Wichita's Stormwater Permit Revised Due to Impaired River Water Quality

The Kansas Department of Health and Environment (KDHE) issued the City of Wichita a revised National Stormwater Discharge Eliminating System (NPDES) Stormwater Discharge Permit in October, 2008. Increased stormwater quality permit requirements included local legislative control for property development in the Wichita area. This is due to federal and state laws and regulations requiring improvement of the surface water quality for the Lower Arkansas River Basin. KDHE has designated the Lower Arkansas River Basin and tributaries as "impaired" for certain water quality parameters and lists improvements as a high priority.

The following report provides general comments on surface water quality trends for rivers and streams in the U.S. and Kansas. Historic surface water quality data used in establishing Wichita's stormwater discharge permit requirements are provided for the Lower Arkansas River Basin in the Wichita area.

General Information:

In Kansas and nationally, surface water quality improvements have been slow due to untreated stormwater runoff called nonpoint source pollution. This type of pollution is generally discharged from a large number of different sources including residential, commercial and industrial activities. Sediment loading is a factor in quantifying nonpoint source pollution and is often used as a good indicator of biological and chemical contaminant levels.

Sediment is a concern for both physical and chemical reasons. Physically, problems caused by excessive sediment may include:

- ✓ degraded water quality
- ✓ degraded aquatic habitat
- ✓ increased water-treatment costs
- ✓ decreased channel capacity
- ✓ clogged water intakes,
- ✓ loss of water-storage capacity in reservoirs.

Chemically, sediment serves as a carrier for various contaminants and, under certain conditions, as a source of contaminants to water and biota. Sediment-associated contaminants include:

- ✓ nutrients (nitrogen, phosphorus)

- ✓ bacteria (e. Coli and fecal coliform)
- ✓ trace elements (copper, mercury, lead)
- ✓ certain pesticides (atrazine)
- ✓ polychlorinated biphenyls (PCBs).

Nationally, sediment has been identified as the most prevalent contaminant of concern by the U.S. Environmental Protection Agency (USEPA). In general, when a high sediment level is found, biological and chemical contaminants are often present in quantities sufficient to exceed national and state health standards.

Specific Information:

Turbidity monitoring, a water clarity indicator, indicates the presence of suspended solids, suggesting that sediment loading in the watershed is a chronic problem. This phenomenon is found in the Wichita area at various established sampling locations.

