LOWER ARKANSAS BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody / Assessment Unit: Sand Creek
Water Quality Impairment: Total Phosphorus

1. INTRODUCTION

Subbasin: Little Arkansas

Counties: Harvey and Marion

HUC8: 11030012 **HUC10** (12): 04 (05, 06)

Ecoregion: Central Great Plains, Wellington-McPherson Lowland (27d)

Drainage Area: Approximately 103.8 square miles

Main Stem Water Quality Limited Segments: Sand Creek Segment 4, starting at the confluence with the Little Arkansas River in southern Harvey County and traveling upstream to the headwaters in southwestern Marion County.

Water Quality Limited Segments Covered Under this TMDL:

Station	Main Stem Segment	Tributary
SC535	Sand Creek (4)	Beaver Creek (26)
		Mud Creek (16)

2008, 2010 & 2012 303(d) Listing: Kansas Stream segments monitored by station SC535 are cited as impaired by Total Phosphorus (TP) for the Lower Arkansas Basin.

Impaired Use: Expected Aquatic Life, Contact Recreation and Domestic Water Supply

Water Quality Criteria:
Nutrients – Narratives: The introduction of plant nutrient into surface waters designated for domestic water supply use shall be controlled to prevent interference with the production of drinking water (K.A.R. 28-16-28e(c)(3)(D)).

The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life (K.A.R. 28-16-28e(c)(2)(A)).

The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of

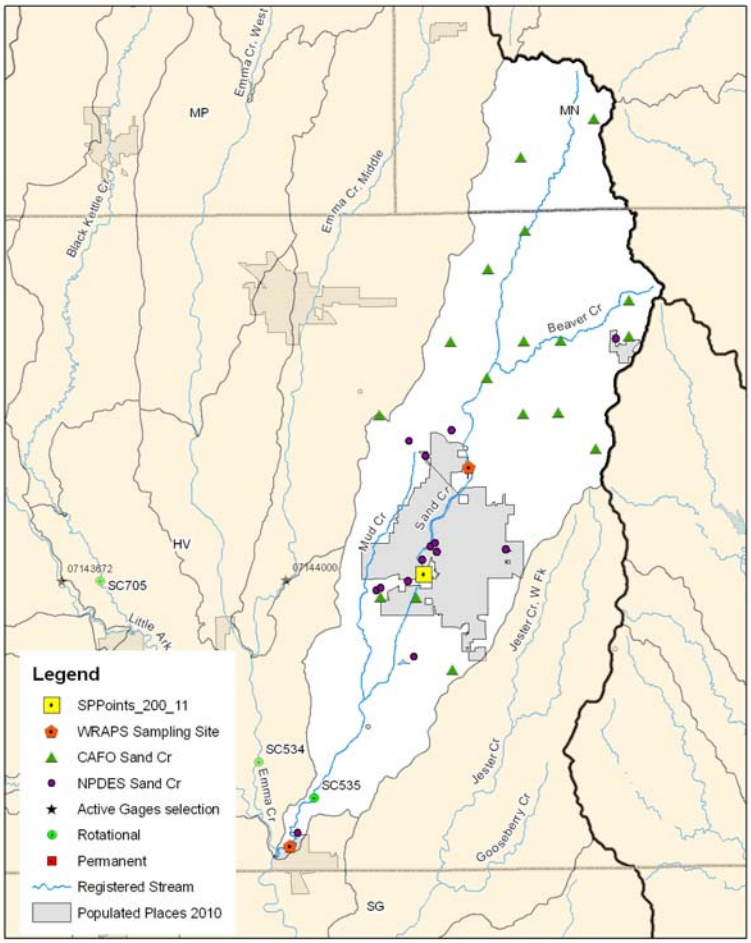
objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation (K.A.R. 28-26-28e(c)(7)(A)).

