LOWER ARKANSAS RIVER BASIN CATEGORY 4b ALTERNATIVE
October 10, 2008 ADDENDUM

This document serves as an addendum to the original Lower Arkansas River Basin Category 4b Alternative submitted to EPA in conjunction with the 2008- 303(d) list of impaired waters. In accordance with the accomplishments of the Little Arkansas River Watershed Restoration and Protection Strategies (WRAPS) Implementation efforts, KDHE will place the subwatersheds where best management practices (BMPs) have been implemented, which also have a designated KDHE stream chemistry sampling station within these designated subwatersheds, within Category 4b. For those watersheds outside of this area KDHE will initially list these watersheds within Category 5, with the anticipation that the WRAPS group will further expand their implementation efforts to areas within these subwatersheds, at which time KDHE may move these specific subwatersheds to Category 4b.

The Little Arkansas WRAPS group implemented BMPs in targeted subwatersheds at the HUC 12 scale. KDHE makes 303(d) impairment listings based on the contributing watershed above the KDHE stream chemistry sampling stations, where the contributing area does not have a specified HUC scale. Therefore the category 4b area is based on the watersheds associated with the KDHE sampling stations and comprises a larger area than HUC 12 areas where the initial WRAPS implementation efforts were initiated. The WRAPS group will further expand their implementation efforts within the 4b areas that have not been targeted to date.

KDHE is listing the following subwatersheds as **Category 4b for the *2008 – 303(d) List***:

Station	***Main Segment***	***Trib 1***	***Trib 2***
Station 533	**Turkey Creek (11)**	Dry Turkey Cr (13)	Bull Cr (24)
	Turkey Creek (12)	Running Turkey Cr (25)	
Station 705	**Black Kettle Cr (368)**		
Station 534	**Emma Cr (6)**	Middle Emma Cr (7) West Emma Cr (8)	
Station 535	**Sand Cr (4)**	Mud Cr (16) Beaver Cr (26)	

KDHE will place the following subwatersheds within **Category 5**:

Station	***Main Segment***	***Trib 1***	***Trib 2***
Station 246	**Little Arkansas R (10-part)**		
	Little Arkansas R (14)	Sand Cr (23) Lone Tree Cr (20)	

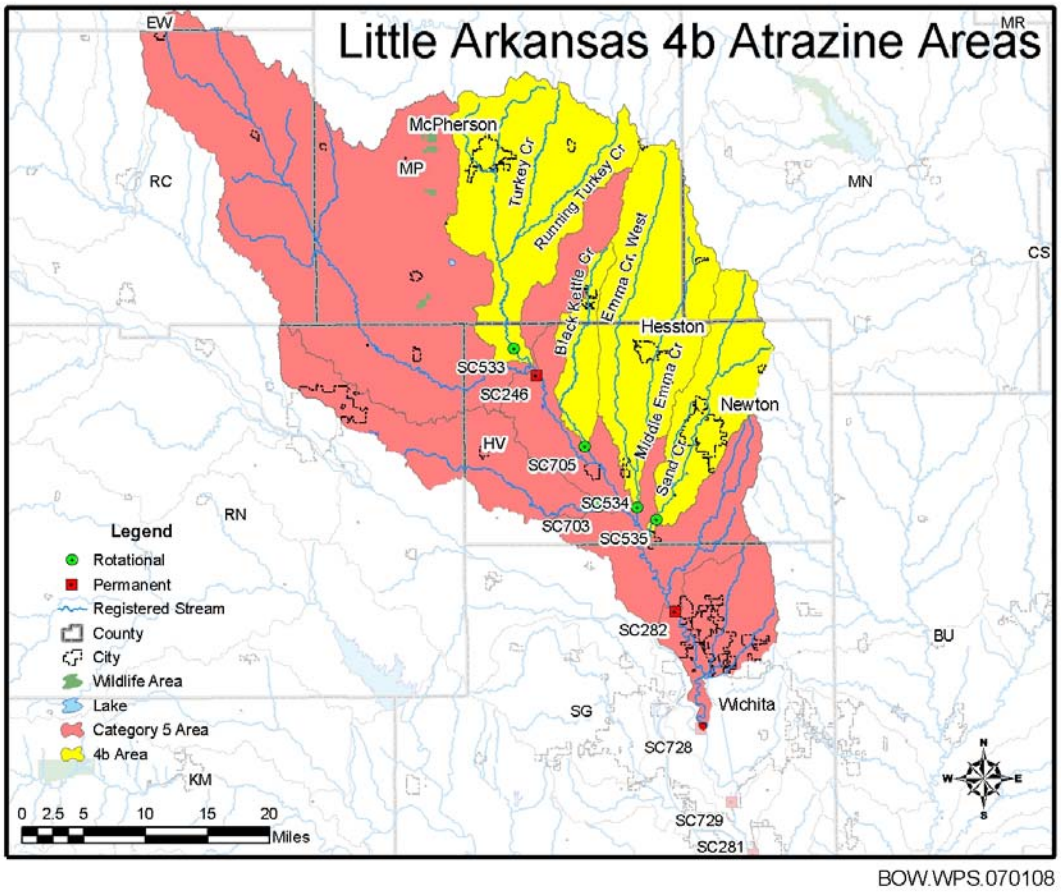
Dry Cr (22)
Salt Cr (21)
Horse Cr (19)

Note: The Blaze Fork subwatershed lies within this watershed, but it is no longer a classified stream in Kansas. The Blaze Fork subwatershed is one of the five-targeted HUC 12 subwatersheds that the WRAPS group is working in.

Station 703 **Kisiwa Cr (15)**

Station 282	**Little Arkansas R (1-part)**	Jester Cr (2)	Gooseberry Cr (17) W. Fk Jester (18)
	Little Arkansas R (3)		
	Little Arkansas R (5)		
	Little Arkansas R (9)		
	Little Arkansas R (10-part)		
Station 728	**Little Arkansas R (1-part)**	Middle Fk Chisholm Cr (817) Chisholm Cr (1693)	

Figure 1. Little Arkansas River Watershed Proposed Category 4b and Category 5 areas.



Water Quality Target: The water quality standard for atrazine is 3 µg/L for the designated uses of domestic water supply and chronic aquatic life support. Based on KDHE's listing methodology, these subwatersheds within the category 4b and category 5 areas are being listed due to an impairment of chronic aquatic life support and domestic water supply (main stem of Little Arkansas River). The assessment of the designated uses are generally tailored after those suggested in EPA's *Guidelines for the Preparation of the Comprehensive State Water Quality Assessments and 305(b) Reports and Updates: Supplement*, where impairment is defined as excursion rates greater than 10 percent for aquatic life (chronic). For Kansas, the atrazine impairment associated with the chronic aquatic life support occurs when greater than 10% of the samples are over 3 µg/L. Furthermore, Kansas utilizes a binomial test if the sampling site fails the raw score test (>10% excursion). If the binomial test indicates impairment (nominally >10%) then the assessment unit is impaired. Additional details regarding the binomial test and listing methodologies can be viewed on the intranet at: http://www.kdheks.gov/tmdl/download/2008_303_d_Methodology.pdf .