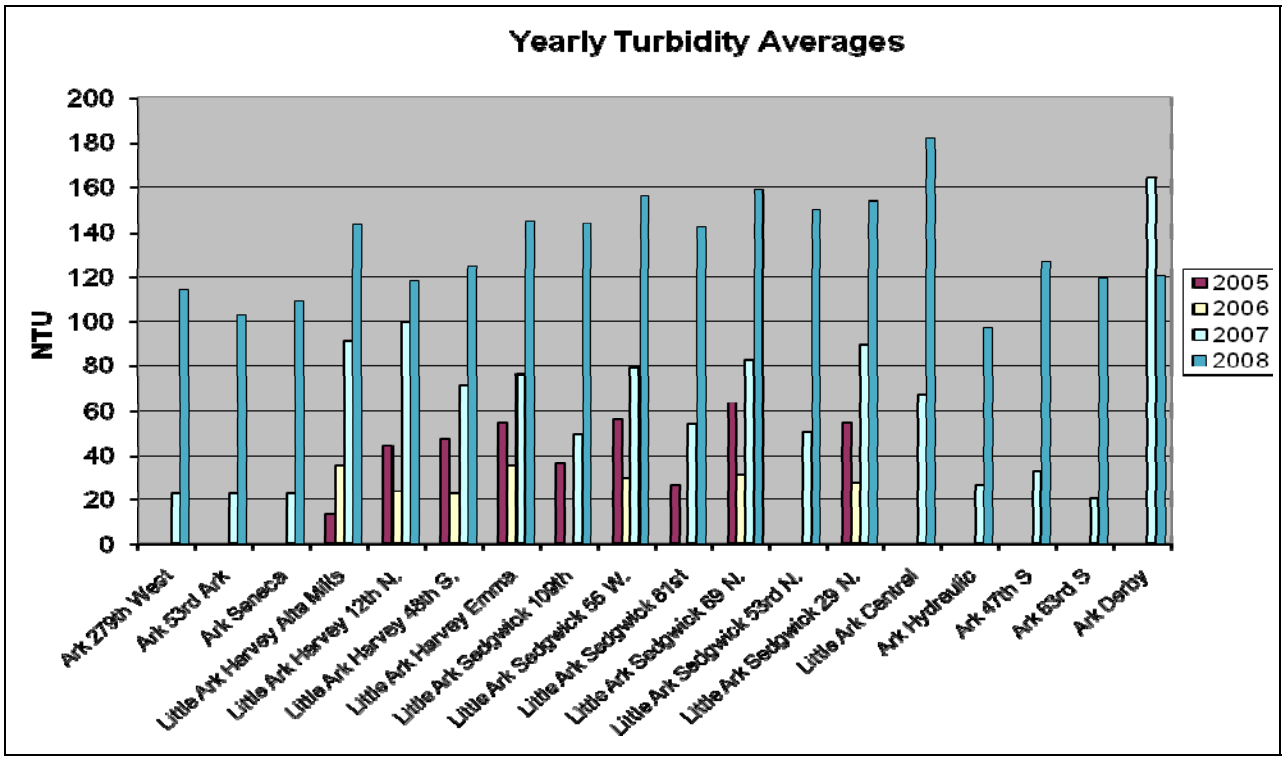


Figure 1

Contaminants that may adhere to total suspended solids, and impact the water quality in a stream are graphed below. The data in the Figure 2 reveal that the Arkansas River bacteria results are well above acceptable criteria for primary recreational uses. These levels impact recreational uses where river water could be inadvertently swallowed during an activity such as swimming, water skiing, canoeing, kayaking and fishing.