Designated Uses: For Sand Creek (segment 4): Expected Aquatic Life Support; Primary Contact Recreation B (segment 4); Drinking Water Supply; Food Procurement; Groundwater Recharge; Industrial Use; Irrigation Use and Livestock Use.

For Beaver Cr (segment 26): Expected Aquatic Life Support; Secondary Contact Recreation b; Drinking Water Supply; Food Procurement; Groundwater Recharge; Industrial Use; Irrigation Use and Livestock Use.

For Mud Creek (segment 16): Expected Aquatic Life Support; Secondary Contact Recreation b; Food Procurement; and Livestock Use.

Figure 1. Sand Creek Watershed Base Map.



2. CURRENT WATER QUALITY CONDITIONS AND DESIRED ENDPOINT

Level of Support for Designated Uses under 2012 – 303(d): Phosphorus levels on Sand Creek are consistently high. Excessive nutrients are not being controlled and are thus impairing aquatic life, domestic water supply, and contact recreation.

Stream Monitoring Sites and Period of Record: KDHE Rotational station SC535 on Sand Creek is sampled bimonthly or quarterly during the sampling years of: 1990, 1994, 1998, 2002, 2006, and 2010. KDHE Probabilistic Station SPA075 on Sand Creek at Newton was sampled three times during 2006.

Supplementing the routine KDHE sampling, the Little Arkansas Watershed Restoration and Protection Strategy (WRAPS) project sampled two locations within the Sand Creek watershed from 2008-2010. This sampling was conducted by Kansas State University.

USGS sampled Sand Creek at the same location as the KDHE sampling site during 2007 and 2008.

Hydrology: Long-term flow conditions for Sand Creek at SC535 were estimated based on the drainage area ratios between the Sand Creek subwatershed and the drainage area for USGS Gage 07144200 (1990-2012) on the Little Arkansas River at Valley Center. As displayed in Table 1, long-term estimates for Sand Creek, Beaver Creek and Mud Creek are detailed. Estimated flow values for the tributaries of Beaver Creek and Mud Creek were derived from the USGS Scientific Investigations Report 2004-5033 (Perry, 2004).

Table 1. Long-term Flow Conditions in the Little Arkansas Watershed as calculated from USGS gage 07144200 for Sand Creek and estimated tributary flow values as estimated from USGS (Perry, 2004).

Stream	Drainage Area	Mean Flow (cfs)	Percent of Flow Exceedance				
			90% (cfs)	75% (cfs)	50% (cfs)	25% (cfs)	10% (cfs)
Sand Cr (4) at SC535 (area ratio from USGS Gage 07144200)	103.77	30.63	1.41	2.97	5.24	12.04	51.28
USGS Estimated Flows (Perry, 2004)							
Mud Creek (16)	16.19	3.75	0	0	0	0.04	1.97
Beaver Creek (26)	17.88	5.32	0	0	0	0.7	3.96

Flow duration curves over the period of record from 1990-2011 are illustrated for the USGS Gage 07144200 and for Sand Creek at KDHE sampling station SC535 in Figure 2. Annual flow averages for Sand Creek are detailed in Figure 3. Extremely dry years were observed in 1990, 1991, 1994, 2006, and 2011. Based on annual flow averages, the wetter years include 1993, 1995, 1998, 1999, 2001, and 2009. As seen in Figure 4, monthly flow averages indicate the months with the highest flows are May, June, and July.

Figure 2. Flow Durations curve for USGS Gage 07144200 on the Little Ark River at Valley Center and for Sand Creek at SC535.