The water quality target for the 4b subwatersheds to meet the drinking water quality standard, is ultimately measured through running annual averages below 3µg/L as determined by 40 CFR Ch. I §141.24(f)(15)(i).

Therefore the chronic category of the aquatic life atrazine standard will be met when the excursion frequency is reduced to <10% of the samples for the period of record evaluated during the next listing cycle. The atrazine criteria for the drinking water supply use are ultimately met when the annual average for the sampling site is less than 3 µg/L. Though magnitude plays an important role in assessing water quality, the determining factor for meeting the water quality standard for the 4b subwatersheds will be tied to the number of exceedances, or frequency, associated with meeting the chronic aquatic life support criteria.

BMP Implementation Efforts and Cost Estimate: Voluntary cost-share BMP incentive programs and information and education (I&E) activities will be the primary components necessary to continue making progress in reducing atrazine concentrations within the targeted subwatersheds. When cost-share incentive funding is no longer sustainable, KDHE anticipates that the successes learned through BMP implementation activities will carry forward with producers continuing to expand BMP implementation efforts based on the water quality benefit and costs savings associated with implementing the recommended BMPs into their standard practices without the reliance of cost-share incentive program monies. Indications to date are the current cost-share incentive payments to individual producers are not the sole reason for employing BMPs.

KDHE is committed to continuing to offer resources and expertise to the WRAPS group to enhance implementation efforts to ensure the targeted 4b subwatersheds make progress towards meeting the goals of the water quality target of the 4b document, which will be evaluated by KDHE each listing cycle.

To support maintaining the atrazine impaired waters in the designated 4b subwatersheds in Category 4b during future 303(d) reporting cycles, the Little Arkansas WRAPS group should continue to demonstrate sufficient progress (each reporting cycle) toward the goal of achieving the atrazine water quality standard by 2016. To that end, KDHE will coordinate with the Little Arkansas WRAPS group to provide a progress report on atrazine reduction efforts in the 4b subwatersheds by April 1st for each 303(d) reporting cycle year (every even numbered year). The progress report should include implementation progress and water quality response progress as indicated below.

<u>Implementation Progress</u>

1. *Annual Atrazine BMP implementation rate in each 4b subwatershed.* Specifically, total acres with atrazine BMPs each year. The number of planned BMP acres (i.e., what the producers sign up for at the beginning of the season) may be different than the BMPs producers/farmers actually end up using each year (e.g., weather conditions may alter BMP selection). Hence, the annual BMP implementation rate should be based on the actual (not

planned) BMPs used each year. Also, to determine the total number of acres eligible for atrazine BMPs each year in the 4b subwatersheds, KDHE is currently using an estimate based on 2008 production acres (see Table 8 of this addendum). KDHE will work with the WRAPS group to assess and consider options for deriving an eligible acres estimate based on the actual corn and grain sorghum acres in production each year in each 4b subwatershed.

2. *Annual Atrazine BMPs implemented in each 4b subwatershed*. Specifically, of the total acres with atrazine BMPs implemented each year, identify the number and percentage of acres of each type of BMP (e.g., early application, preplant incorporation) and the associated atrazine removal efficiency estimate for each type of BMP.

3. *Annual producer/farmer BMP participation rate in each 4b subwatershed.* Specifically, total number of producers/farmers implementing atrazine BMPs each year compared to the estimated total number of producers/farmers eligible to implement atrazine BMPs.

4. *Annual producer/farmer sign-up rate in each 4b subwatershed*. Specifically, the total numbers of producers/farmers (that receive an on-farm visit) that sign up to implement BMPs each year compared to the total number of producers/farmers that receive an on-farm visit.

5. *Water Quality Results in each 4b subwatershed*. Specifically, water quality results at each of the KDHE monitoring stations (downstream pour points of each "medium-sized" 4b subwatershed) and relevant monitoring data collected by the WRAPS group.

Assessing and reporting out on these multiple lines of evidence will provide KDHE flexibility for demonstrating progress in each 4b subwatershed. Selecting and reporting on just one of these lines of evidence may miss and/or under report progress being made in the watershed. For example, over the past two years, on-farm visits have been targeted at the largest producers (measured by acres) in the watershed. Hence, as smaller producers are targeted in the future, it is reasonable to anticipate that less BMP acres may be implemented for the same number of on-farm visit effort, which may lead to a tapering off of the annual BMP implementation rate over the next few years. Therefore, if KDHE only chooses to report on the annual BMP implementation rate, it would under report the additional on-farm visits and may yield the overall impression that the WRAPS group is having difficulty achieving additional implementation progress. However, assessing and reporting out on each of the implementation and water quality response lines of evidence should (1) help provide a clear assessment of what progress and challenges are occurring in the subwatersheds, (2) help clarify what corrective actions may be needed, and (3) provide flexibility for the WRAPS group to continue to demonstrate progress toward the goal of achieving the atrazine water quality target by 2016 in the 4b subwatersheds.

At a minimum, producers and applicators that utilize atrazine must comply with existing label restrictions. Atrazine BMP practices being promoted within the Little Arkansas WRAPS watershed go beyond the current label restrictions. The BMP practices supplement and comply with label instructions since the BMP practices generally call for applying less atrazine on the ground than the label permits.

To fund the information and education and cost-share BMP incentive programs within the 4b watersheds it is anticipated adequate funding will need to remain in place over the next couple of years to continue to make sufficient progress toward meeting the water quality target for the watershed. Until producers and applicators apply atrazine BMP practices into their standard operating practices without the incentive of cost-share monies, funding will need to be available to supplement these efforts within the targeted watersheds.

Implementation Schedule: The focus for implementation will be on the HUC 12 subwatersheds that are targeted by the Little Arkansas WRAPS leadership team that lie within the 4b area. Implementation timeframes are not specified in EPA's Category 4b guidance, however KDHE anticipates significant progress will be achieved in improving the atrazine impairment within the 4b watersheds by the next listing cycle in 2010. Implementation goals for 2009 and 2010 have not been established as of yet by the WRAPS group as their leadership team has not met to set these goals and awaits funding to be secured for implementation activities for 2009 and 2010. Funding will become available in October of 2008. Funding will be applied for through a USDA competitive grant, EPA 319 funds, and through local sources such as the City of Wichita.

