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Wichita MS4 Program: Implementation of an off-site BMP program for unified watershed management

Ron Graber & Trisha Moore
Kansas State University

Kansas Water Conference
November 9th, 2017

Knowledge for Life

Offsite program stakeholder group

- Stormwater Advisory Board to the City of Wichita
  - Greg Allison, Richard Basore, Chris Bohm, Don Kirkland, Hoyt Hillman, David Leyh, Mitch Mitchell, Gary Oborny, Joe Pajor, Jim Weber
- City of Wichita
  - Jim Hardesty, Joe Hickle, Don Henry, Alan King
- KDHE
  - Tom Stiles

Intro: municipal stormwater programs

- Stormwater discharge from City of Wichita, KS regulated by MS4 permit (MS4 = Municipal Separated Storm Sewer)
- Permit includes requirement to address TMDLs within MS4 area
- Development and redevelopment required to meet water quality treatment (> 1 acre)

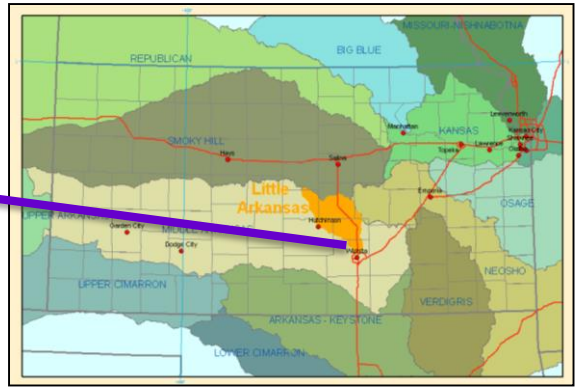
E. Total Maximum Daily Load (TMDL) Regulated Pollutants - The Permittee shall continue to review, update, implement and develop, when necessary, structural and non-structural BMPs which will reduce to the Maximum Extent Practicable the discharge of the TMDL regulated pollutants from the MS4 as listed in PART II. The updated SMP shall provide:

1. Selection of Best Management Practices (BMPs)

The permittee shall provide an updated SMP document which discusses the structural and non-structural BMPs that have been or will be implemented to reduce the discharge of TMDL regulated pollutants from the MS4 significantly contributing to or causing an exceedence of the water quality standard. The SMP shall identify:

TMDLs in Wichita's MS4 permit

- Many TMDL streams influenced by land use upstream of City
- Current TMDL regulated pollutants include sediment, nutrients & bacteria



Current Onsite BMP Program

Storm Water Advisory Board

- With KDHE, City of Wichita SWAB began exploring logistics of watershed-based offsite program as alternative to more traditional onsite BMP program
- WHY? Potential to target BMPs in high priority areas of the watershed = greater economic and environmental efficiency

Pic from swab meeting

WRAPS

BOW - Watershed Management Section - Watershed Restoration And Protection Strategy (WRAPS)

A to Z Topic Listing

- Water Home
- Geology & Well Technology
- Industrial Programs
- Livestock Management
- Municipal Programs
- Public Water Supply
- Technical Services
- Watershed Management
- Watershed Planning and TMDL Program

Watershed Restoration And Protection Strategy

KANSAS wraps

A Watershed Restoration and Protection Strategy (WRAPS) is a planning and management framework intended to engage stakeholders in a process to:

- Identify watershed restoration and protection needs
- Establish management goals
- Create a cost effective action plan to achieve goals
- Implement the action plan

In addition to this framework, the process documents stakeholder goals, strategies to achieve the goals, and the resources required to implement the strategies.

WRAPS efforts can address a variety of water resource concerns statewide. These concerns can include water quality, public water supply protection, flooding, and wetland and riparian habitat protection or restoration. Solutions to identified concerns are developed locally by stakeholders within the watershed.

The WRAPS Process-

Contact

Amanda Reed, WRAPS Project Manager

akreed@kdheks.gov
(785) 296-7165

Get Involved

1. Go to www.kswraps.org to see if there is a WRAPS project in your area.
2. Call the WRAPS project contact in your area, or
3. Call the Kansas Department of Health and Environment, Watershed Management Section at 785.296.4195.