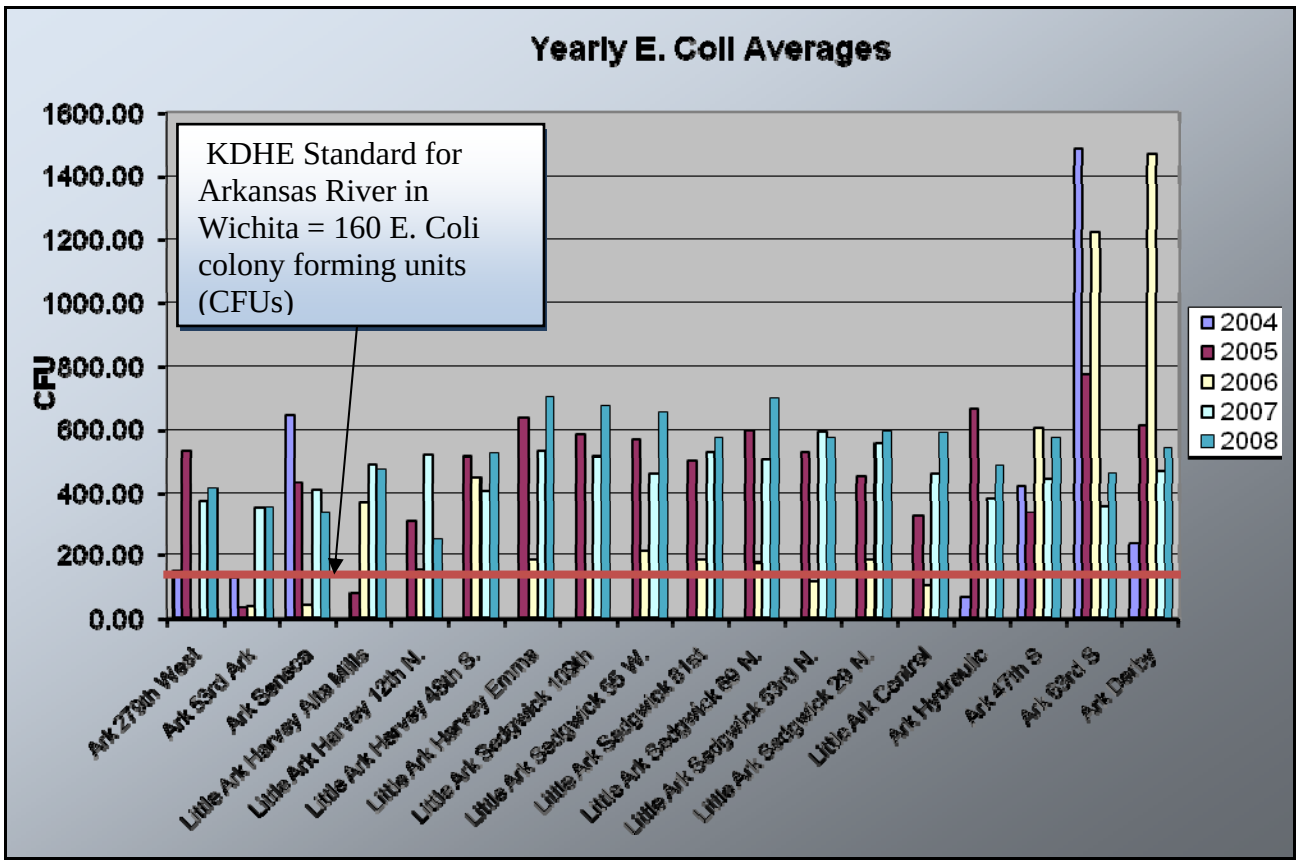


Figure 2

Nitrates concentrations depicted in Figure 3 are above KDHE water quality criteria for the Arkansas River watershed, especially in the Big Arkansas river segment. The nitrate levels in the Little Arkansas River upstream of Wichita are lower than the nitrate concentrations in the Big Arkansas. The site that has the most significant impact is the Big Arkansas at the Derby bridge site. This site receives all of the runoff from urban activities in Wichita, including the major streams flowing through Wichita; the Cowskin, the Big Slough, and Chisholm Creek. Nitrates and phosphorus are the key ingredients in fertilizer that contribute to algae growth in waterways.

