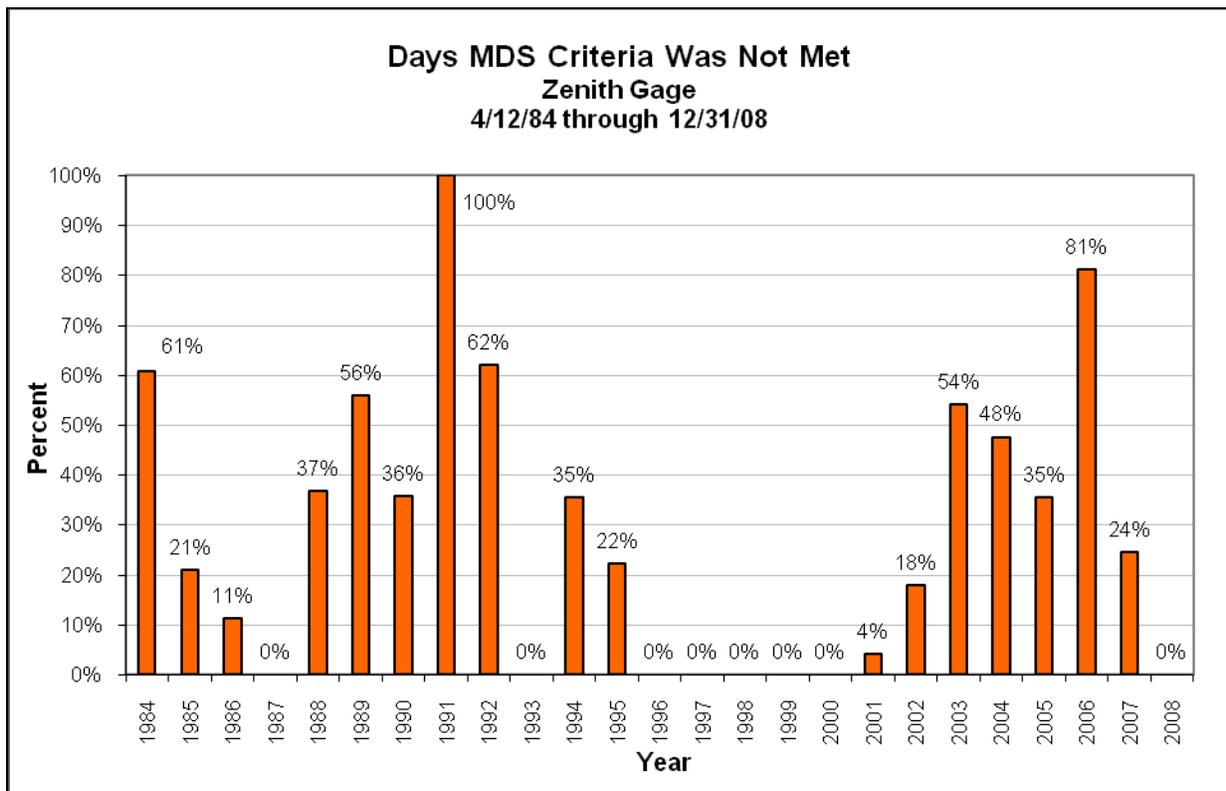
## Minimum Desirable Streamflow (MDS) at the Zenith Streamflow Gage

In 1984, the Kansas Legislature amended the Kansas Water Appropriation Act to include Minimum Desirable Streamflow (MDS). Once a streamflow gage station records streamflow for seven consecutive days below the MDS value set by the legislature, administration of water appropriations with a priority date after April 12, 1984 can begin and will not cease until the gage has recorded fourteen consecutive days above the MDS value. The chief engineer can prohibit the use of certain diversions for this period if they are affecting streamflow. The Zenith streamflow gage is a MDS gage station (Table 1).

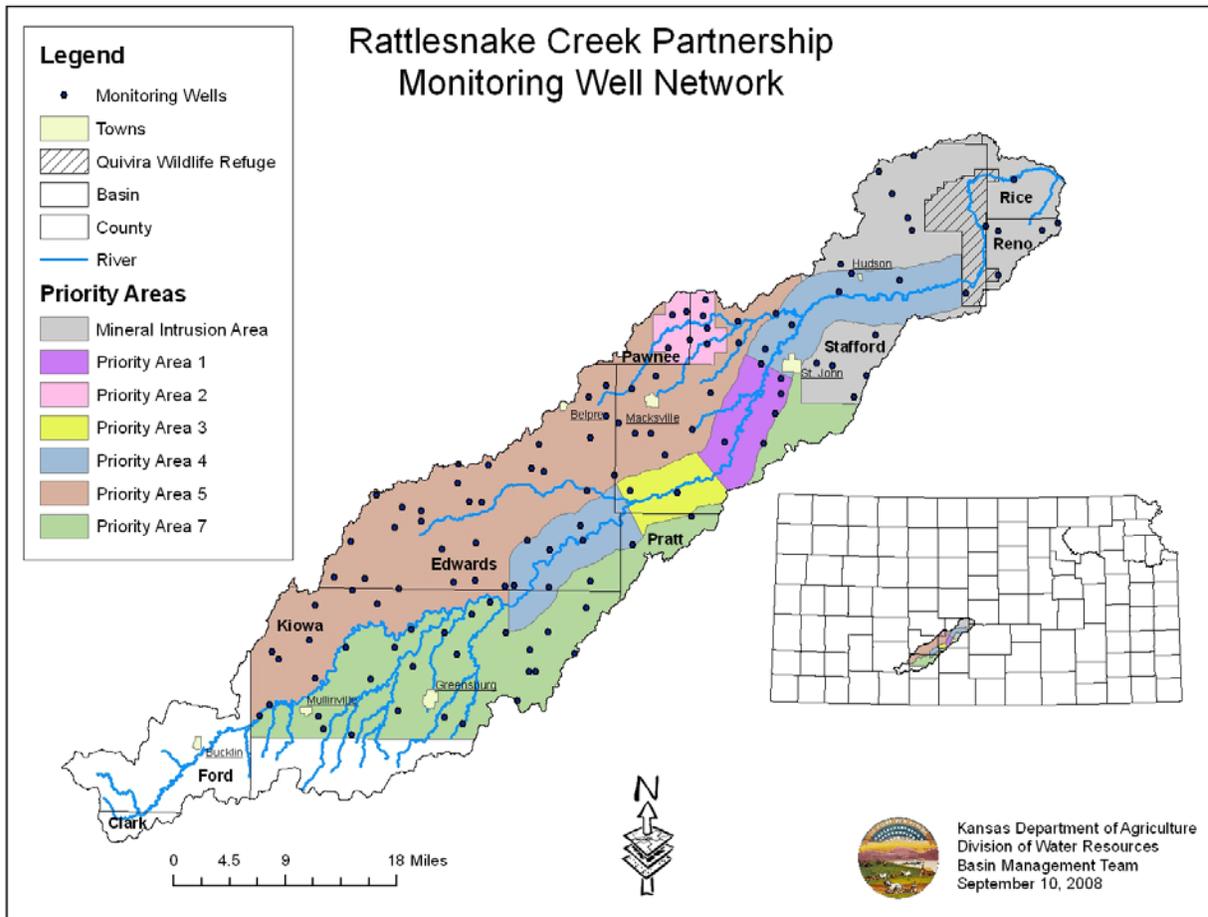
**Table 1: MDS values for Zenith gage (cfs)**

MO.	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
MDS	15	15	15	15	15	15	5	3	3	3	10	15

MDS has never been administered at the Zenith gage even though streamflow has fallen below MDS criterion. This is due to the complexity of the stream-aquifer interaction of the area making it difficult to determine which diversions would have a direct effect on streamflow. The above MDS criterion was not met at the Zenith streamflow gage for a period of time for each of the years under review except 2008. In 2005, the MDS criterion was not met 35% of the year. Over 80% of the year in 2006, MDS criterion was not met. The next year saw some improvements and the criterion was not met 24% of the year in 2007 (Figure 4). MDS has been met every day in 2008.