Monitoring and Measuring Progress

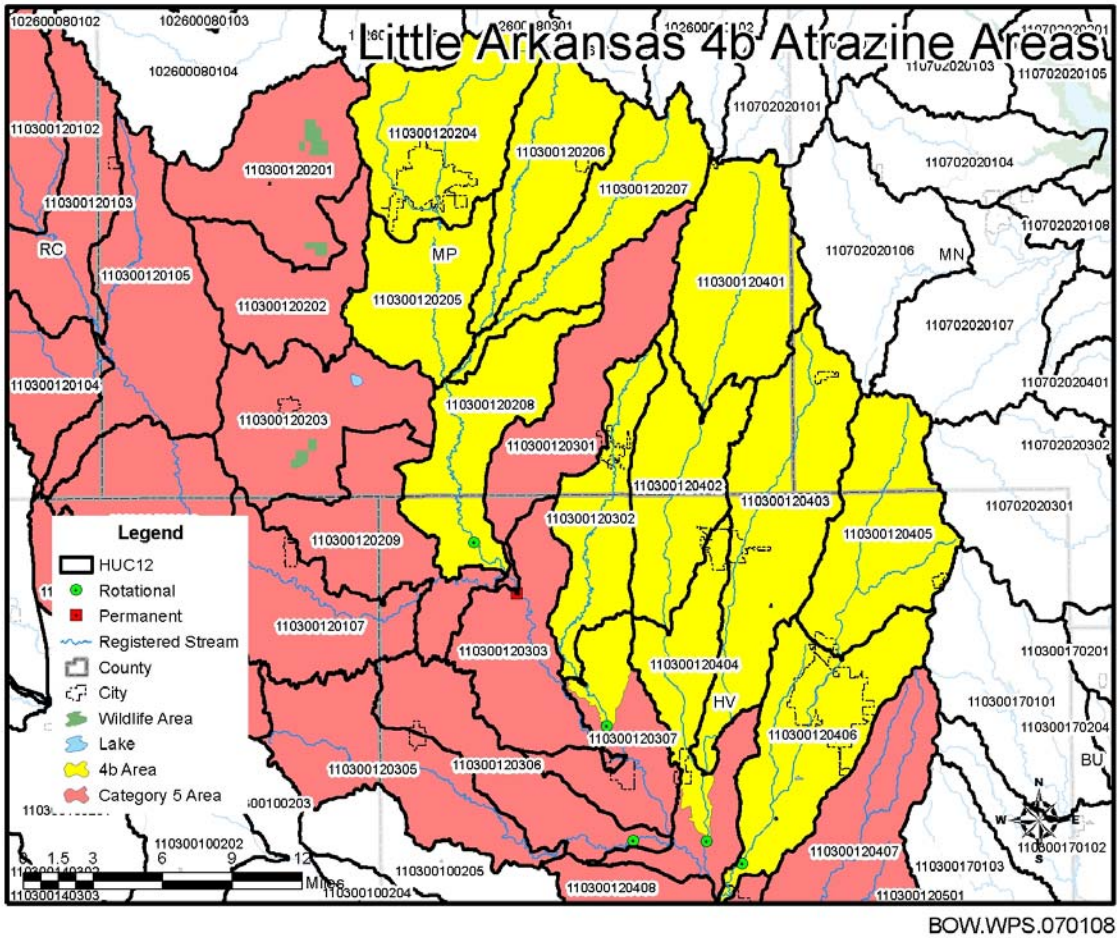
Implementation in 2006: Implementation was initiated in 2006 with $20,000 in incentive payments distributed to producers for the implementation of atrazine BMPs on 4,792 total acres within three WRAPS targeted HUC 12 subwatersheds; Upper Turkey Creek, Upper West Emma Creek and Black Kettle Creek. It should be noted that the upper portion of Turkey Creek (Upper Turkey Creek) is locally referred to as Dry Turkey Creek and any reference to Dry Turkey Creek within the Little Arkansas WRAPS projects is actually in reference to Turkey Creek, segment 12, as indicated in the Kansas Surface Water Register for the Little Arkansas subbasin (HUC 11030012).

Table 1. Number of acres and type of atrazine BMP implemented in 2006.

Atrazine BMP Implemented	*Number of Acres BMP Implemented*	*Percent of Total Acres with BMPs*
Preplant Incorporation	705	15%
Early Application	817	17%
Postemergence application	146	3%
Reduce soil-applied rates	455	10%
Alternative Crop	1807	38%
Combination of early application and reduced soil applied rate	852	18%
No Atrazine Applied	6	0.1%

(Source: D. Devlin, KSU)

Figure 2. HUC 12 Map for the Little Arkansas 4b areas



There were 40 producers that participated in 2006 that received cost-share incentives to implement atrazine BMPs within three of the targeted HUC 12 subwatersheds. On average, each participating producer applied atrazine BMPs to 120 acres.

Table 2. Implementation of atrazine BMPs by WRAPS targeted HUC 12 subwatersheds for 2006.

Targeted Subwatershed	Grain Sorghum Acres Atrazine BMPs Implemented	Total Grain Sorghum Acres in Subwatershed	Percent of Grain Sorghum Acres with Atrazine BMPs Implemented	HUC 12
Upper Turkey Cr	1,818	4,131	44%	110300120206
Upper W. Emma Cr	1,688	5,115	33%	110300120401
Black Kettle Cr	1,286	3,897	33%	110300120302
Total	4,792	13,143	36 %	

Figure 3. Details for 2006 BMP implementation and monitoring activities by HUC 12s within the Little Arkansas River Basin.

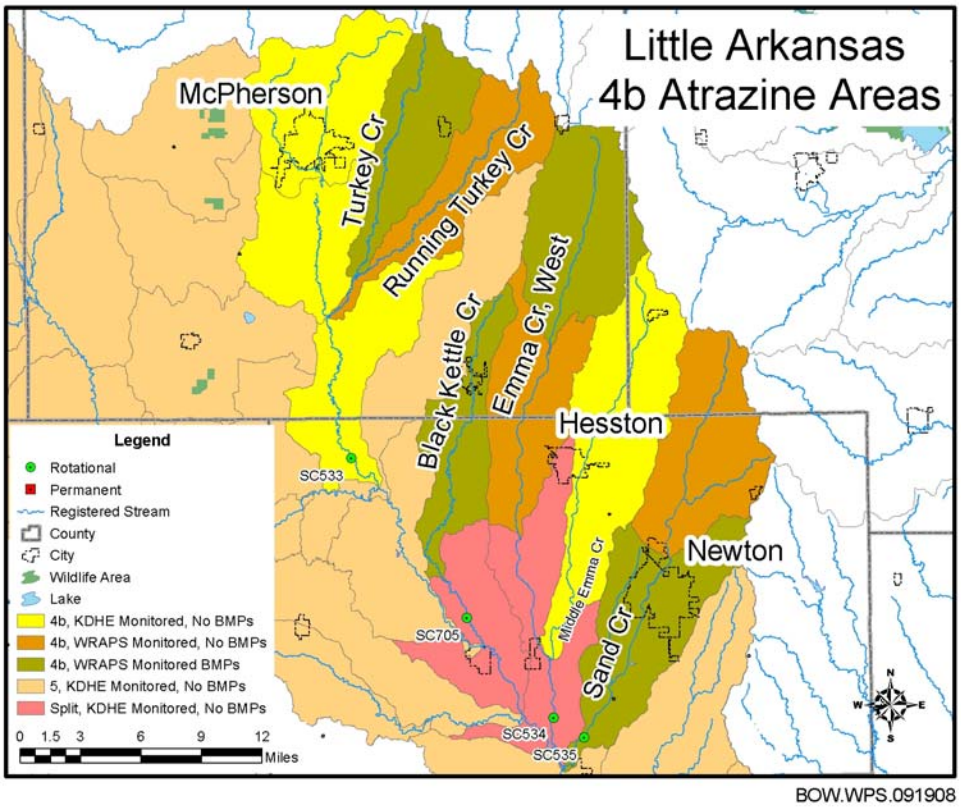


Figure 3 displays the HUC 12 areas that the WRAPS group targeted in 2006. The KDHE monitoring stations within the 4b area are generally the downstream watershed boundary for the 4b area. Therefore, since the scale of the map is based on the HUC 12 boundaries the split category in the legend refers to the portion above the station being the 4b area and the area below the station is within the category 5 areas, which is accurately displayed in Figure 2.