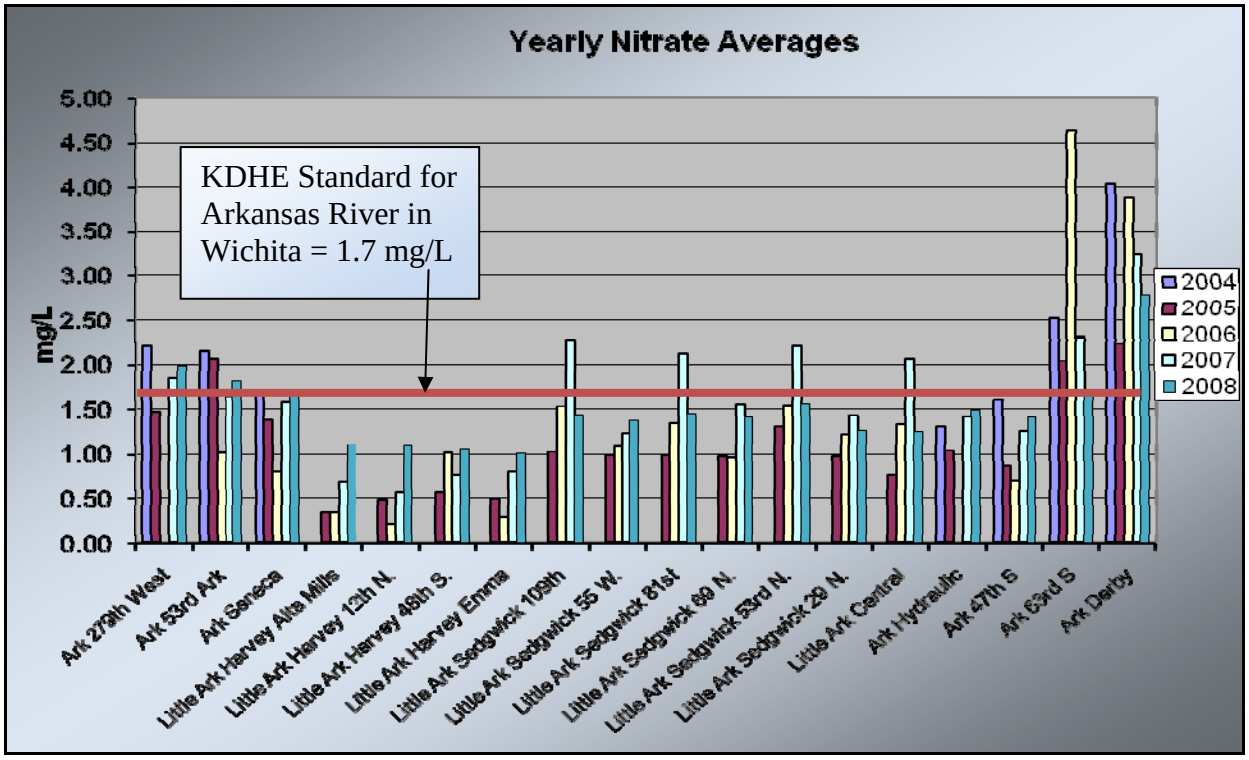


Figure 3

At majority of the sampling sites show phosphorus levels are meeting the KDHE water quality criteria, but are elevated during wet weather years such as 2007 and 2008. In freshwater lakes and rivers, phosphorus is often found to be the growth-limiting nutrient, because it occurs in the least amount relative to the needs of plants. If excessive amounts of phosphorus and nitrogen are added to the water, algae and aquatic plants can be produced in large quantities. When these algae die, bacteria decompose them, and use up oxygen. This process is called eutrophication. Dissolved oxygen concentrations can drop too low for fish to breathe, leading to fish kills. The loss of oxygen in the bottom waters can free phosphorus previously trapped in the sediments, further increasing the available phosphorus.