**Figure 4: Zenith Streamflow and MDS**



**Figure 5: Priority Areas and Monitoring Network**

### C. Groundwater Level Trends

Monitoring wells from all the priority areas are measured annually during winter (December, January and February). The wells are averaged for each priority area. Priority Area 4 was divided into a north and south (Figure 5). For the 2008 review, the GMD 5 transect wells were included. Many of the measurements for these wells did not begin until 2001 or 2002.

The basinwide groundwater average in 2005 showed an increase of 0.17 feet (Table 2). The following year showed little change, averaging an increase of 0.10 feet. In 2007, the basinwide average groundwater change showed less than 1.5 feet of declines. All the priority areas exhibited declines in 2007 with some of the areas over 2 feet including 4S (2.15 ft), 3 (2.09 ft) and MIA (2.17 ft). In 2008, all levels increased with Priority Area 2 increasing the most at 5.05 feet and Priority Area 7 increasing the least at 1.15 feet. Average increase for 2008 was 3.63 feet.

**Table 2: Average water level change by priority area**

Year	1	2	3	4N	4S	5	7	MIA	Average
# Wells	20	7	10	13	12	51	24	25	
1996	0.65	0.38	0.88	0.65	0.80	1.13	0.42	1.49	0.80
1997	0.50	-0.48	2.59	0.24	2.40	1.37	0.40	0.19	0.90
1998	0.25	-0.12	1.14	1.26	2.21	1.12	1.31	0.75	0.99
1999	0.18	0.32	-0.99	-0.51	-0.93	-0.70	0.25	0.56	-0.23
2000	-0.27	0.58	-1.11	-0.33	-0.95	-0.25	-0.54	-0.44	-0.42
2001	0.35	-0.50	0.33	-0.20	-0.44	-0.08	0.12	-0.88	-0.16
2002	-0.50	0.39	-1.34	-0.43	-1.65	-1.53	-0.40	-0.80	-0.78
2003	-0.95	-2.68	-0.97	-0.65	-2.62	-2.03	-2.01	-0.84	-1.59
2004	-1.19	-1.40	-1.59	-0.75	-2.02	-1.57	-1.36	-0.75	-1.33
2005	0.70	0.15	0.96	1.13	-1.12	-0.31	-0.89	0.75	0.17
2006	0.85	-0.35	0.81	-0.33	-0.36	-0.26	-0.22	0.69	0.10
2007	-0.90	-0.81	-2.09	-0.60	-2.15	-1.89	-1.19	-2.17	-1.47
2008	3.01	5.05	4.24	2.69	4.88	3.27	1.15	4.75	3.63
Net Change 2005-2008	3.65	4.04	3.92	2.89	1.25	0.81	-1.15	4.02	2.43
Net Change 2001-2008	1.37	-0.15	0.35	0.87	-5.48	-4.39	-4.80	0.76	-1.43

The first net change is a sum of the changes in water level for each year during this review period (2005-2008) in each priority area. Each of the eight priority areas had a positive net change from 2005-2008 except Priority Area 7. The Mineral Intrusion Area and Priority Area 2 showed the greatest increases of over four feet. The Mineral Intrusion Area showed positive changes during each year under review except 2007. Priority Areas 1 and 3 increased an average of more than three feet during the period of review. Priority Areas 4S and 5 have shown smaller increases while Priority Area 7 has shown an average decline of over one foot. Throughout the subbasin, during the current review period, the average net groundwater level change has been an increase of 2.43 feet.

The second net change is the sum of the changes in water level for the previous eight years (2001-2008). Priority Areas 1, 3, 4N, and the Mineral Intrusion Area have all ultimately increased in the last eight years. The Priority Area 1 has increased the most at 1.37 feet. Priority Areas 4S, 5 and 7 have all declined over 4 feet. The average change over the last eight years is a water level decline of 1.43 feet.