WRAPS Info (State and Federal Agencies)

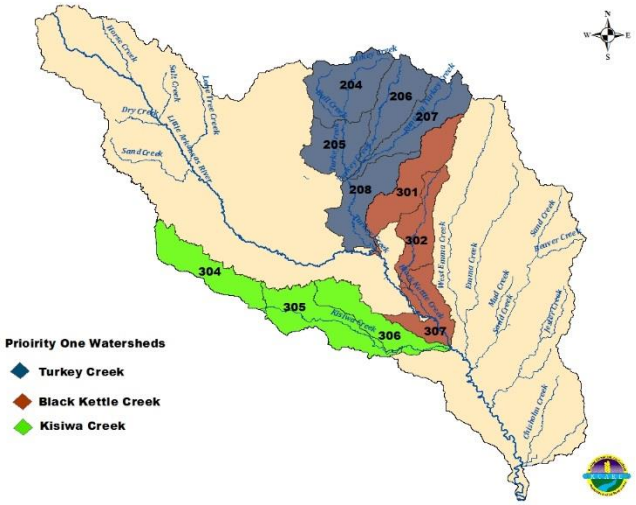
- Current WRAPS Map
- WRAPS Brochure
- Kansas Water Quality Celebrations
- Banner Creek Watershed Success Story
- Clarks Creek Watershed Success Story

Approved WRAPS 9-Element Plans

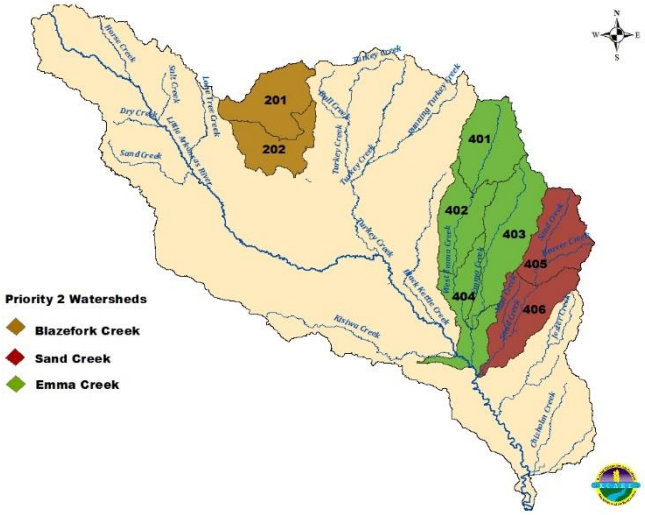
- WRAPS 9-Element Watershed Plans

Targeted Areas for **Sediment**

Priority 1



Priority 2



Load Reduction Needed
– 6,571 tons/yr
(40 years)

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Economic efficiency of sediment BMPs

Little Ark Watershed Cropland BMP Effectiveness	
BMP	**$/Ton TSS, BMP life**
Streambank stabilization	$2.30
No-Till	$2.87
Conservation Tillage	$2.87
Intensive Crop Rotations	$4.30
Nutrient Management	$4.88
Vegetative Buffers	$7.17
Grassed Waterways	$8.60
Ponds	$13.44
Terraces	$18.28
Permanent Vegetation	$28.30
Cover Crops	$43.01

Urban stormwater BMP Effectiveness	
BMP	**$/Ton TSS, BMP life**
Vegetative Buffers	$475
Grass filter strip	$930
Extended detention basin	$2,120
Bioretention	$4,440
Hydrodynamic separator	$5,425
Pervious pavement	$19,130

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Sediment credit payment rate

- Sediment credit payment rate based on:
  - Cost to producer to adopt AND maintain no-till with intensive crop rotations (selected as representative and "most-likely" offsite BMP)
  - Requirement to purchase 2 offsite sediment credits for every 1 unit of sediment production onsite
  - Cost to replace sediment credits if offsite BMPs are discontinued
  - Administrative costs to enroll and track offsite BMPs