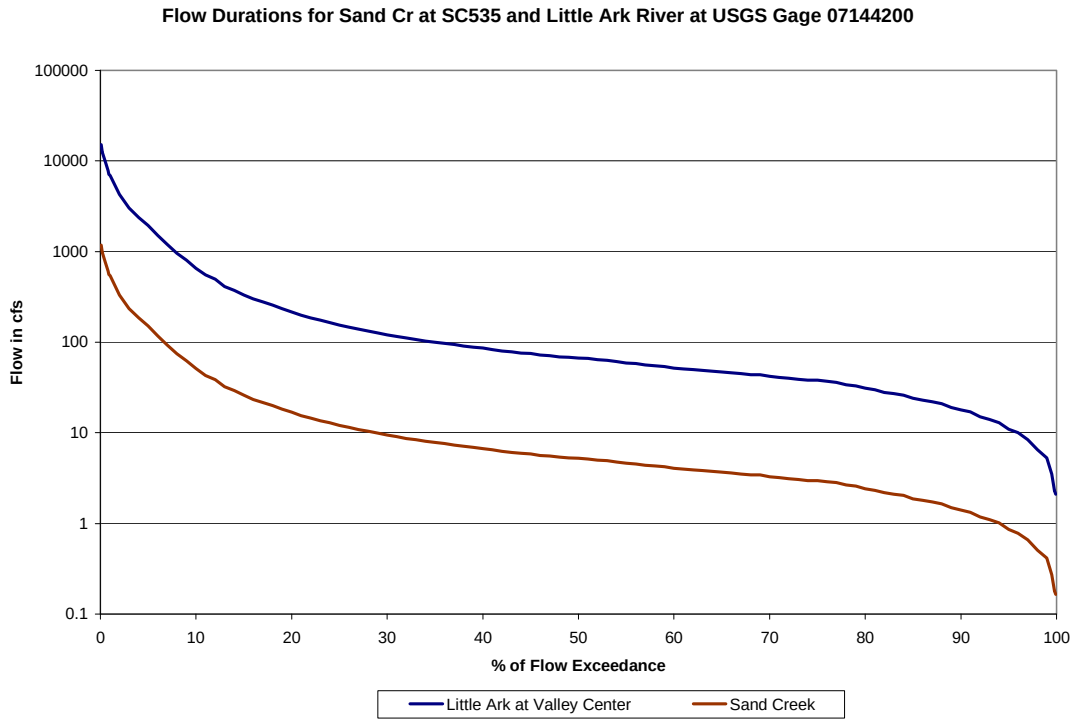


Figure 3. Annual Flow Averages at SC535 on Sand Creek.