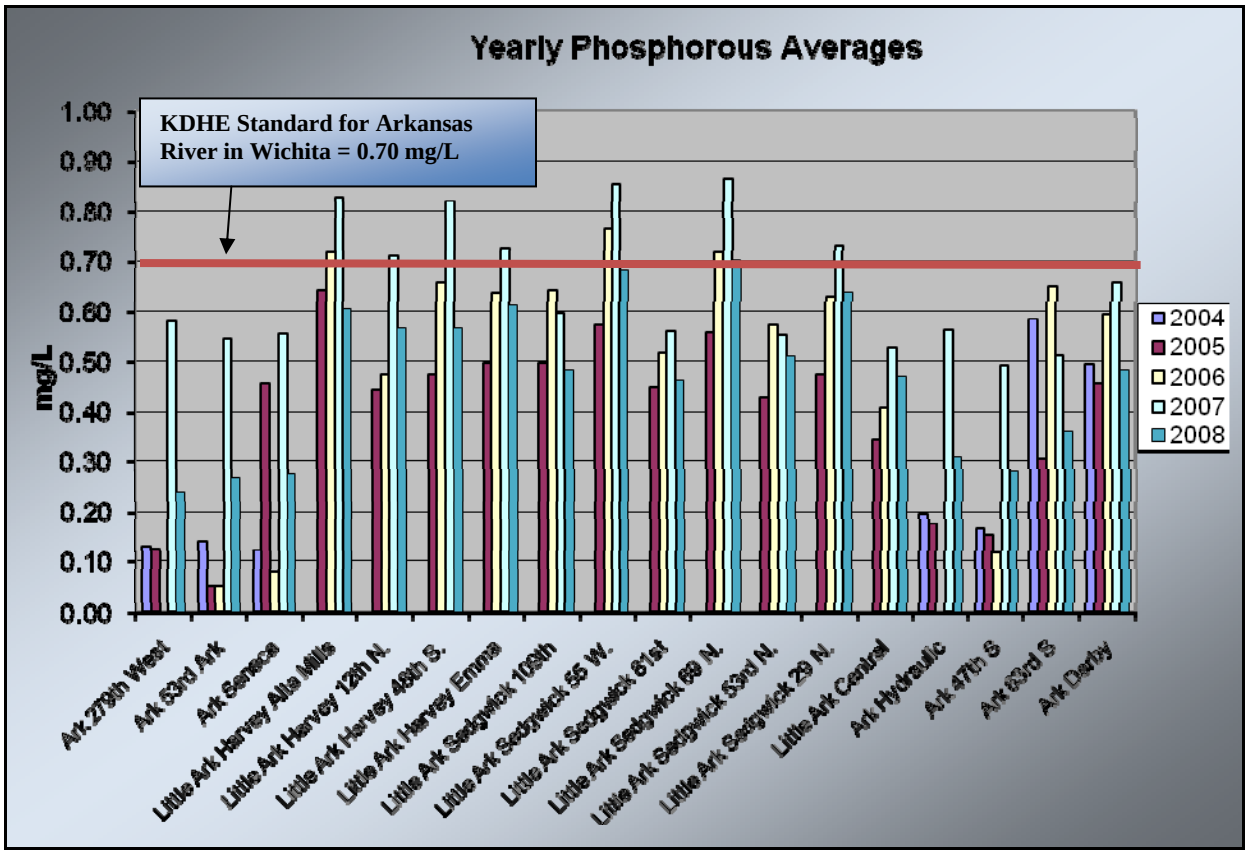
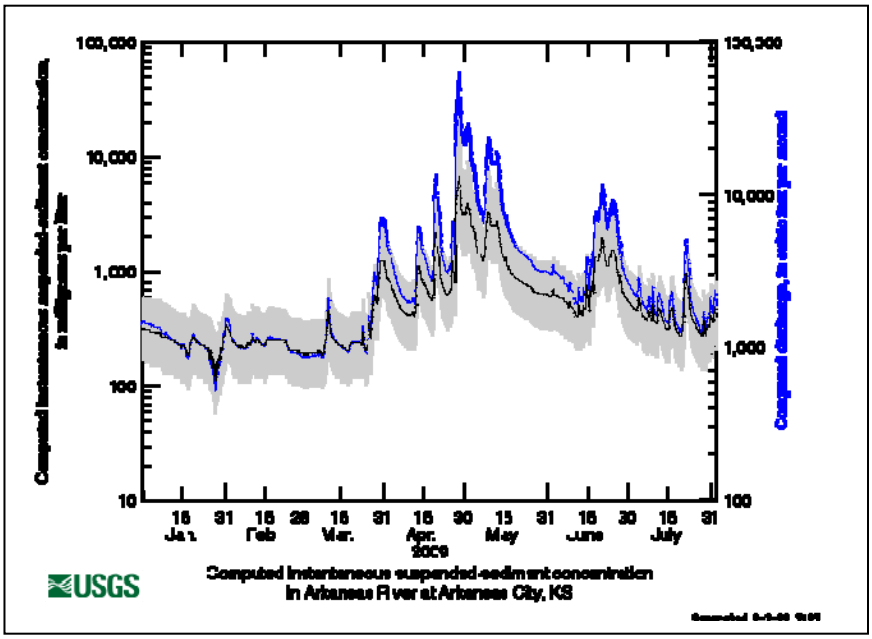