Implementation in 2007: In 2007, the WRAPS group coordinated the implementation of BMPs within two new watersheds, Blaze Fork Creek and Sand Creek, and expanded implementation efforts within the original three subwatersheds where implementation efforts were initiated in 2006. Efforts were expanded to include both corn and grain sorghum acres in 2007. There was $38,000 in incentive payments distributed to producers for the implementation of atrazine BMPs on 10,511 acres in 2007.

There were 74 producers that participated in 2007 that received cost-share incentives to implement atrazine BMPs within five subwatersheds, of which four are in the targeted 4b watersheds. BMPs were implemented in 39% of the grain sorghum acres (7,615 acres) and 41% of the corn acres (2,896 acres) planted in the five-targeted watersheds. The estimated percent of corn and grain sorghum acres within the WRAPS targeted HUC 12 subwatersheds with atrazine BMP implementation in 2007 was 37%. There were no reported acres for "alternative crops" as a BMP in 2007. The WRAPS group elected to discontinue offering incentives for alternative crops since it was difficult to confirm if a producer actually made the change due to the incentive payment. Acres significantly increased for the "no atrazine applied" BMP for 2007, which applied to sorghum and corn acres in which a producer utilized alternative herbicides not containing atrazine. On average, each participating producer applied BMPs to 143 acres.

Table 3. Atrazine BMPs implemented in 2007 by BMP and acres implemented.

Atrazine BMP Implemented	***Number of Acres BMP Implemented***	***Percent of Total Acres with BMPs***
Preplant Incorporation	1880	18%
Early Application	1544	15%
Postemergence application	796	8%
Reduce soil-applied rates	4570	43%
Combination of early application and reduced soil applied rate	157	1%
Combination of reduced soil-applied rates and postemergence application	270	2%
No Atrazine Applied	1294	12%

(Source: D. Devlin, KSU)

Table 4. Implementation of atrazine BMPs by watershed for 2007 is as follows:

Targeted Subwatershed	Grain Sorghum and Corn Acres - Atrazine BMPs Implemented	Total Grain Sorghum and Corn Acres in Subwatershed	Percent of Grain Sorghum and Corn Acres with Atrazine BMPs Implemented	HUC 12
Upper Turkey Cr	1,184	3,491	34%	110300120206
Upper W. Emma Cr	1,901	3,116	61%	110300120401
Black Kettle Cr	2,044	5,524	37%	110300120302
Upper Blaze Fk Cr	2,276	5,551	41%	110300120202
Lower Sand Cr	3,140	9,813	32%	110300120406
Total	10,545	27,495	36 %	

Figure 4 illustrates the WRAPS targeted HUC 12 areas that had BMPs implemented within the Little Arkansas River Basin during 2007. The two HUC 12s associated with Blaze Fork Creek, upper and lower, lie outside of the 4b area and are in the category 5 area since the KDHE monitoring station associated with these HUC 12s monitors a much larger portion of the impaired watershed. As the WRAPS group continues to progress and expand implementation efforts, the watershed associated with the KDHE monitoring station (SC246) that captures the Blaze Fork Creek subwatershed may later be considered for Category 4b.

Figure 4. Details of the 2007 WRAPS BMP implementation and monitoring efforts by HUC 12 within the Little Arkansas River Basin.

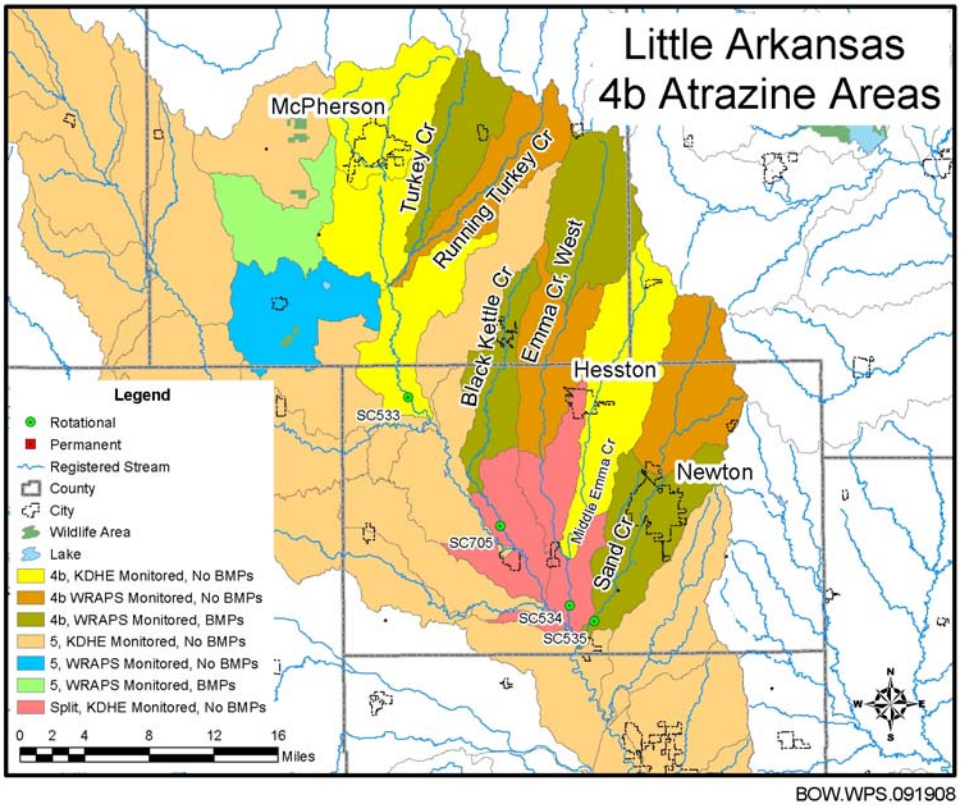


Figure 5. BMP Implementation Summary for the Little Arkansas WRAPS.