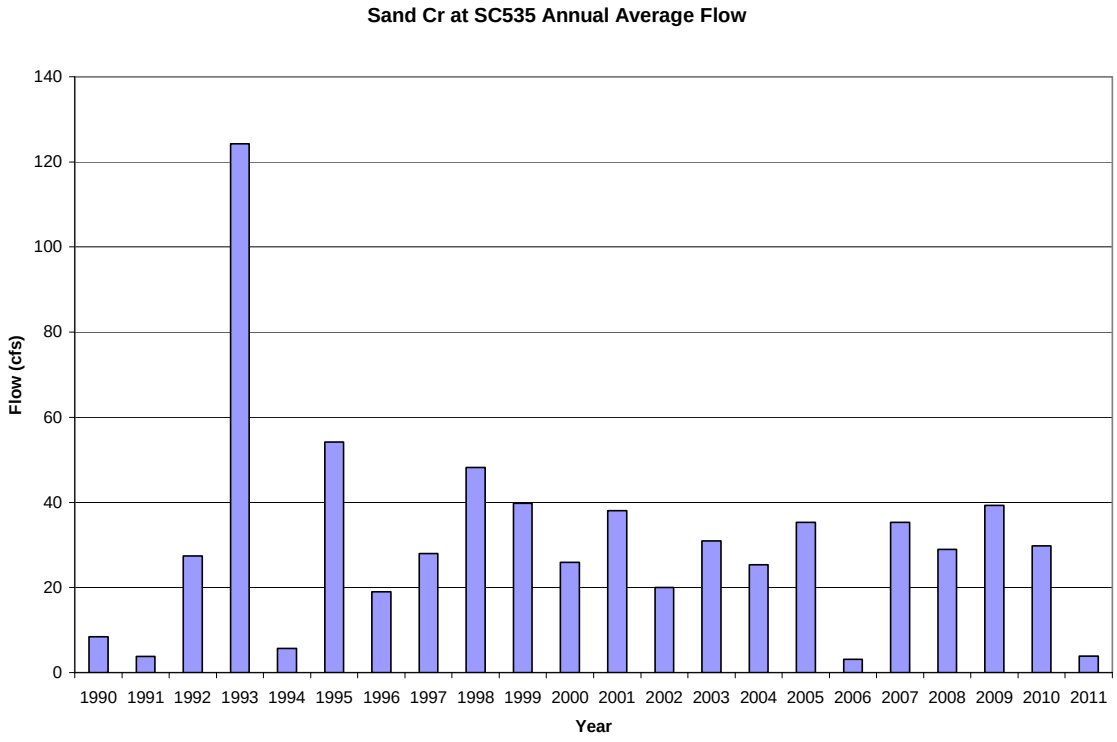
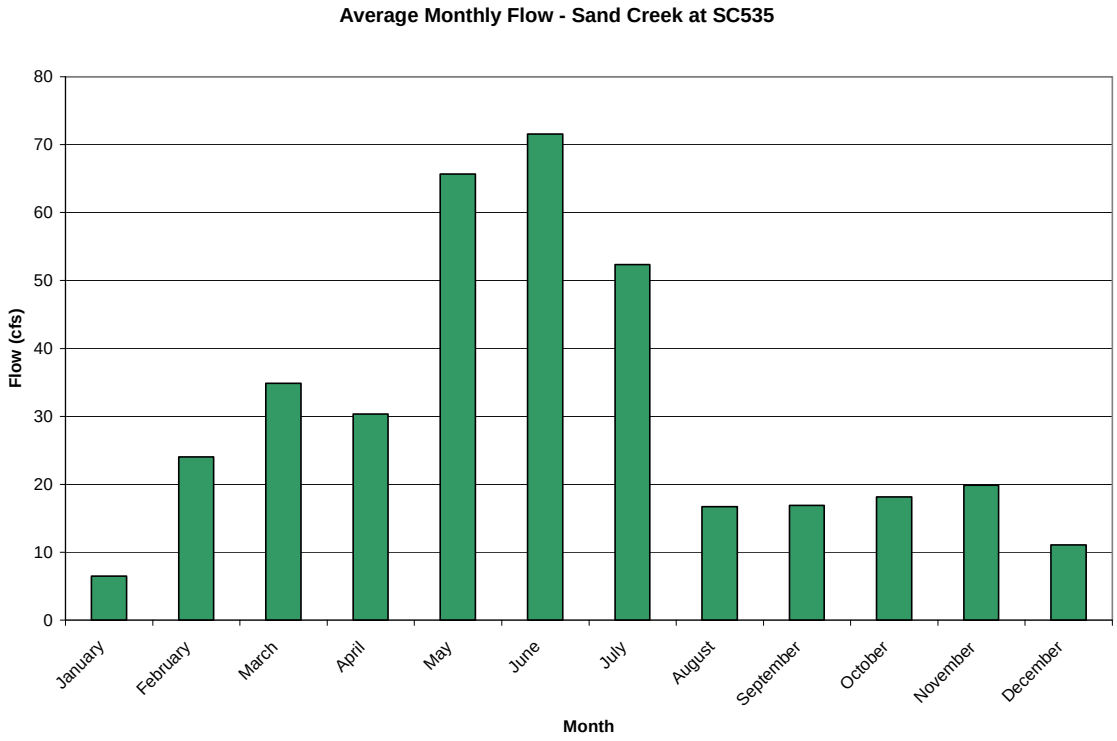