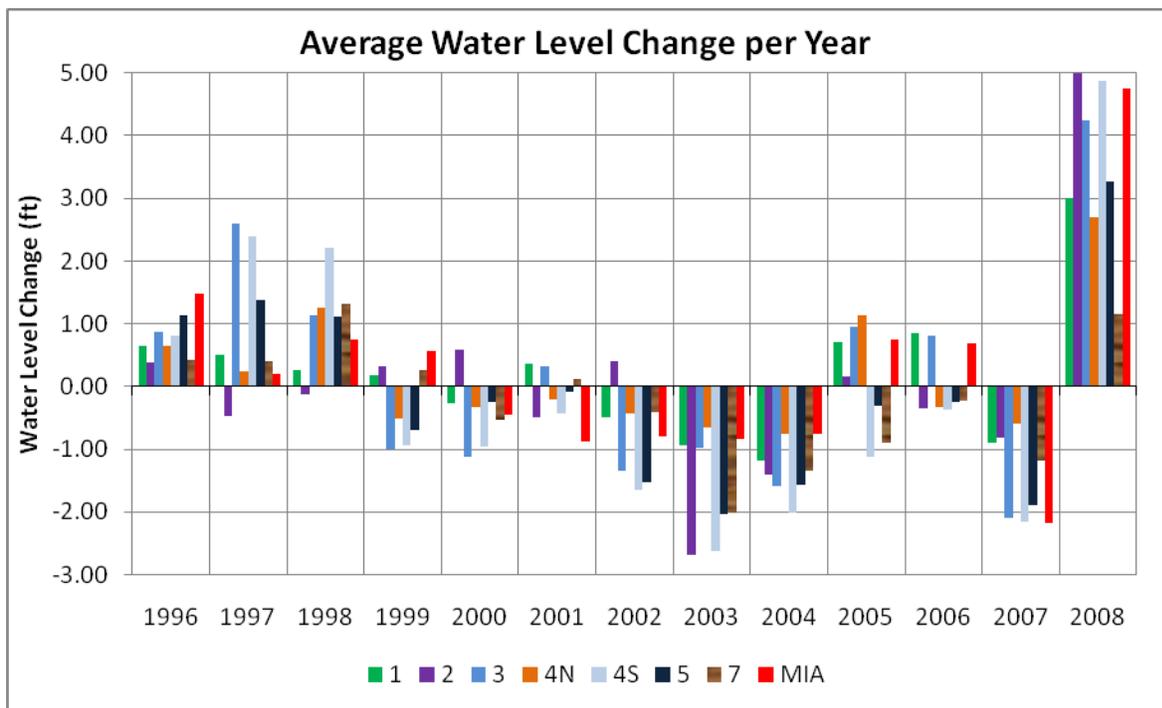


Figure 6: Average Water Level Change by Priority Area

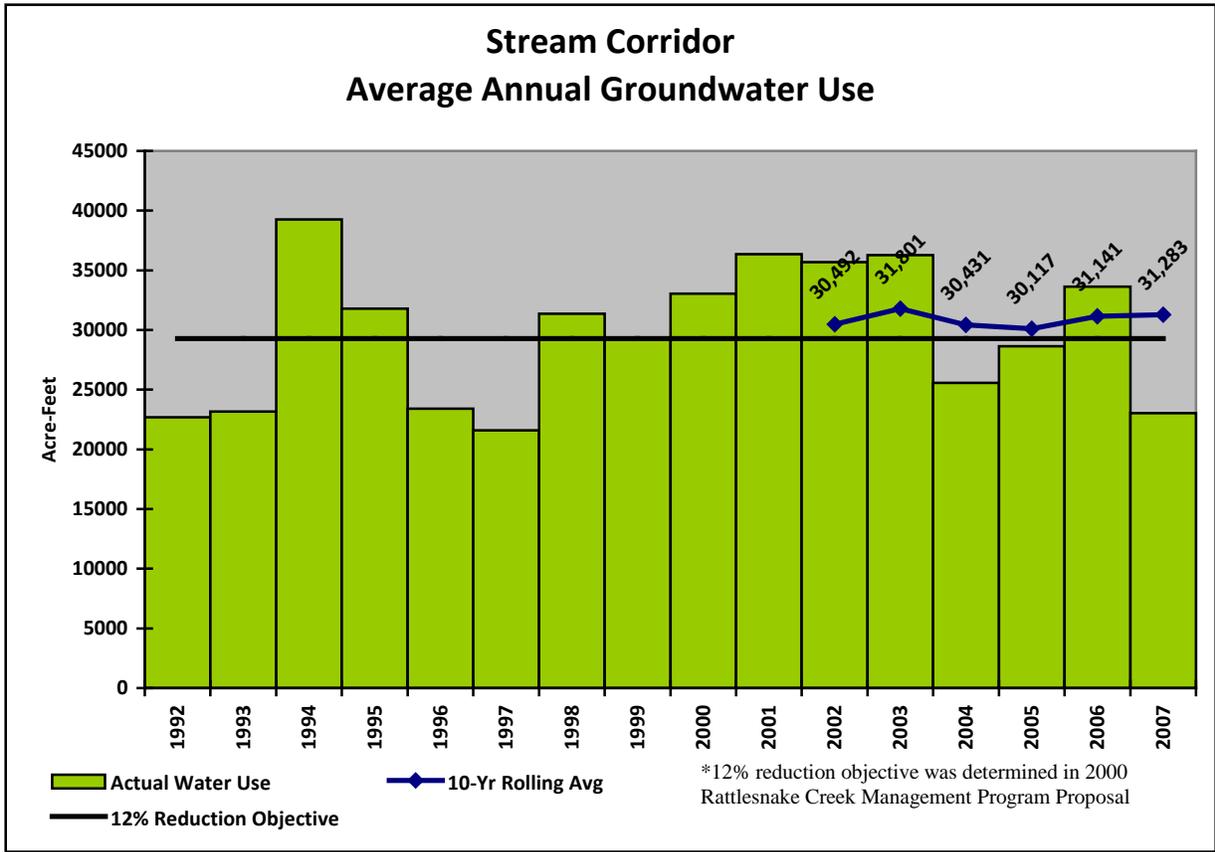
## D. Water Use

Water Use values and authorized quantities are an estimate based on the available information that the Kansas Department of Agriculture – Division of Water Resources has. These values could change over time. The analysis queried inactive water rights because they may have had use in the previous years.

### Stream Corridor Area

The Stream Corridor Area is described as a 4-mile wide zone, two miles on either side of the Rattlesnake Creek from the Quivira National Wildlife Refuge boundary where the Rattlesnake Creek enters the refuge to the west side of Section 10, Township 27 South, Range 17 West in Kiowa County (Figure 5). Section 10 line that extends north and south creates the cut off point for the upper end of the corridor area. This area was selected based on the hydrologic relationship to the stream. The division of the corridor into separate areas was for targeting water right purchase funds to higher priority areas.

The objective is to reduce average groundwater use within the corridor by 4% during each review period, totaling a 12% reduction by 2012. These numbers are based on the 1987-1996 base period average water use. The corridor consists of Priority Areas 1, 3 and 4. The 12% reduction objective was established in the 2000 Rattlesnake Creek Management Program Proposal and the Partnership agreed to set it at 29,284 acre-feet of groundwater use. This was calculated based on 72% average water use of the authorized quantity for the corridor. In a recent letter (January 2009), GMD No. 5 has requested that the Partnership continue to use the objectives and goals from the original proposal until the GMD No. 5 district-wide model is completed (December 2009). The 10-year rolling average was not met from 2005-2007. Water use data for 2008 was not available at the time of this analysis.



**Figure 7: Stream Corridor Groundwater Use**

Ten-year rolling average water use in 2005 was 30,117 acre-feet, 31,141 acre-feet in 2006 and 31,283 acre-feet in 2007. Over the last seven years, the rolling average water use in the stream corridor area has not dropped below the established objective. Average actual water use since the base period was 30,403 acre-feet.

**Groundwater Management Area**

The current management objective for groundwater use is to decrease use in both Priority Area 5 (formally known as 1<sup>st</sup> Groundwater Unit) and the High Decline Area (Priority Area 2) by 16% from the 1987-1996 average water use. The original Rattlesnake Creek Management Program also included the Mystery River area so this area’s water use was also included in the analysis.

From 1987-1996, in Groundwater Management Area, a 16% reduction in average groundwater use calculates to 84,996 acre-feet. The 10-year rolling average groundwater use in 2005 was 99,004 acre-feet. It rose to 102,873 acre-feet in 2006 and then increased again to 104,426 acre-feet in 2007. Since 1997, annual water use has exceeded the established objective (Figure 8). The 10-year rolling average was not met from 2005-2007. Water use for 2008 was not available at the time of this analysis.