USER INPUTS						
Onsite Sediment produced	0.4	tons/ac/yr				
Offsite:onsite credit ratio	2	:1				
% no-till fields replaced	100%	every 5 years				
No-till sediment credit "cushion"	1.1	(affects pace at which no-till implemented to remain ahead of onsite sediment demand)				
Starting fee all acres to date, $/ton sed.	$ 48.00			$ 38.40	Annual Cost/acre under initial fee	
Reduced fee for all subsequent years, $/ton sed	$ 10.00	Year of fee reduction	8	$ 8.00	Annual Cost/acre under reduced fee	
Inflation rate, annual program costs	3.00%					
Inflation rate, annual fee	3%	per year				
City growth rate, year 1	200	acre	Avg annual growth, ac/yr	200	City participation rate	*100%*
Interest rate on start-up funds	0%	annual	# compounded/yr	12	payback period (yrs)	7

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Program stakeholders & roles

KDHE

- Regulatory oversight

City of Wichita

- Raise program awareness
- Tracks new, redevelopment projects
- Collects sediment credit fee from properties opting for offsite program
- Transfers fees to KSU-WRAPS
- Reports to KDHE

KSU-WRAPS

- Recruit producers from high priority sub-basins to program
- Execute payments for contracted BMPs
- Track offsite BMP sediment credits through time
- Report to City

Developers

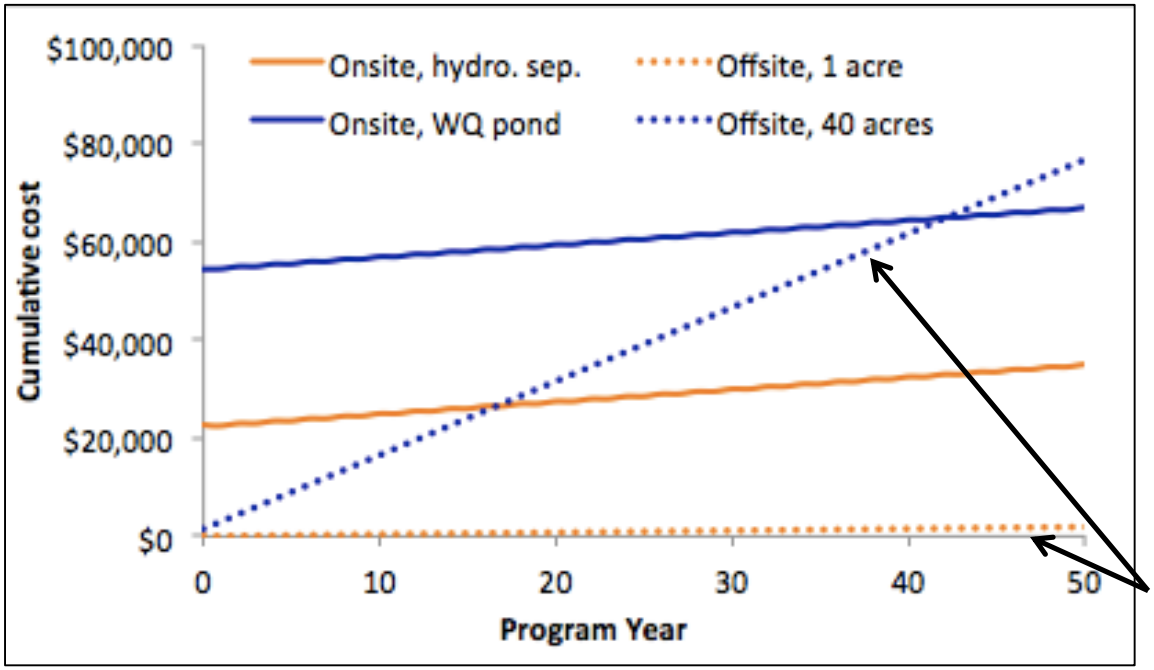
- Choose onsite or offsite BMPs
- Pay fee to CoW for offsite credits
- Maintain peak flow standards

Producers

- Implement contracted BMPs
- Maintain contracted BMPs

Sediment credit payment rate

- Hypothetical example of costs for on-site water quality BMP versus offsite BMP program



Onsite BMP: pond for 40-acre residential

Onsite BMP: Hydrodynamic sep. for 1-acre commercial

Offsite BMP: **$37.60** per acre per year

Timeline

- Nov. 2011 – SWAB formed
- April 2012 – Ideas brought forward
- Feb. 2013 – Brainstorm/ KDHE supportive
- Nov. 2013 – WRAPS
- June 2014 – RFP
- Sept. 2014 – KSU contracted
- June 2015 - Final Report
- July 2015 – Public outreach
- May 2016 – City council meetings
- June 2016 – City council approval
- Aug. 2016 – Approval to execute contract
- Jan. 2017 – First payment to operator