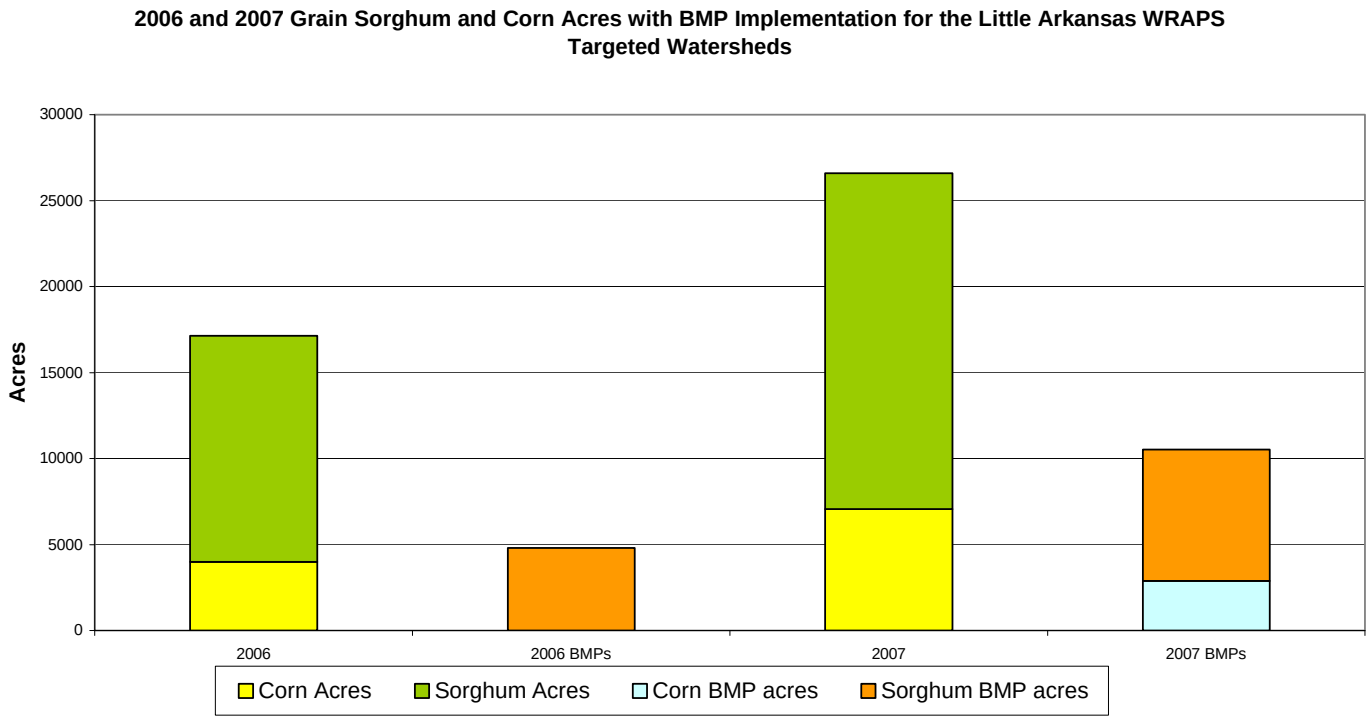
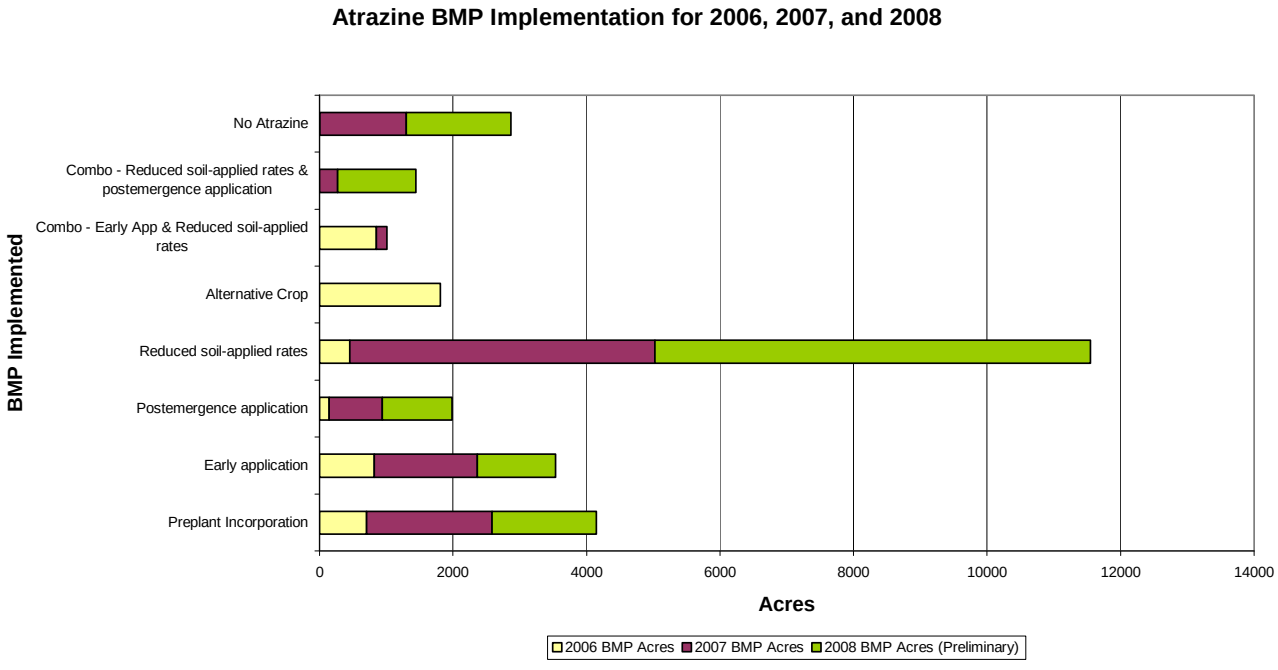


Figure 6. Summary of Atrazine BMPs in 2006, 2007, and 2008



Implementation in 2008: Though 2008 figures are preliminary, there has been $49,618 in incentive payments made to 95 participating producers to implement atrazine BMPs on 13,044 acres (acres signed up for program but final figures not available). The estimated percent of corn and grain sorghum acres within the WRAPS targeted HUC 12 subwatersheds with atrazine BMP implementation in 2008 was 44%. BMP efforts were expanded to a sixth subwatershed, North Kisiwa Creek, in 2008. Each participating producer applied BMPs to 137 acres, on average.

Table 5. Atrazine BMPs implemented in 2008 by BMP and acres implemented.

Atrazine BMP Implemented	***Number of Acres BMP Implemented***	***Percent of Total Acres with BMPs***
Preplant incorporation	1565	12%
Early application	1174	9%
Postemergence application	1044	8%
Reduce soil-applied rates	6522	50%
Combination of reduced soil-applied rates and postemergence application	1174	9%
No atrazine applied	1565	12%

(Source: D. Devlin, KSU)

Final data for the implementation of atrazine BMPs by the WRAPS targeted HUC12 subwatershed for 2008 are not yet available. Based on the preliminary data, the total number of farmers for each subwatershed is listed in Table 6, along with the number of farmers that signed up to implement atrazine BMPs on their corn and/or grain sorghum acres. In addition, Table 6 contains the estimated number of acres that are farmed within each subwatershed and the estimated number of acres (includes all crops) under the operation of farmers that signed up for atrazine BMPs. It is important to note that not all of these acres have atrazine BMPs implemented since this includes all farm acreage, whereas the BMPs are only applicable to their grain sorghum and corn acres. In addition, farmers that have acreage within two HUC 12 subwatersheds are counted in the total number of producers participating column for each subwatershed that they farm.