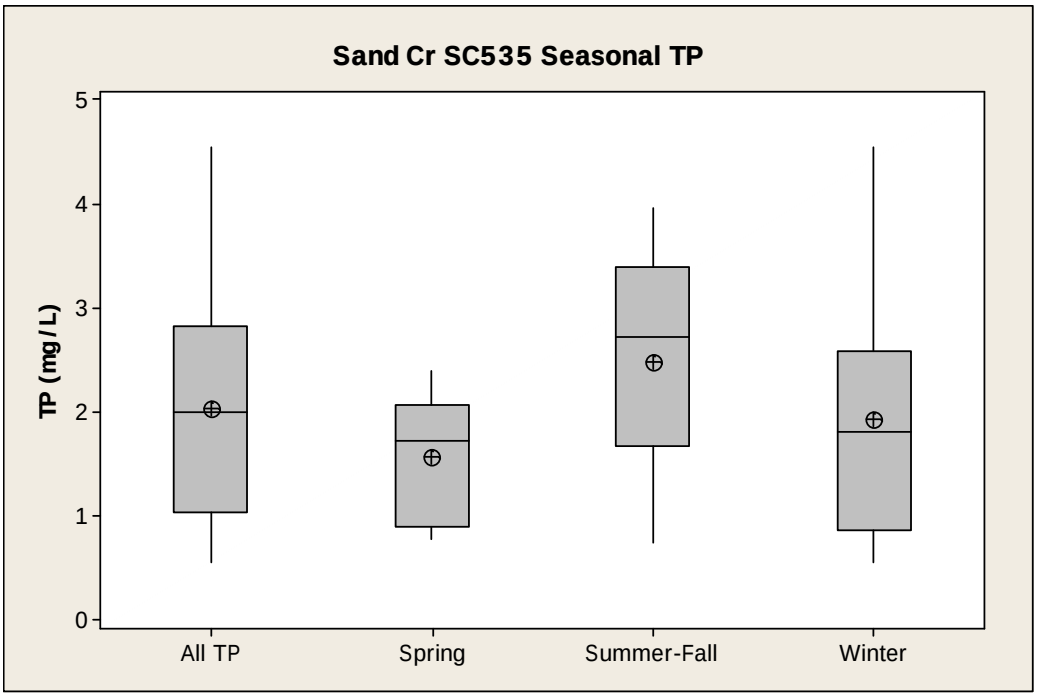
Figure 4. Monthly flow averages at SC535 on Sand Creek.



Assessment Season: Seasonal variability has been accounted for in this TMDL. A three season approach was utilized to include: the Spring season consisting of the months of April, May, and June; the Summer-Fall season consisting of the months of July, August, September, and October, and the Winter season that includes November, December, January, February, and March.