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Offsite BMPs targeted to priority subwatersheds. 5 year contact based on sediment reduction

Little Ark WRAPS Watershed Field Sign Up Sheet

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CITY OF WICHITA www.wichita.gov

City of Wichita off site BMP Sediment Reduction Program

SD 01

	Best Management Practices	Erosion Reduction Efficiency (%)
___	Establish riparian vegetative buffer (check width) ___ less than 30' wide ___ 30' to 60' wide ___ greater than 60' wide	 .25 .40 .50
___	No-till	.75
___	Crop rotations	.25
___	Conservation till (≥30% residue following planting)	.30
___	Farm on the contour	.35
___	Establish new terraces	.30
___	Establish contour grass strips	.50
___	Establish grassed waterways	.30
___	Establish permanent grass	.95
___	Other	
	Total Erosion Reduction (TER) (accumulative effect of BMP's)	

Field Legal Description & HUC 12: _____

Land Operator/Manager _____

Address and Telephone Number _____

Total Payment = ERE% x acres _____ x $50 = $ _____

Payments will be split over 4 years.	**Payments**	**BMP Atr. # or crop**	**Inspection date**
Payment each year will be made	year 1) $_____	year 1)_____ ___	year 1) _____ ___
after inspection by KSU agronomist.	year 2) $_____	year 2)_____ ___	year 2) _____ ___
I agree to implement this practice(s)	year 3) $_____	year 3)_____ ___	year 3) _____ ___
and maintain it for 5 years.	year 4) $_____	year 4)_____ ___	year 4) _____ ___
		year 5)_____ ___	year 5) _____ ___

Participant(s) must agree to utilize Best Management Practices for Atrazine for crops labeled for Atrazine use on the above location for the duration of the 5 year agreement period. BMP Atrazine agreement work sheet number and or crop is listed above.

Land Manager/Operator _____ Date: _____

Agronomist _____

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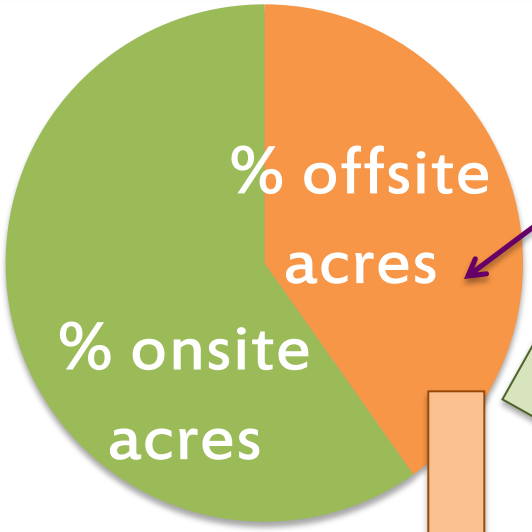
Year 1 implementation: by the numbers



171 acres (representing 30 of 67 developments) enrolled in offsite program

$

~ 70 tons TSS yr^{-1}

~ 370 tons TSS yr^{-1} offsite sediment credits enrolled

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What does it take?

- Stakeholder buy-in (education)
  - KDHE, City of Wichita, Sedgwick County, development community, offsite participants
- Watershed "champion"
  - WRAPS – prioritize watershed efforts, landowner/producer relationships
- Time
  - Offsite BMP program is result of coversaions started over 5 years ago
- Monitoring
  - Assess changes in eco service provision & adapt as necessary

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Economic efficiency of sediment BMPs

Little Ark Watershed Cropland BMP Effectiveness				
Best Management Practice	**Cost Per Treated Acre**	**Erosion Reduction Efficiency**	**Total Reduction*** Over lifetime	**$/Ton**
No-Till	$40	75%	14.0	$2.87
Conservation Tillage	$20	38%	7.0	$2.87
Grassed Waterways	$160	40%	18.6	$8.60
Vegetative Buffers	$67	50%	9.3	$7.17
Nutrient Management	$57	25%	11.6	$4.88
Terraces	$102	30%	5.6	$18.28
Intensive Crop Rotations	$20	25%	4.7	$4.30
Cover Crops	$60	25%	1.4	$43.01
Water Retention Structures	$125	50%	9.3	$13.44
Permanent Vegetation	$500	95%	17.7	$28.30
Streambank stabilization	$91/ft	85%	60	$2.30