Table 6. Preliminary summary of participating farmers by subwatershed for 2008.

Subwatershed	Total Number of Producers in Watershed	Total Number of Producers Participating	Total Farm Acres in Subwatershed	Total Farm Acres Controlled by Participating Farmers	Percent of Total Farm Acres Controlled by Participating Farmers	HUC 12
Upper Turkey Cr	58	20	18,996	10,408	55%	110300120206
Black Kettle Cr	67	21	20,087	9,130	45%	110300120302
Upper W. Emma Cr	69	27	25,752	13,341	52%	110300120401
Lower Sand Cr	74	21	29,652	12,854	43%	110300120406
Upper Blaze Fork Cr	65	21	27,530	10,702	39%	110300120202
North Kisiwa Cr	53	12	16,070	6,497	40%	110300120306

Figure 7. Details of the 2008 WRAPS BMP implementation and monitoring efforts by HUC 12 within the Little Arkansas River Basin.

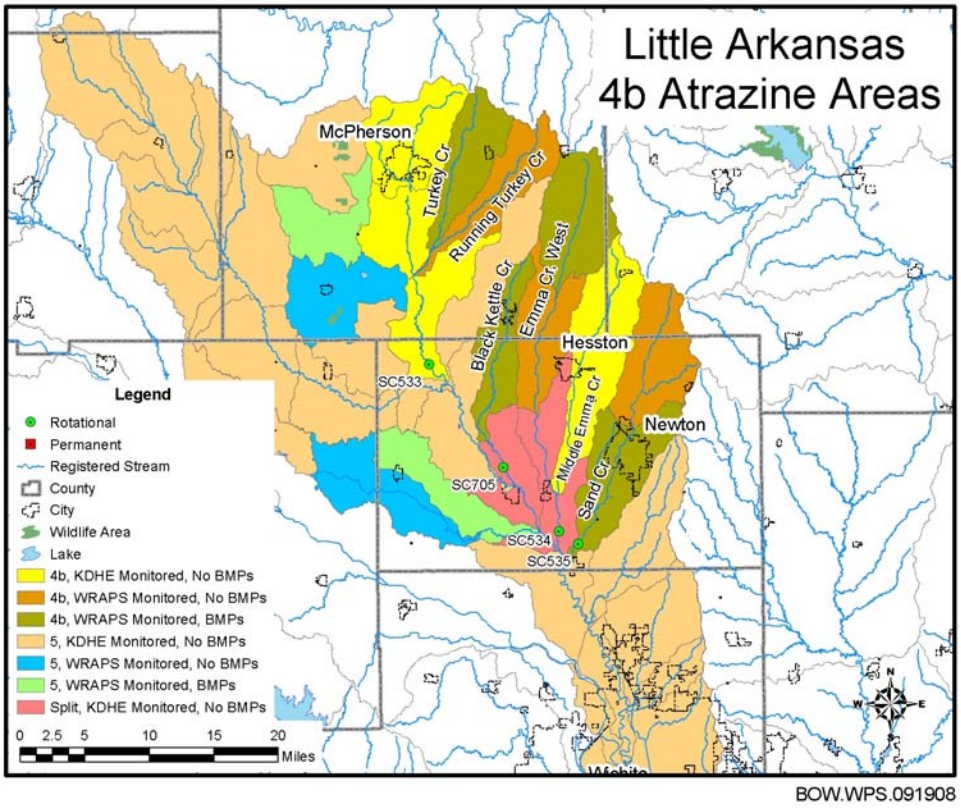


Figure 7 illustrates the WRAPS targeted HUC 12 areas for 2008, where implementation efforts were expanded into the Kisiwa Creek watershed. KDHE anticipates by 2010 that the Kisiwa Creek watershed will be added to the 4b area since there is a KDHE stream chemistry monitoring station within this watershed (SC703).

On-Farm Visit Summary: On-farm visits proved very successful for the sign up of acres into the atrazine BMP program. The percent of farmers that received an on-farm visit and signed up for the atrazine BMP program during the initial year, 2006, is estimated at over 80%. In 2007, 99% of the farmers visited signed up for the program. In 2008, 98% of the farmers visited signed up for the atrazine BMP program.

Table 7. Percent of acres of corn and grain sorghum in the targeted watershed that on-farm visits were made to farm operators.

Subwatershed	2006	2007	2008
Upper Turkey Cr	45%	34%	55%
Black Kettle Cr	44%	41%	45%
Upper W. Emma Cr	39%	37%	52%
Lower Sand Cr		32%	43%
Upper Blaze Fk Cr*		39%	39%
N Kisiwa Cr*			40%

* Outside of initial 4b area
(Source: D. Devlin, KSU)

Implementation Assurances:

Authority: Under Kansas law: persons that apply atrazine are required to become certified applicators, which includes training on atrazine label restrictions; and may be subject to fines if pesticides are not used in a manner that is consistent with the pesticide's label or labeling. There is no federal, state, or local requirements for the producers to implement BMPs not specified on the atrazine label (i.e., those BMPs being promoted through the cost-share incentive program). Hence, KDHE's assurances that the voluntary BMPs will be implemented and maintained are based primarily on the extent of (1) existing commitments already demonstrated in the subwatersheds, (2) dedicated funding to support full implementation of needed BMPs, (3) local initiatives to address atrazine management via the WRAPS process and (4) other relevant factors specific to the subwatersheds under consideration for Category 4b.

Existing Commitments: Development of the Little Arkansas WRAPS represents a significant fundamental first-step commitment to restore the watershed. The likelihood of the WRAPS being implemented is enhanced because the watershed stakeholder leadership team that developed the plan included watershed producers that would need to implement the needed controls/BMPs. The WRAPS group has already made significant progress in implementing the WRAPS plan where the plan has been applied within the targeted HUC 12 subwatersheds. The success of these commitments is evident through the high success rate previously displayed with farmers that signed up for the BMP program after an on-farm visit. In addition, the number of BMP acres has increased each year since 2006. These successful, existing commitments demonstrate that the WRAPS implementation approach can not only be successful within the WRAPS targeted subwatersheds, but can also be successful within other portions of the Little Arkansas watershed that will have future Category 4b consideration.

Funding: KDHE intends to coordinate with the WRAPS group to fully implement the plan in the WRAPS targeted HUC 12 subwatersheds within the 4b area with 319 grant funds. As available, the WRAPS group will supplement these with funds from other agencies (USDA) or other stakeholders in the watershed (City of Wichita). The WRAPS group pools the available funds together to fund their respective implementation efforts,

which include funding for the cost-share incentive payments, information and education activities, and funding the watershed coordinator position.