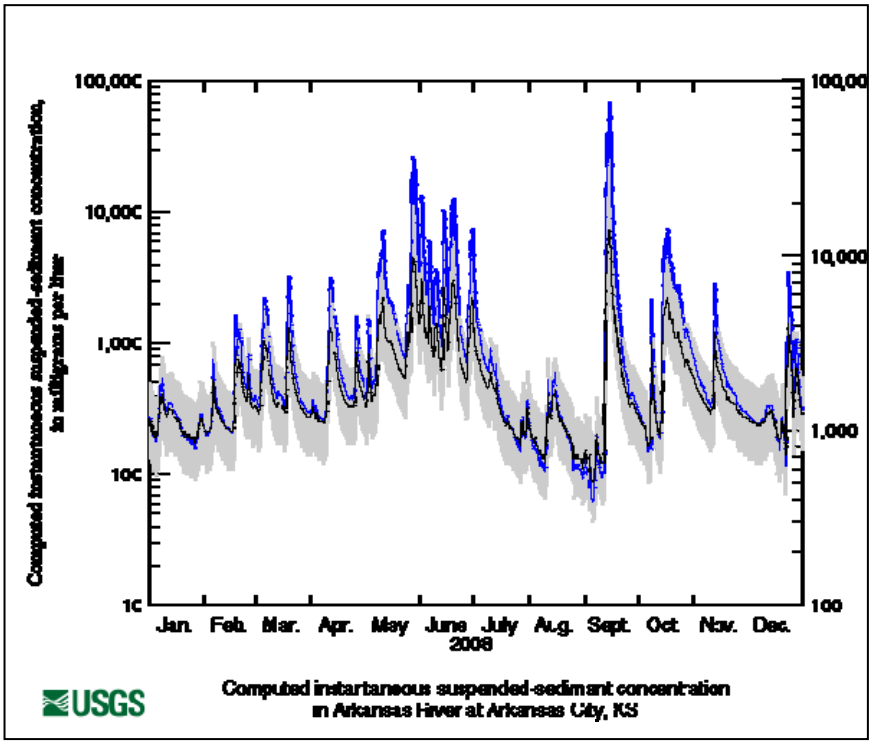
Figure 4

All of these contaminants depicted in the above graphs adhere to suspended solids, and are elevated during high flow periods from storm events. On the next page, are graphs (2009 YTD and 2008) of the USGS monitoring station of the Arkansas River near Arkansas City that reveal a very close correlation between flows and the concentration of total suspended solids.



Discharge Flow

Suspended Solids



Discharge Flow

Suspended Solids

KDHE TMDL Allocations on the Lower Arkansas River Basin

The table below describes the pollutants of concern that KDHE has identified in the most recent Total Maximum Daily Load (TMDL) allocation for the Lower Arkansas River watershed. The table provides a comparison of Biological Index Values and Average Nutrient and TSS Concentrations at monitoring stations located in the Arkansas River watershed.

Station	Macroinvertebrate Biological Index (MBI)	Total Phosphorus	Nitrate	Ammonia	Biochemical Oxygen Demand (BOD)	Total Suspended Solids (TSS)
Desired End Points	4.5 (or less)	0.70	1.7	Seasonal 0.15 – 1.5 mg/L (lowest values during summer)	Not Available	100 mg/L
Great Bend	5.45	1.13 mg/L	1.3 mg/L	1.0 mg/L	6.1 mg/L	106 mg/L
Valley Center*	4.67	0.80 mg/L	0.95 mg/L	0.16 mg/L	4.6 mg/L	127 mg/L
Derby	5.15	0.82 mg/L	1.89 mg/L	0.73 mg/L	6.6 mg/L	98 mg/L
Ark City	4.81	0.73 mg/L	1.37 mg/L	0.15 mg/L	6.6 mg/L	153 mg/L
Cowskin	4.56	0.33 mg/L	0.65 mg/L	0.085 mg/L	4.7 mg/L	103 mg/L

* Little Arkansas

Desired Endpoint for Arkansas River

The use of biological indices allows assessment of the cumulative impacts of dynamic water quality on aquatic communities present within the stream. As such, these index values serve as a baseline of biological health of the stream. Sampling occurs during open water season (April to November) within the aquatic stage of the life cycle of the macroinvertebrates. The desired endpoint would be average MBI values of 4.5 or less. Achievement of this endpoint would be indicative of full support of the aquatic life use in this stream reach. While MBIs can be utilized as an assessment tool to monitor stream conditions, there is no direct linkage between MBI values and nutrients (phosphorus, nitrate, ammonia, BOD). The nutrient concentrations along with factors such as flows, habitat and stream modifications will contribute to MBI values.

Given the runoff characteristics of the watershed, overland runoff can easily carry phosphorus and nitrates from the watershed into the streams. The sporadic nature of the MBI values indicates that nutrient impairment waxes and wanes over time, hinting that loadings are variable. As such, nonpoint sources are implicated as a primary source of these loadings.

There are a variety of sources contributing nutrient loads to the stream. Additional assessment is necessary to quantify those contributions. Sources include agricultural livestock and crop production activities and construction activities in urban development areas. At this point, the Total Maximum Daily Load Allocation for nonpoint sources will be a reduction of nutrient loadings such that average phosphorus concentrations are below 0.70 mg/L in stream and nitrate concentrations average below 1.70 mg/L