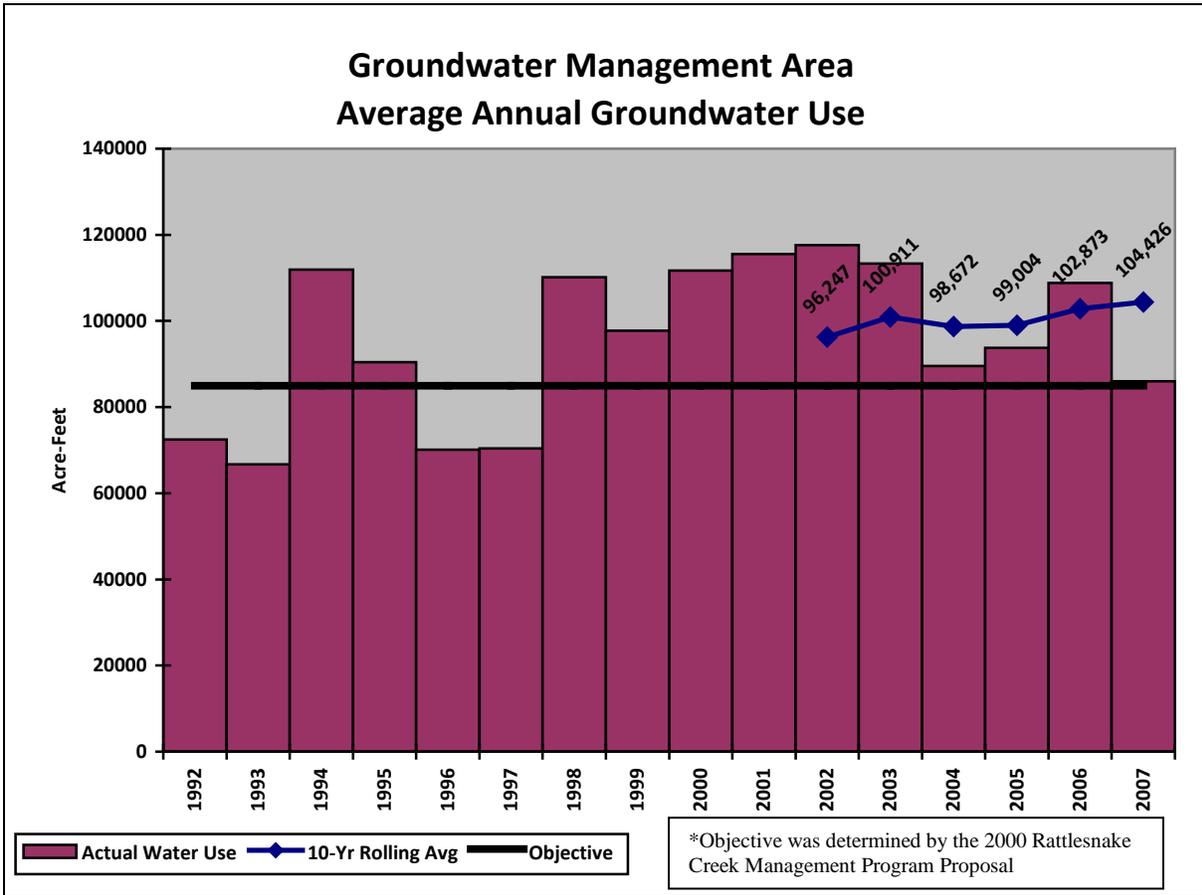


Figure 8: Groundwater Use for Groundwater Management Area

**Basinwide Area**

The basinwide area includes Priority Area 7 and the groundwater rights in the Mineral Intrusion Area. The 10-year rolling average water use for this area in 2005 was 48,302 acre-feet. It increased in 2006 and also in 2007 to a total of 54,388 acre-feet. The objective for this area is to achieve an annual groundwater use of 46,906 acre-feet as was established in the 2000 Rattlesnake Creek Management Program. The 10-year rolling average was not met from 2005-2007 (Figure 9).

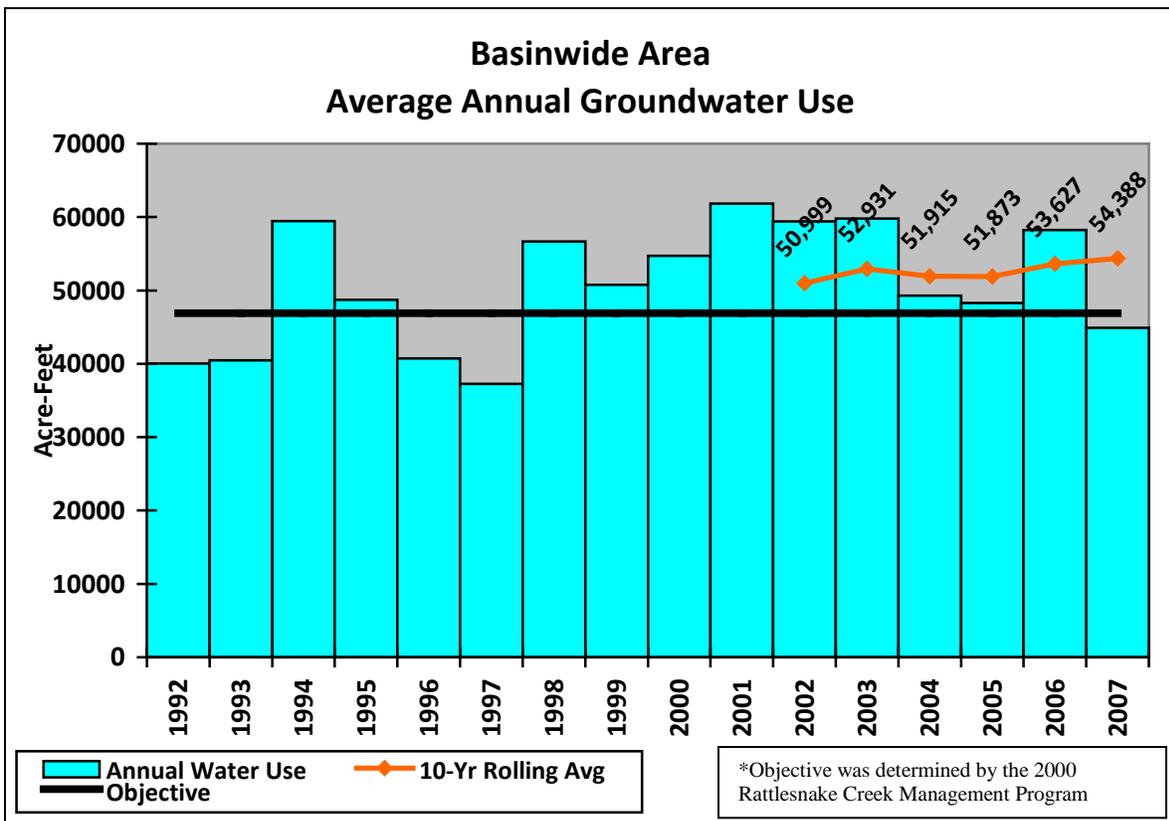


Figure 9: Basinwide Area Groundwater Use

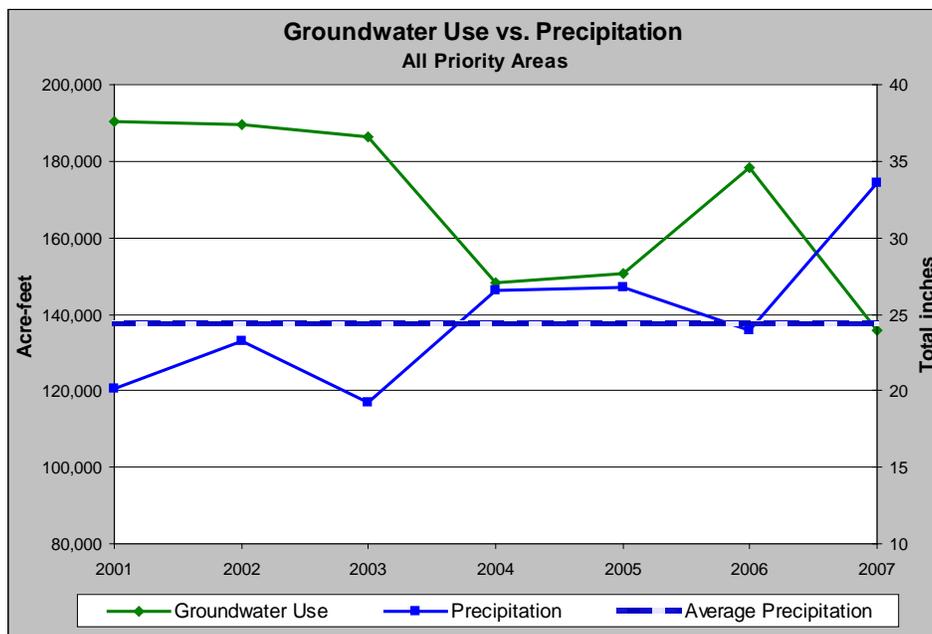


Figure 10: Groundwater Use and Precipitation

Figure 10 shows the relationship between groundwater use and precipitation. Rainfall was between five to nearly fifteen inches higher during the 2005-2007 second review period than the 2001-2004 first review period, contributing to the lower average water use seen during the second review period.

### **III. Management Strategies**

#### **A. Water Transition Assistance Program**

In 2006, the State Conservation Commission (SCC) implemented the Water Transition Assistance Pilot Project Program (WTAP) as a 5-year program. This project was designed to decrease historic consumptive use in designated high priority areas, including the Rattlesnake Creek Subbasin. The annual budget cannot exceed \$1.5 million dollars and is designed for farmers seeking incentives for permanent retirement of their water rights. WTAP offers the option of dryland farming after the water right retirement. Priority is given to the most senior water rights.