Assumes an erosion rate of 1.86 tons/acre/year, with the exception of streambank stabilization (2.8 tons/ft/yr)

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Cost effectiveness: "Urban" BMPs

Urban BMP Lifecycle Costs/ton sediment removed				
Best Management Practice	**Cost Per Acre treated**	**Erosion Reduction Efficiency**	**Sediment Reduction* Over lifetime (tons)**	**$/Ton sediment removed**
Hydrodynamic separator	$28,750	50%	5.3	$5,425
Pervious pavement	$179,840	88%	9.4	$19,130
Extended detention basin	$18,465	80%	8.7	$2,120
Bioretention	$35,500	75%	8	$4,440
Vegetative Buffers	$4,500	90%	9.5	$475
Grass filter strip	$9,600	95%	10.3	$930

Assumes an Erosion Rate of 0.43 tons/acre/year for Medium Density Residential or Parking Lot

25-year lifetime assumed for all urban BMPs

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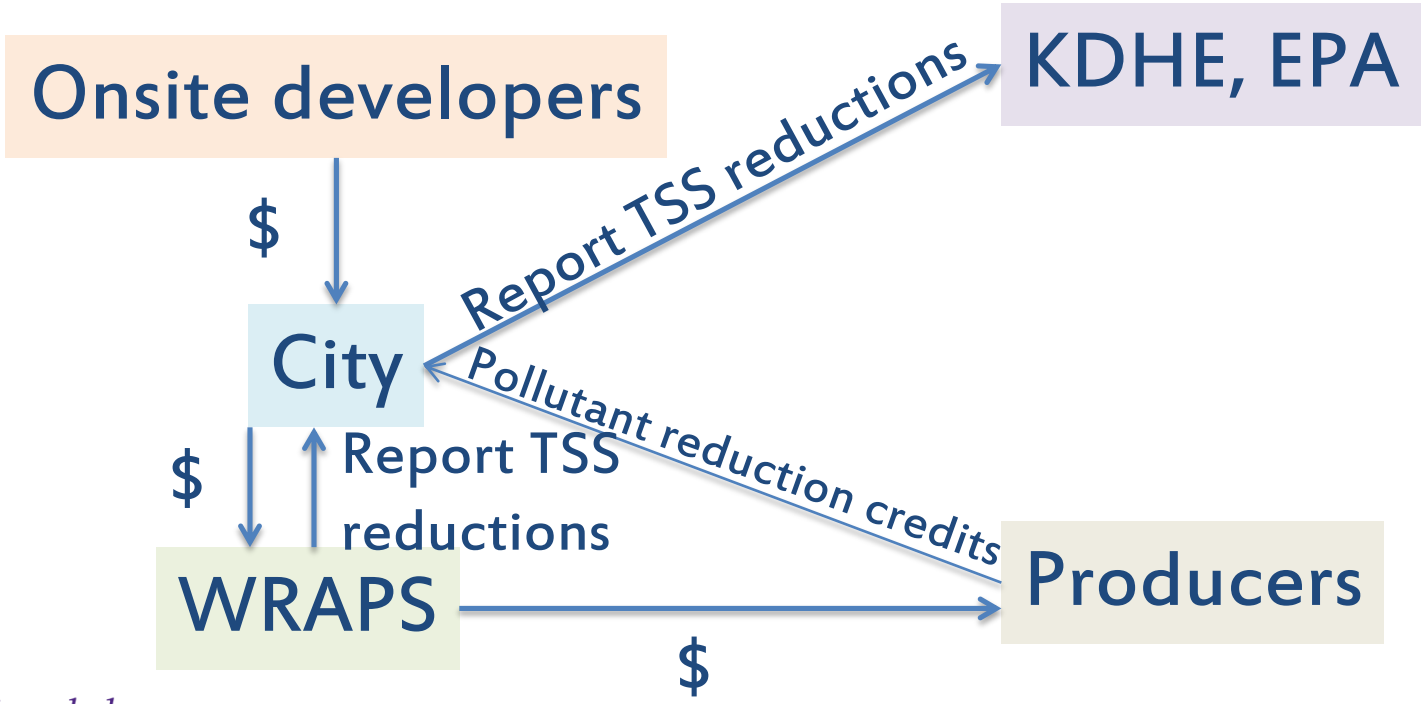
Where we are now