The primary funding source to fully implement the plan will be EPA 319 grant funds and State Water Plan funds that are dedicated to WRAPS, which are managed through KDHE. KDHE's annual 319-grant allocation for the entire state is typically $1.2 million each year and the State Water Plan funds dedicated to WRAPS projects is typically $800,000. Both funding sources have necessary match requirements. KDHE is committed to continue funding the Little Arkansas WRAPS project to continue to implement the information and education and BMP cost-share incentive programs in the WRAPS targeted HUC 12 subwatersheds within the 4b area. KDHE is committed to utilizing a portion of Kansas's 319 grant funds to continue funding the Little Arkansas WRAPS group. Among the 44 active WRAPS projects in Kansas, the Little Arkansas WRAPS is considered among the top ten in priority for implementation. Furthermore, the Little Arkansas watershed has been selected by Kansas to evaluate success in improving water quality in order to meet EPA's SP-12 performance measure. In addition, the WRAPS group will continue to seek additional implementation funds provided by other funding entities to supplement or replace 319 grant funds.

Table 8. Number of cropland acres within the KDHE contributing areas of the 4b area, estimated percent and number of grain and sorghum acres based on 2008 information, estimated number of producers, and estimated annual maximum cost-share incentive dollars required for 100% BMP implementation on all grain sorghum and corn acres within the 4b area.

KDHE Station/ Contributing Area	Number of Cropland Acres	Est. % of Grain Sorghum and Corn Acres	Est. Number of Grain Sorghum and Corn Acres	Est. number of Producers	Est. Max Incentive Payment with 100% Impl *
SC533, Turkey Creek	95,680	25%	23,920	267	$71,760
SC705, Black Kettle Cr	20,220	23%	4,650	57	$13,950
SC534, Emma Cr	85,280	23%	19,614	238	$58,842
SC535, Sand Cr	39,110	31%	12,124	109	$36,372
Total	240,290	25%	60,308	671	$180,924

* Incentive payment per acre based on $6.00 x 0.5 (avg. Reduction in Runoff Factor).

If 100% implementation occurred within the 4b watersheds, the estimated annual cost-share incentive monies necessary would be approximately $180,924 per year. Table 8 indicates the estimated costs for each 4b watershed above the KDHE sampling station. This is a conservative estimate as this assumes that all grain sorghum and corn cropland acres are subject to atrazine application, and the designated producer will need incentive monies to implement BMPs. The number of cropland acres for each watershed was derived from the 2001 MLRC GIS land use and land cover dataset. The estimated number of corn and grain sorghum acres within the total cropland acres was estimated based on the percentage of these crops from the 2008 WRAPS producer information that

detailed the types of crops grown by each producer within the respective WRAPS targeted HUC 12 subwatersheds as seen in Table 9. The estimated number of producers for the 4b area was extrapolated based on the 2008 producer information provided by the WRAPS group, which resulted in an average of one producer for every 358 acres of farmland as detailed in Table 10. The estimated cost-share incentive dollars required is derived from the previous incentive payment, $6.00 per acre multiplied by the total atrazine BMP runoff effectiveness reduction factor, paid by the WRAPS group. The reduction factor averaged 0.5 for 2007 and this average value was utilized for estimating the costs for achieving 100% implementation. As previously mentioned, the WRAPS group and KDHE anticipate producers will begin or continue implementing atrazine BMPs within the 4b watershed without the lure of the incentive payments.

Table 9. 2008 Atrazine BMP Participating Producer Crop Information in acres.

2008 Crop	Upper Turkey	Black Kettle	Upper W. Emma Cr	Upper Blaze Fk	Lower Sand Cr	N. Kisiwa Cr	Total Acres	% of Total Acres
Wheat	5512	4511	7493	5962	5445	3243	32,166	60%
Corn	**778**	**304**	**875**	**993**	**819**	**669**	**4438**	**8%**
Grain Sorghum	**1608**	**1419**	**1757**	**1208**	**2390**	**464**	**8846**	**17%**
Soybeans	966	1266	1238	1051	1268	1062	6851	13%
Alfalfa	319	93	139	327	179	40	1097	2%
Cotton	38						38	0%
Sudan					20	11	31	0%
Summer Fallow				21			21	0%
Total	9221	7593	11,502	9562	10,121	5489	53,488	100
% of acres Corn and Grain Sorghum	25%	23%	23%	23%	31%	21%	25%	

Table 10. Number of Acres per producer in accordance with the WRAPS 2008 producer information.

WRAPS Targeted HUC 12	Total Number of Producers	Total Farm Acres	Acres/ Farmer
Upper Turkey Cr	58	18,996	328
Black Kettle Cr	67	20,087	300
Upper W. Emma Cr	69	25,752	373
Lower Sand Cr	74	29,652	401
Upper Blaze Fork	65	27,530	424
North Kisiwa Cr	53	16,070	303
Total	386	138,087	358 avg.

Implementation progress for the designated 4b area has increased each year as the total acreage with BMPs has increased 8.5% from 2006 to 2008, as seen in Table 11. The WRAPS group will be able to build on this success and continue to increase the BMP implementation percentage within the 4b area as they target their future implementation

efforts within the 4b area. The percentage of participating farmers in the 4b area, as estimated in Table 12, will increase each year as the WRAPS group expands their efforts within these watersheds.

Table 11. Number of Acres in 4b area with BMPs and percent of BMP implementation for 2006, 2007, and 2008.

KDHE Station/ Contributing Area	2006 Acres with BMPs	2007 Acres with BMPs	2008 Acres with BMPs (est.)	Est. Number of Grain Sorghum and Corn Acres	2006 % BMP Imp	2007 % BMP Imp	2008 % BMP Imp (Est)
SC533, Turkey Creek	1,818	1,184	2,386	23,920	8%	5%	10%
SC705, Black Kettle Cr	1,286	2,044	1,723	4,650	28%	44%	37%
SC534, Emma Cr	1,688	1,901	2,632	19,614	9%	10%	13%
SC535, Sand Cr	0	3,140	3,209	12,124	0	25%	27%
Total	4,792	8,269	9,950	60,308	8%	14%	16.5%

Table 12. Estimated percent of participating producers in 4b area during 2008.

KDHE Station/ Contributing Area	2008 Participating Producer	Estimated Total Producers in Watershed	% of Farmers Participating
SC533, Turkey Creek	20	267	7.5%
SC705, Black Kettle Cr	21	57	37%
SC534, Emma Cr	27	238	11%
SC535, Sand Cr	21	109	19%
Total	89	671	13%

Other Factors: Kansas State University was selected by the Little Arkansas WRAPS group to lead the WRAPS planning effort, which also encompasses research, water quality monitoring, and extension programs for the WRAPS implementation activities in the watershed. Hence, there is continuity in the lead entity/organization developing and implementing the WRAPS. Kansas State University provides a significant amount of technical expertise to the restoration process. Kansas State University began research in the late 1980's to identify BMPs that would help control atrazine runoff into drinking water supplies and has published recommended atrazine BMPs and effectiveness in Kansas State University publications MF-2208 and MF-2572. The Kansas State University staff participating in the WRAPS are trained agronomists and watershed specialists, which facilitates development and implementation of a sound restoration strategy.