For fiscal year 2009, there are currently over 3 million dollars budgeted for the WTAP program.

One water right was enrolled in the Rattlesnake Creek Subbasin in 2007, the first year of enrollment. The authorized quantity of this right was 225 acre-feet. The SCC increased the purchase price for fiscal year 2009 to a fixed rate of \$2000 per acre-foot. Three applications, representing a combined 802 acre-feet, were received in the Rattlesnake Creek area and were approved. The current management goal is 7,396 acre-feet.

#### **Other Purchase Programs**

GMD No. 5 has independently purchased one water right in the Rattlesnake Creek Subbasin located in Priority Area 5. It was purchased in 2006 and was authorized for 195 acre-feet. The water right is currently enrolled in the Water Right Conservation Program (WRCP). GMD No. 5 is currently in the process of purchasing two water rights in Priority Area 4 North totaling an authorized quantity of 33 acre-feet. The GMD plans to place these rights in WRCP for a minimum of five to ten years.

#### **B. Water Banking**

The Kansas Legislature passed the Water Banking Act in 2001. The rules and regulations were adopted in 2004 with the Charter for the Central Kansas Water Bank following in 2005. The water bank is chartered for seven years until December 31, 2011. It comprises the entire Big Bend Groundwater Management District No. 5 and is administered from the District office.

The primary purpose of the groundwater bank is to allow a water user the ability to deposit all or part of their water right into the bank. Monetary compensation occurs when another water user leases the water. In addition, water users will be able to establish a safe deposit account that allows a carryover of a portion of annual unused water for use in later years. A representative past period of 1987 to 1996 will be used as a base for deposited and leased water use quantities. Attached to both the leases and deposits is a conservation component.

The goal of the water bank is to reduce water use in priority management areas. The rules and regulations of the Central Kansas Bank Charter require a minimum ten percent savings in consumptive use. The charter prevents the movement of water within two miles of the Rattlesnake Creek or to any area with over twenty feet of decline. A point system that allows for a potential 20% savings is approved to prevent potential impacts from the water bank program. Parameters used to determine the conservation component for each transaction are saturated thickness, sustainable yield and location in respect to the stream, and the amount of groundwater decline.

The Central Kansas Water Bank uses an online bulletin board system that allows water users the ability to post water available for deposit and lease. The review of banking operations will occur after five years of operation to determine if the program has positively affected the subbasin. Information about the Water Bank, as well as the bulletin board itself, is available at [http://www.gmd5.org/Water\\_Bank/](http://www.gmd5.org/Water_Bank/).

The chief engineer authorized the Central Kansas Water Bank in 2005. Total consumptive use was reduced by 20 acre-feet in the Rattlesnake Creek subbasin in 2006 and 24 acre-feet in 2008 through water bank deposits. This averages 22 acre-feet each year the bank has been available during this review.

The water savings goal for the current review period is 2,390 acre-feet.

### **C. Flex Account**

Flex Accounts were established after the adoption of the Rattlesnake Creek Management Program and replaces the Five-Year Water Rights Program. Flex Accounts (K.A.R. 5-16-1 through 5-16-7) aim to establish a voluntary water right management program that enables water users to manage their water rights in a manner which promotes conservation and efficiency, yet allows for crop demands in dry years.

Participants who file for and receive approval for a flex account receive a five-year term permit which deposits a maximum quantity of water authorized for diversion in five consecutive calendar years. The program adds the total actual water use for the period 1992 to 2002, divided by eleven, multiplied by 0.9 and then multiplied by five. The term permit includes a 10% conservation component reflected in the total authorized amount for the five-year period.

The goal for this four-year review is 953 acre-feet. At this time, there has currently been no enrollment in this program in the Rattlesnake Creek subbasin.

### **D. Conservation Practices and Irrigation Management**

The State Conservation Commission committed over \$34,000 to water conservation projects during the review period in the Rattlesnake Creek subbasin. With cost-share contributions, total allocations reach over \$68,000 for sprinkler re-nozzling projects. These projects were in cooperation with the Natural Resource Conservation Service.

The Rattlesnake Creek Subbasin has the opportunity to participate in the Environmental Quality Incentive Program (EQIP) in cooperation with the Natural Resource Conservation Service, GMD No. 5, State Conservation Commission, Kansas Water Office and the Kansas Department of Agriculture. The program sets aside irrigation land for a period of four years unless the water right is enrolled into the Water Rights Conservation Program for 5-10 years. The land can be dryland farmed. This conservation program is considered due and sufficient cause for non-use. Current enrollment will produce a savings of 449 acre-feet per year for the years of 2006, 2007, 2008 and 2009. Total savings equal 1,796 acre-feet. For this review period (excluding 2009) total savings is 1,347 acre-feet. Enrollment in EQIP is temporary. Over the next review period, EQIP savings will likely change.

U.S. Fish and Wildlife Service has removed over 60,000 trees that were consuming water, rehabilitated numerous water control structures to better manage available water, and cleaned out

canals and removed invasive cattails to allow better water delivery with less seepage and evapotranspiration loss.

The current management goal is 7,909 acre-feet.

## **E. Voluntary Removal of End Guns**

### **2000-2004**

On October 31, 2003, regulation K.A.R. 5-25-17 became effective. The regulation stated that participants who voluntarily removed the end guns from their center pivot irrigation systems would agree to permanently reduce their authorized quantity and authorized place of use, in exchange for a credit toward any reduction required by alternative management actions implemented in accordance with the Rattlesnake Creek Subbasin Management Program. Participation for this program expired March 31, 2004 with no enrollment. After the expiration of the regulation, the Division of Water Resources and the State Conservation Commission proposed to initiate a pilot program in the stream corridor area and made a proposal to the Groundwater Management District No. 5 in December 2004, but it was not accepted.

Potential water savings of 5,562 acre-feet was originally placed as a goal for this strategy. The goal was revised for the period 2004-2008 to 2,375 acre-feet; however the Partnership never agreed to this change.

### **2004-2008**

The GMD No. 5 Board discussed a mandatory removal of end guns but did not implement a program.

In 2007 and 2008, the Board reverted back to a voluntary direction. They proposed a program but decided not to proceed with an end gun removal program because proper incentives were not proposed for the irrigator.

Presently, the GMD No. 5 is not pursuing an end gun removal program in the Rattlesnake Creek Subbasin; however, the District has obtained information regarding end guns during 2006-2008 individual site inspections. The following table indicates the potential number of end guns removed in the Rattlesnake Creek Subbasin in Edwards, Kiowa and Stafford counties. With 43 total end guns removed, the District estimates potential of 421 acre-feet has been saved (43 end guns \* 7 acres/end gun \* 1.4 AF of water/acre used). It is unknown at this time whether the end guns on these systems were removed during the review period or if they ever had end guns, thereby truly accruing savings. The Partnership needs to work to determine a method to estimate the savings for end gun removal.