- City Council supports program – June 17, 2016
- Authorize start up funds - $60,000
- Amend ordinance
- Execute contract with program administration –August 9
- Offsite program officially begins – Sept. 1, 2016



Little Arkansas Watershed

Agricultural watershed

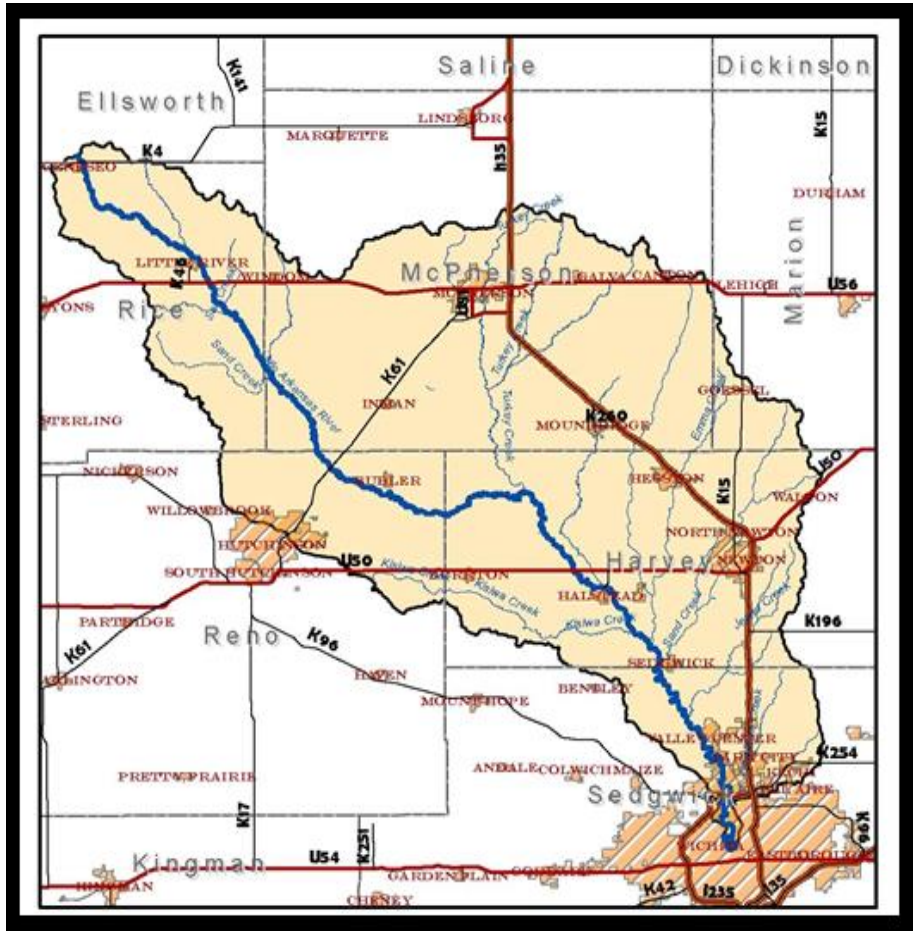
- 913,430 acres
- 78% cropland
- 19% grazingland
- 237 registered CAFO's

TMDLs set for the watershed

- 52% of stream segments required TMDLs
- Water quality concerns include bacteria, nutrients, sediments, pesticides