Dan Devlin with Kansas State University has reported: "Recommended atrazine BMPs and effectiveness are published in Kansas State University publications MF-2208 and MF-2572. Research has shown typical runoff losses of approximately 5% of applied atrazine when applied as a preemergence application. A survey in the Little Arkansas River watershed indicated average preemergence atrazine rates of 1.5 lb of active ingredient (ai) per acre. Using these figures and assuming 100% of the atrazine applied prior to this implementation project was applied as a preemergence treatment, it is possible to calculate total atrazine applied in the targeted watersheds. In 2006, it was calculated that 19,478 lbs ai of atrazine was applied to grain sorghum in the targeted watersheds and there was potential atrazine runoff losses prior to atrazine BMP implementation of 974 lb ai. Following BMP implementation in 2006, total atrazine applied (estimated) in the targeted watersheds was 16,383 lb ai with potential runoff losses of 716 lb ai or a total reduction in atrazine runoff across the targeted watersheds of 27%. This 27% reduction in potential atrazine runoff occurred even when assuming no atrazine BMPs were implemented on the remaining 63% of the grain sorghum acres not in the incentive program. In 2007, it was calculated that 41,379 lbs ai of atrazine was applied to corn and grain sorghum in the five targeted watersheds with potential runoff of 2,068 lbs ai atrazine. Following BMP adoption in 2007, total atrazine applied (estimated) in the targeted watersheds was 35,997 lbs ai with potential runoff of 1,593 lbs ai or a total reduction in atrazine runoff across the targeted watersheds of 23%.

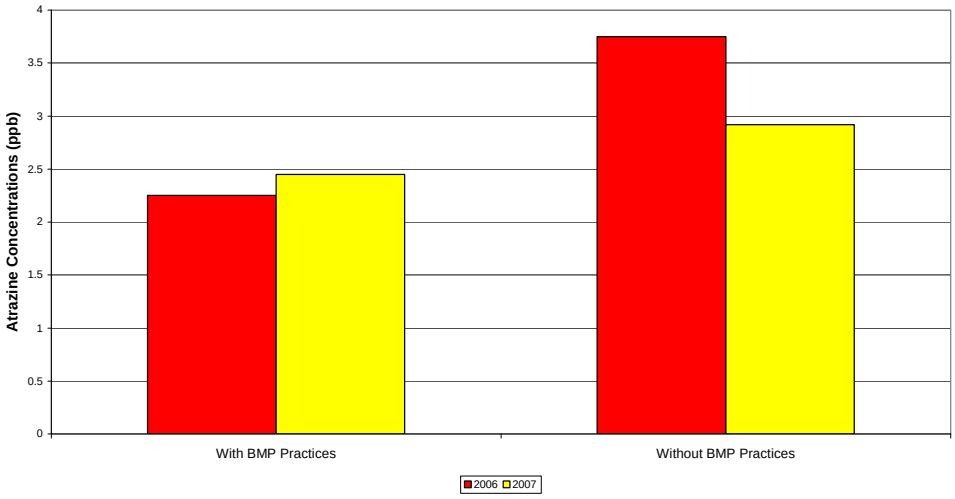
Water Quality Response Progress: Atrazine concentrations within the streams of the targeted watersheds where BMPs were implemented were 40% and 18% lower for 2006 and 2007 respectively, in comparison to concentrations observed in adjoining watersheds where BMPs were not implemented. The excessively wet conditions of 2007 diminished the magnitude of water quality improvement in the 4b subwatersheds, but the water quality benefit was still notable.

"A paired watershed study was designed to determine water quality improvements with BMP implementation. An automated surface water monitoring system was installed in the streams at the base of the watersheds targeted for BMP implementation and also at the base of two adjoining watersheds, Running Turkey Creek and Lower West Emma Creek. The adjoining watersheds had no special programs for BMP implementation so can serve as check watersheds to determine water quality improvements in the targeted watersheds. Water quality monitoring of treated and untreated watersheds in 2006 and 2007 found approximately 40% and 18% lower atrazine concentrations, respectively, in streams in targeted watersheds in which best management practices had been implemented (Figure 1). Average concentrations of atrazine in the Little Arkansas River in the summer months of 2006 were consistently below the 3 ppb goal established by the watershed stakeholder group (Figure 2).

It is difficult to compare the two years, as streamflow (and rainfall) in the Little Arkansas River was completely different in 2006 and 2007, for the critical months of April, May, June, July, and August (Figure 3). Streamflow in 2006 was much lower than normal while, in 2007, streamflow was substantially higher for all five months. Streamflow in the critical month of May 2007 was approximately six times greater than the 13 year

average. We believe the extremely high rainfall and field runoff into surface water in 2007 may have reduced the effectiveness of best management practices for 2007 and was the reason for lower atrazine reduction rates in 2007 (18%) compared to 2006 (40%)" (D. Devlin, KSU).

Figure 8. Atrazine concentrations for 2006 and 2007 in streams in watersheds in which atrazine BMPs were implemented compared to atrazine concentrations in streams in watersheds in which atrazine BMPs had not been implemented. Monitoring data collected during April through August 2006 and 2007. Data supplied by Philip Barnes, KSU (*Little Arkansas WRAPS Implementation Accomplishments in 2006 and 2007).*



KDHE sampled Turkey Creek (SC533), Emma Creek (SC534), and Sand Creek (SC535) on June 21, 2006. Data from the 2006 KDHE sampling event is summarized in Table 13 and compared to the April-July Atrazine concentration averages for the respective stations through the period of record (1990-2006). Black Kettle Creek (SC705) had no flow to sample in 2006. According to the KDHE sampling data, atrazine concentrations were reduced in the three watersheds where the WRAPS group implemented atrazine BMPs, although flow was sampled at base flow prior to a runoff event in June. It should be noted that the KDHE network captures the entire watershed, thus the water quality reflects both BMP treated and untreated subwatersheds.

Table 13. 2006 Atrazine Concentrations, Atrazine Averages for April-July (1990-2006)

Station	Stream	Atrazine Avg. April-July for all data (ppb)	Atrazine Avg for June 21, 2006 (ppb)	% of Atrazine Concentration Reductions for 2006
SC533	Turkey Creek	3.11	2.4	**22.8%**
SC534	Emma Creek	6.05	3.8	**37.2%**
SC535	Sand Creek	4.95	4.25	**14.1%**

Based on the recent monitoring results and the WRAPS documents, the data conclude that the watersheds where BMPs are being implemented are seeing significant atrazine concentration reductions. KDHE anticipates that BMP implementation throughout the Little Arkansas River watershed will increase as the BMPs continue to prove effective at reducing atrazine runoff to the streams within the watershed. As BMPs move within subwatersheds that are currently listed as Category 5, KDHE will evaluate their effectiveness and consider moving these subwatersheds into Category 4b for forthcoming 303(d) list submissions to EPA. In 2012, evaluation will be made to move the original 4b subwatersheds to Category 2, reflecting attainment of the atrazine criteria for aquatic life and domestic water supply.