**Table 3: GMD No.5 End Gun Checks**

COUNTY	FILE NO	SEC	TWP	RNG		COUNTY	FILE NO	SEC	TWP	RNG
EDWARDS	25166	31	25	16		KIOWA	30812	36	27	20
EDWARDS	22359	3	25	17		KIOWA	18874	1	27	17
EDWARDS	29774	12	25	17		KIOWA	26751	4	27	18
EDWARDS	20113	17	25	17		KIOWA	30306	11	27	19
EDWARDS	30254	30	25	17		KIOWA	27736	21	27	19
EDWARDS	36989	28	25	18		KIOWA	20299	28	27	19
EDWARDS	34679	8	26	16		KIOWA	14145	31	27	19
EDWARDS	35429	18	26	16		KIOWA	30462	33	27	19
EDWARDS	18297	4	26	17		KIOWA	2598	24	27	20
EDWARDS	18297	4	26	17		KIOWA	18750	25	27	20
EDWARDS	36816	14	26	17		KIOWA	16842	32	27	20
EDWARDS	19422	18	26	17					Total Wells: 11	
EDWARDS	27609	4	26	18						
EDWARDS	25932	5	26	18		STAFFORD	39710	6	23	14
EDWARDS	36547	6	26	18		STAFFORD	24757	16	23	14
EDWARDS	24663	9	26	18		STAFFORD	33266	18	23	14
EDWARDS	13771	15	26	18		STAFFORD	19029	7	24	13
EDWARDS	23609	15	26	18		STAFFORD	17828	25	24	13
EDWARDS	26473	31	26	18		STAFFORD	25859	8	24	14
EDWARDS	24993	9	26	19		STAFFORD	18924	9	24	14
EDWARDS	12844	21	26	19		STAFFORD	38727	16	24	14
EDWARDS	16778	21	26	19		STAFFORD	39049	18	24	14
			Total Wells: 22			STAFFORD	37526	18	24	14
									Total Wells: 10	

## **F. Enhanced Enforcement and Compliance**

The Division of Water Resources with some assistance from GMD No. 5 has enhanced the current compliance and enforcement efforts to ensure water right conditions are followed and that guidelines pertaining to the use of new management options are followed.

Even prior to the implementation of the management program, the ongoing efforts to conserve water through compliance with water rights conditions were quite good. Therefore, a relatively small quantity (927 acre-feet) of water was originally estimated for the strategy. The current goal for the period is 1,582 acre-feet. Beginning in 2000, DWR has included the Rattlesnake Creek Subbasin in its Blatant and Recurring Overpumping enforcement program (BRO).

For the previous review, DWR was multiplying BRO savings for each year of the review. For example, if one water right did not overpump 50 acre-feet in 2000, then the quantity was multiplied by 4 for the 4 year review. However, because all other analyses in these reviews are done in an annual format, (average annual water use) DWR considers a single year to be more representative of conservation for the BRO program in the subbasin.

From 2005 through 2007, a sum of 604 acre-feet of water is no longer being over pumped due to the enhanced presence of the BRO program. 2008 water use data was not available at the time of this analysis. For the first four-year Program Review, a total of 693 acre-feet of water is no

longer over pumped. The total water no longer over pumped is 1297 acre-feet. This is based on an average annual water use.

Also, the increased concentration of compliance inspections in the area has increased awareness of the monitoring efforts as well as the quantity of water savings. However, it is difficult to quantify water conservation due to these efforts.

## **G. Water Appropriation Transfers**

K.A.R. 5-25-18 allows water right holders within the Rattlesnake Creek Subbasin to move water rights or portions to other locations within the subbasin that are not experiencing major water level fluctuations. The purpose is to add flexibility in achieving the overall objective of the management program by allowing water rights to move from within the two-mile corridor and the high groundwater decline areas to other locations in the subbasin. An overall reduction in water use should take place. No water rights are allowed to move into the stream corridor, closer to the stream or into the high decline priority areas.

All proposed transfers greater than 2,640 feet shall be subject to the following review:

1. The average saturated thickness within the two-mile radius circle in which the proposed well will be located is greater than 40 feet as shown on the saturated thickness map adopted by K.A.R. 5-25-19.
2. The water levels within the two-mile radius circle surrounding the proposed well location have not declined in excess of 20 feet of the predevelopment water levels as referenced in the Kansas Geological Survey bulletins number 65, 80 and 88.
3. No authorization of other wells by the chief engineer located within a one-mile radius of the proposed well location under the provisions of this regulation.

The program implementation occurred in November 2003. Originally, a goal of 927 acre-feet was set for this strategy. The overall effectiveness of this strategy is in question as a reduction in water use would occur only at the point of the water right removed and increase where it was re-drilled.

During the period of review, two water rights have been moved from within the stream corridor and one from the high decline area to produce a savings of 30 acre-feet.

The current management goal for this program is 15 acre-feet.

## **H. Mineral Intrusion Area-Replacement Wells**

GMD No. 5 implemented this management strategy through a program designed to delineate wells withdrawing high chloride water and then recommend modifications to well replacement and construction when the wells are re-drilled. The results of the water quality monitoring survey were beneficial in reducing the intrusion of the highly mineralized water.

All water right holders of existing groundwater wells within the Mineral Intrusion Area located in the Rattlesnake Creek Subbasin east and north of the federal highways US-281 and US-50, respectively, were required to participate in this water quality monitoring survey.

Well sampling began in August 2001 to determine the potential effects of heavy seasonal ground water pumping. The survey included 87 water rights covering 84 points of diversion with 79 samples collected in August 2001.

Notification was sent to owners of nine water rights that exceeded the 300-mg/L chloride limits and that an observation well to bedrock (K.A.R. 5-25-10(a)) would need to be drilled before any change in point of diversion could be approved as required under K.A.R. 5-25-16.

In October 2003, District adopted regulation K.A.R. 5-25-16 to implement the requirements set forth in the Rattlesnake Creek Management Program. Since the last Management Program review, no wells have been tested for high chloride levels in the GMD No. 5 district. One observation well has been drilled due to an approval in change in point of diversion in this area and high chloride levels.

## **I. Augmentation**

GMD No. 5 investigated augmentation of streamflow by groundwater pumping into the stream. The District spent a considerable amount of time and money investigating the feasibility of the program. This project was tabled due to a lack of economic feasibility.

The Kansas Water Office (KWO) has recently stated that if the augmentation project proceeds, it recommends the purchase rather than lease of water rights to augment streamflow. It also suggests GMD No.5 be responsible for the operation of the program. KWO has estimated the quantity of water needed annually as 1,460 acre-feet. The total cost including water right purchase, construction cost, operation and maintenance for a 10-year project at \$5.9 million as estimated in 2006 by the KWO. No other progress has been made toward this program ([http://www.kwo.org/Reports%20&%20Publications/Rpt\\_Stream%20Flow%20Augmentation%20of%20the%20Rattlesnake%20Creek%20Basin\\_012506\\_cbg.pdf](http://www.kwo.org/Reports%20&%20Publications/Rpt_Stream%20Flow%20Augmentation%20of%20the%20Rattlesnake%20Creek%20Basin_012506_cbg.pdf)).

## **J. Low Head Dams**

A study completed in 1999 for the Quivira National Wildlife Refuge by Burns and McDonnell indicate recharge estimates of as much as 2,500 to 5,000 acre-feet per year by constructing a number of low head dams on the Wild Horse Creek, which is a tributary to the Rattlesnake Creek and overlies much of the area where declines occur. GMD No. 5 initiated action to secure grants to fund a pilot project (\$360,000) with the submission of grant application letters to several institutions. The District was unsuccessful in their first attempt, but would like to continue to explore potential grants for this pilot project and assess the feasibility.

During the current period of review, the District has not sought funds to develop this project.

## **IV. Alternative Action Management Strategies**

Originally, alternative action management strategies focused on the corridor and groundwater decline area. If the Partnership includes the entire subbasin, an evaluation would need to occur.

The following should be included if alternative action management strategies occur within the subbasin.