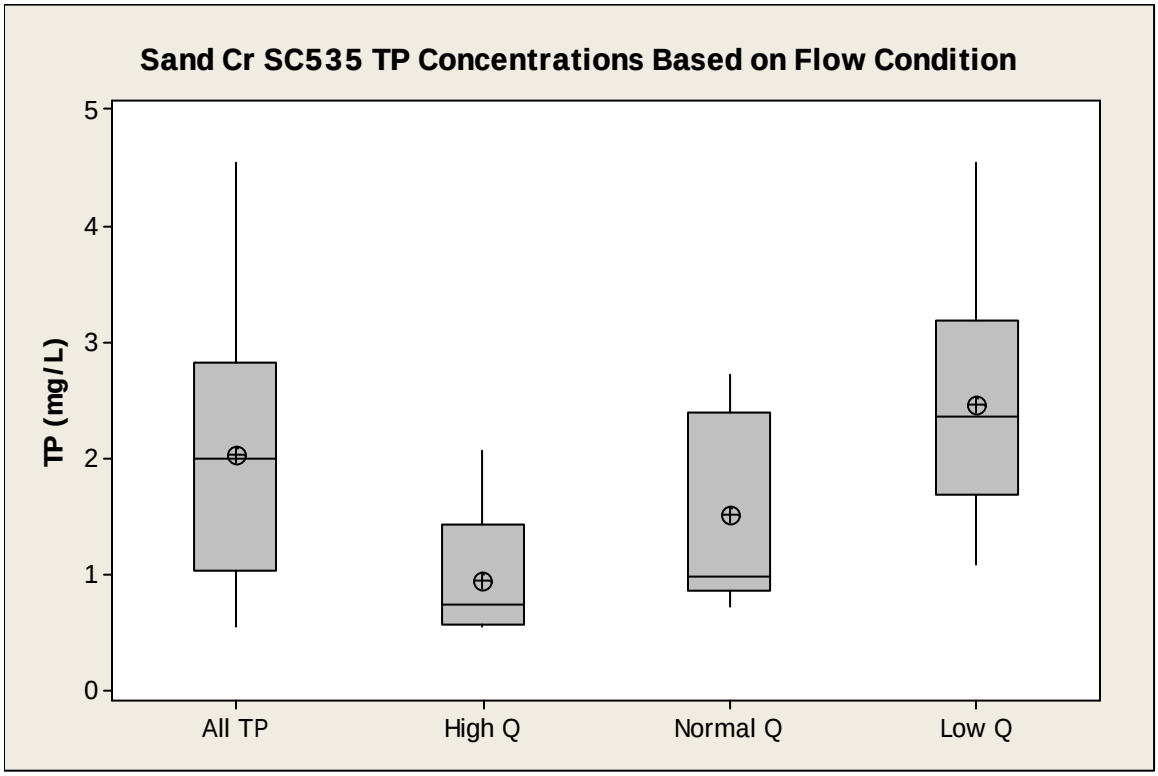
Phosphorus Concentrations: The overall Total Phosphorus (TP) concentration average at SC535 is 2.03 mg/L, with a median concentration of 2.0 mg/L. Seasonal TP averages range from a low of 1.58 mg/L in the Spring season to a high of 2.48 mg/L in the Summer-Fall season. Seasonal median concentrations are 1.73 mg/L in the Spring, 1.82 mg/L in the Winter, and 2.72 mg/L in the Summer-Fall season. Seasonal TP concentrations are further detailed in Figure 5.

Figure 5. Seasonal Boxplot of TP data at SC535.



TP concentration averages are the highest during the low flow condition (50-99% flow exceedance), with an average of 2.46 mg/L at SC535. During normal flows (25-49% flow exceedance) TP averages 1.52 mg/L and during the high flow condition (0-24% flow exceedance) TP has the lowest average at 0.95 mg/L at SC535. Median concentrations are 2.35 mg/L for the low flow condition, 0.98 mg/L for the normal flow condition, and 0.74 mg/L for the high flow condition. TP concentrations relative to the flow conditions are detailed in Figure 6.

Figure 6. Boxplot of TP data at SC535 relative to flow condition.