Drinking water source for city of Wichita and numerous smaller cities and towns

- 205 public water supplies
- 7400 groundwater wells



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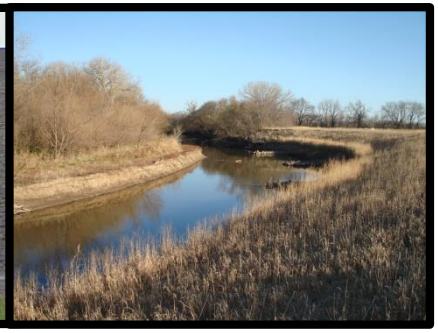
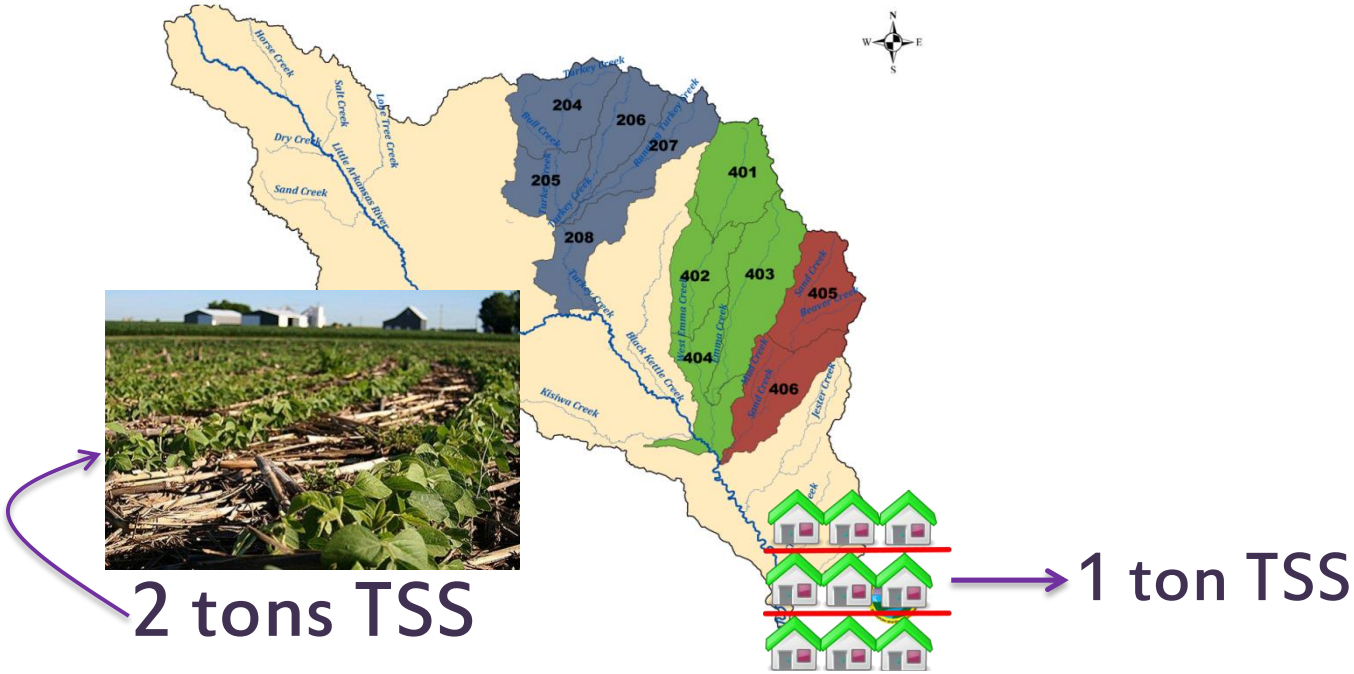
WRAPS Implementation Goals

- Atrazine from Cropland
- Sediment from Cropland
- Nutrients from Cropland and Livestock
- Fecal Coliform Bacteria from Livestock
- Sediment and Nutrients from Streambank and Riparian Areas



Program Framework

- Sediment credit ratio
  - Ratio serves as "factor of safety" given uncertainty in actual sediment delivery from offsite sediment sources to downstream aquatic systems
  - 2:1 selected to meet expectations of regulatory community (KDHE)



Program framework

- Allowable offsite BMPs
  - City's comfort level with "non-permanent" (e.g., no-till) BMPs was initially low
  - We accommodated by assuming that sediment credits provided by non-permanent BMPs would be replaced. The sediment credit fee reflects this assumption.

Where we are now

- Offsite enrollment - 30 developments comprising 171 acres
- Traditional onsite enrollment – 37 developments comprising 254 acres
- HDS units – approximately 46 have not been installed as a result of offsite program, saving developers about $ 690,000
- Offsite rural enrollment – 115 acres of no-till, 43 acres are needed to meet compliance
- As-built certification – 16 developments are completed and eligible to start receiving monthly bills