- Allow a water user that has two or more wells to have the opportunity to take the total required reduction from one or more wells.
- Allow a rotational reduction scheme which would reduce the economic impact of the reductions and increase flexibility for the water user.

## **V. Recommendations for meeting Next Four Years Goals**

### **(2009 – 2012)**

The Partnership acknowledges a need to address short-term and long-term water resource concerns in the Rattlesnake Creek Subbasin. The partnership agreed to build a hydrologic model as an additional resource for determining management within the subbasin. Members of the partnership actively participate in the Technical Advisory Committee (TAC) meetings. The TAC meetings provide an opportunity for the partners to stay involved in the modeling process and to also peer review the model so it is an accurate and reliable tool. The peer review also allows for all the partners to ‘buy-in’ to the results and in the future use the model for management options.

Groundwater modeling: The Partnership agrees that the proposed modeling efforts will be used to assess the management program and other possible management alternatives. USFWS has requested that the changes in land use and the recent changes in cropping patterns be incorporated into the modeling efforts. The modeling process will take approximately eighteen months to complete, July 2008 to December 2009.

The following were recommendations submitted by each partner how actions they would like to see occur over the next four years to ensure the 2012 goals are met. The listing of these recommendations does not mean all partners have agreed to take this particular course of action.

1. Big Bend GMD No. 5 plans to pursue programs that will reduce water use while protecting the local economies. Other projects will be considered.
2. USFWS recommends that the Division of Water Resources begins to determine whether an Intensive Groundwater Use Control Area will need to be implemented and the administrative actions that will be taken in order to ensure the groundwater use goals set for the management program will be met. Actions should be planned fully and ready to implement in 2012.
3. Division of Water Resources will continue to target the subbasin for enhanced compliance and enforcement. DWR plans to work closely with the GMD No. 5 in evaluating all options they have to manage their groundwater and surface water resources.

The following is a proposed timeline submitted by the Division of Water Resources chief engineer. Its intent is to provide a structure to ensure all partners remain engaged during the next four years and strive to meet the 2012 goals as outlined in the management program.

## 2012 Rattlesnake Creek Management Program Timeline

August 2008

- Partnership met to review the status of the Rattlesnake Creek Management Program.

October 2008

- First GMD No. 5 Model TAC meeting. These will be held approximately every 4-6 weeks until completion of model

June 2009

- Finalize 8-Year Review document

September 2009

- Begin reviewing Rattlesnake Creek management alternatives with Partnership regarding options for managing the groundwater within the subbasin.

December 2009

- Complete construction of GMD No. 5 groundwater model including the core scenarios runs
- Begin to run additional scenarios

January 2010- October 2010

- Evaluate changes needed in the Rattlesnake Creek Management Program based on model results (6-9 month process)
- Finalize the review of the Rattlesnake Creek management alternatives with Partnership
- Hold public meetings to present model results to the stakeholders, potential changes in management alternatives, and outline expected work over the following 6 months
- Partnership approve any changes made to Rattlesnake Creek Management Program

October 2010- December 2010

- Take necessary actions to implement any changes to the Rattlesnake Creek Management Program that are needed to meet the 2012 goals of stabilizing groundwater levels and streamflow.

January 2011

- If determined that action is necessary and none is taken by GMD No. 5, KDA-DWR will meet with Board to outline the course of action it believes necessary to achieve the Rattlesnake Creek Management Program goals

August 2012

- Hold 12-Year Review to evaluate if the Rattlesnake Creek goals were met

## VI. Summary

The total authorized quantity of the Rattlesnake Creek Priority Areas has decreased by 178 acre-feet since the first four-year review in 2004. Although the GMD5 closed the Rattlesnake Subbasin to new appropriations in 1990, some areas increased in total authorized quantity. This closure did not include 15-acre feet permits. However, a one-year processing suspension was

placed on 15 acre-feet permits applied for in GMD5, including the Rattlesnake Creek, on April 23, 2008. In addition, two stock watering rights have been certified during this review due to a grandfather clause. These water right owners proved beneficial stock watering had taken place during the time when stock watering did not require a permit, before 1985. Also, one water right was inadvertently omitted in the previous analysis.

Participation in water saving management strategies has increased such as the Water Transition Assistance Program, Water Banking, the Environmental Quality Incentive Program, and Water Right Transfers. The Division of Water Resources has continued to enforce overpumping with the Blatant and Recurring Overpumping Program. GMD No. 5 has contributed to the decline in water use by purchasing a water right in the subbasin and providing incentives for participation in EQIP. The Flex Account Program continues to have no participation.

**Table 4: Summary of Estimated Water Conservation (\*denotes short-term savings)**

Management Strategies	Estimated Water Conservation			
	2000-2004	2004-2008	Total Conservation	2012 GOAL
WTAP	0	225	225	7,396
Water Banking	0	22	22	2,390
Flex Account	0	0	0	953
Conservation/Irr. Management				
a. SCC & State Water Plan Cost-Share Projects	4408	0		
b. EQIP*	0	449	4857	7909
End Gun Removal	0	0	0	2375
Transfers	0	30	30	15
Comp. & Enforcement	693	604	1297	1582
GMD5 Water Right Purchases		228	228	No Goal
Totals	5101	1558	6659	<b>22,620</b>

Streamflows at the Zenith gage (Figure 3) have been sufficient to meet the goal of a 10-year rolling average of 25 cfs. However, the 2008 value is at 25 cfs, and streamflow will have to be significantly above 25 cfs in 2009 to keep the 10-year rolling average above the goal. Figure 11 shows the annual average streamflow at the Zenith USGS gage compared to annual precipitation. The Zenith gage was installed in 1974; therefore, all historic streamflow highs and lows cannot be evaluated. The average precipitation during 1974-2007 is 25.19 inches. In 2007, the subbasin received the most precipitation since 1974 with 33.60 inches. Streamflow improved but only to the third highest recorded streamflow at 91.71 cfs.