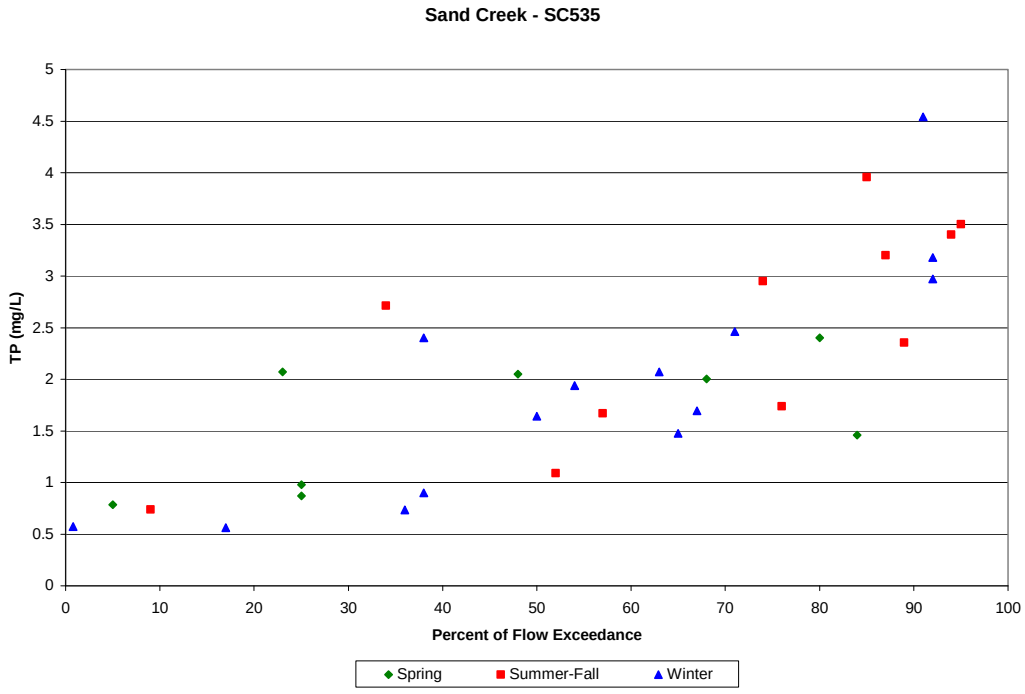


Seasonal TP concentrations based on the flow conditions are further detailed in Figure 7 and Table 2. The highest average TP concentrations are observed during the low flow condition during the summer-fall season and the lowest average TP concentrations are observed during the high flow condition in the winter. The higher TP concentrations during the low flow condition are indicative of wastewater loading, which in this case is a result of TP loading from the City of Newton's wastewater treatment plant.

Table 2. Seasonal average and median TP concentrations based on flow conditions.

Season / Flow Condition	TP (mg/L) Low Q (50-99%) cfs	TP (mg/L) Normal Q (25-49%) cfs	TP (mg/L) High Q (0-24%) cfs	TP (mg/L) Average (mg/L)	TP Season Median (mg/L)
Spring Avg/Median	1.96 / 2.00	1.3 / 0.98	1.43 / 1.43	1.58	1.73
Summer-Fall Avg/Median	2.65 / 2.95	2.72 / 2.72	0.74 / 0.74	2.48	2.72
Winter Avg/Median	2.44 / 2.07	1.35 / 0.90	0.57 / 0.57	1.94	1.82
Flow Condition Average (mg/L)	2.46	1.52	0.95	2.03	
Flow Condition Median (mg/L)	2.36	0.98	0.74		2.00