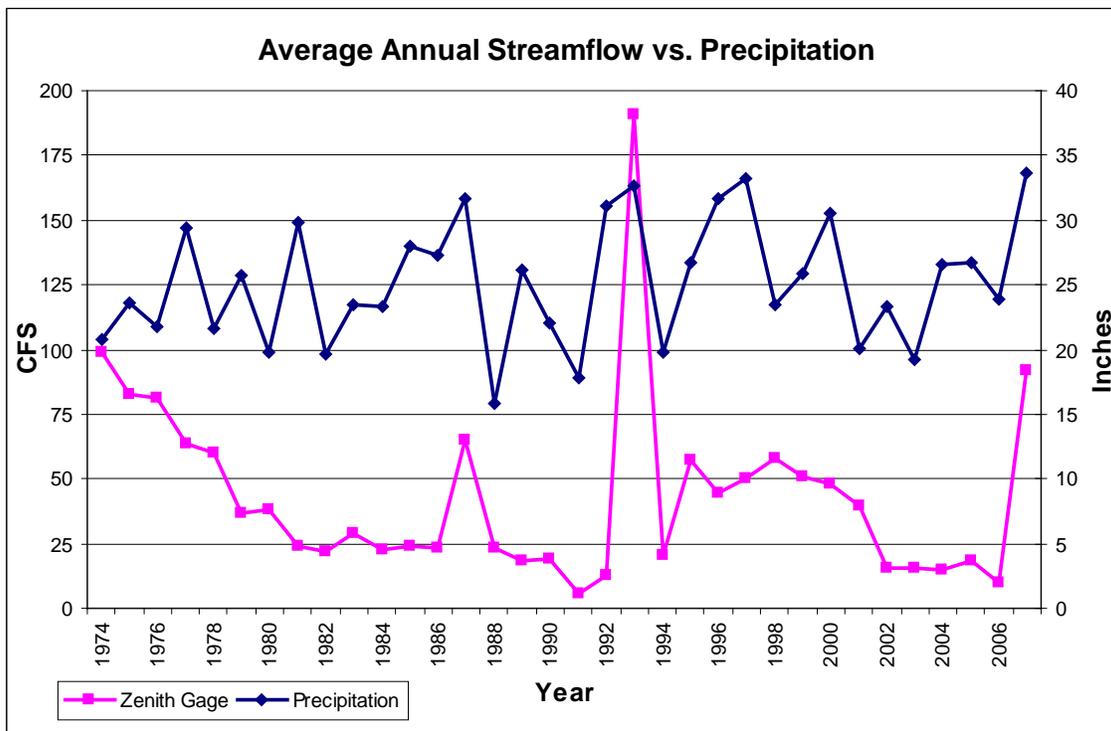


Figure 11: Average Annual Zenith Streamflow vs. Precipitation 1974-2007

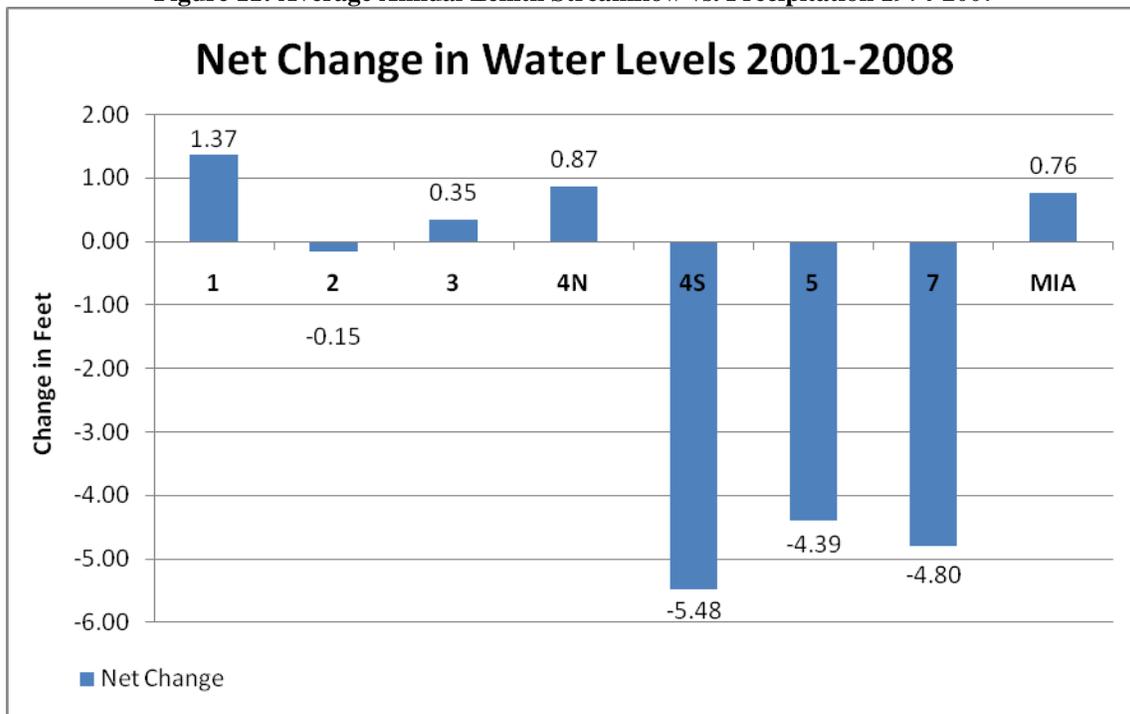


Figure 12: Net Change in Water Levels 2001-2008

Groundwater levels have averaged a positive change during the 2005-2008 period of over 2.4 feet, but have shown a net decline of over one foot for the period of 2001-2008. The biggest declines were in priority areas 4S, 5 and 7 (Figure 12). Priority Area 1 had the largest increase in water levels with 1.37 feet. Water levels in priority areas 3, 4N and the Mineral Intrusion Area also increased, but by less than a foot.

The following tables (Table 5 and Table 6) show water use and authorized quantities by priority area and changes in each from review period to review period.

**Table 5: Change in water use by Priority Area**

PRIORITY AREA	AVG. WU 1987-1996	4 YR. REVIEW 2001-2004	8 YR. REVIEW 2005-2007*	CHANGE 4YR TO 8 YR REVIEW
1		7,031	5,884	-1,152
2		5,335	4,900	-435
3		6,242	5,062	-1,180
4		20,190	17,254	-2,802
5		90,347	77,057	-11,918
7		49,468	43,059	-6,259
MIA		8,069	7,129	-940
Mystery River		13,317	12,819	-498
<b>Total</b>	<b>185,390</b>	<b>199,999</b>	<b>173,164</b>	<b>-26,835</b>

**Table 6: Authorized quantities (acre-feet)**

PRIORITY AREA	AQ 1 <sup>ST</sup> REVIEW	AQ 2 <sup>ND</sup> REVIEW	CHANGE
1	9,992	9,607	-385
2	7,528	7,381	-147
3	7,606	7,592	-14
4	25,200	25,009	-191
5	111,461	111,610	149
7	59,281	59,691	410
<b>Total</b>	<b>221,068</b>	<b>220,890</b>	<b>-178</b>
MIA	unknown	11,047	
Mystery River	unknown	18,437	

The following table (Table 7) outlines progress in the Rattlesnake Creek Subbasin from 2001 to 2008.

**Table 7: Summary of Progress**

<b>Groundwater Use vs. Program Water Use Goals (acre-feet)</b>											
	2001	2002	2003	2004	2005	2006	2007	2008		1987-1996 Avg	Authorized Quantity**
Groundwater Unit (PA 5,2,Mystery River) 10-Yr Rolling Avg. Water Use	91,734	96,247	100,911	98,672	99,004	102,873	104,426				137,428 (2008)
Groundwater Unit Actual Water Use	115,579	117,637	113,361	89,532	93,774	108,810	85,959				
*Goal	84,996	84,996	84,996	84,996	84,996	84,996	84,996	84,996	84,996	101,476	140,939
Stream Corridor (PA 1,3,4) 10-YR Rolling Avg. Water Use	29,194	30,492	31,801	30,431	30,117	31,141	31,283				42,208 (2008)
Stream Corridor Actual Water Use	36,345	35,672	36,275	25,559	28,641	33,639	23,027				
Goal	31,876	31,876	31,876	31,876	30,548	30,548	30,548	30,548	30,548	33,204	46,117
PA 7, MIA "Basinwide" 10-YR Rolling Avg. Water Use	49,064	50,999	52,931	51,915	51,873	53,627	54,388				70,738 (2008)
"Basinwide" Actual Water Use	61,848	59,409	59,783	49,271	48,303	58,254	44,891				
Goal	46,906	46,906	46,906	46,906	46,906	46,906	46,906	46,906	46,906	50,709	70,430
<b>Sum of All Rolling Avg. Water Use</b>	169,992	177,738	185,643	181,018	180,994	187,641	190,097				
Goal	161,187	161,187	161,187	161,187	161,187	161,187	161,187	161,187	161,187		
*Water use goals were established in 2000 with the original management program for priority areas and all progress is evaluated based on the 10-yr rolling averages (Goal).											
** Authorized quantities were re-calculated in 2008 to determine changes due to water right purchases, water right transfers, abandonments, data entry corrections, etc. However, the partnership has agreed to not use updated numbers for analyses.											