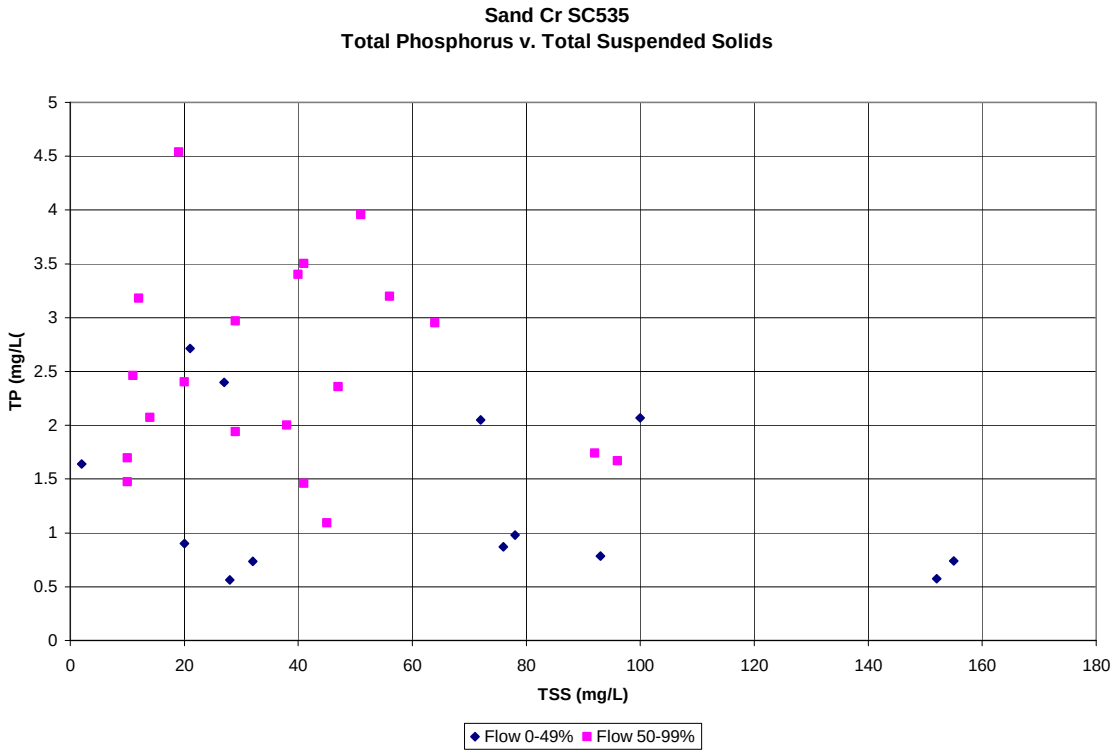
Figure 7. Seasonal concentrations relative to percent of Flow Exceedance at SC535.



Because of the large variability in ambient phosphorus concentrations, median values are appropriate for determining long-term conditions. Listing on the 2012 section 303(d) list for phosphorus was determined by median concentrations exceeding 0.201 mg/L for any station.

Phosphorus is typically linked to sediment or total suspended solids because of the propensity of those solids to adsorb phosphorus. As seen in Figure 8, TSS levels on Sand Creek are poorly correlated with phosphorus concentrations. This notable lack of relation between the two is indicative of the dominant influence of the Newton wastewater with the elevated phosphorus and low TSS content within Sand Creek.

Figure 8. Total phosphorus concentrations relative to Total suspended solids concentrations at SC535.



Data collected by USGS in the watershed are detailed in Table 3. These samples were collected in 2007 and 2008 when KDHE did not sample SC535. Concentrations are similar to those seen by KDHE at SC535, which is expected since the USGS sampling location is near the KDHE sampling site. The orthophosphate (PO4) at low flow and the proportion of TP that is PO4 is indicative of Newton's wastewater. Runoff tends to dilute the wastewater concentrations.

Table 3. USGS Sampling Concentrations on Sand Creek.

Sample Date	TP (mg/L)	Orthophosphate (mg/L)	Recorded Flow (cfs)
8/14/2007	1.23	1.16	4.8
12/5/2007	3.24	3.13	3.2
3/5/2008	0.82	0.396	107
4/25/2008	0.69	0.525	41
5/28/2008	0.73	0.361	733

The Little Arkansas Watershed Restoration and Protection Strategy (WRAPS) project has collected water quality data since 2008 at two sampling locations on Sand Creek, an upper Sand Creek location above the City of Newton and a lower Sand Creek sampling station near or at the SC535 sampling location (Barnes, 2011). A TP profile along Sand Creek for the sampling years of 2008, 2009, and 2010 are illustrated in Figure 9a. Figure 9b details a ratio comparison for the samples collected in the Upper Sand Creek watershed to those samples collected at the Lower Sand Creek sampling station on the same day, indicating concentrations are higher at the lower station. Monthly TP concentrations and averages for the two sampling locations in Sand Creek are detailed in Table 4 and Figures 10a and 10b. The figures detail the higher TP concentrations at the lower Sand Creek station.

Figure 9a. Sampling profile of WRAPS sampling data from 2008-2010.

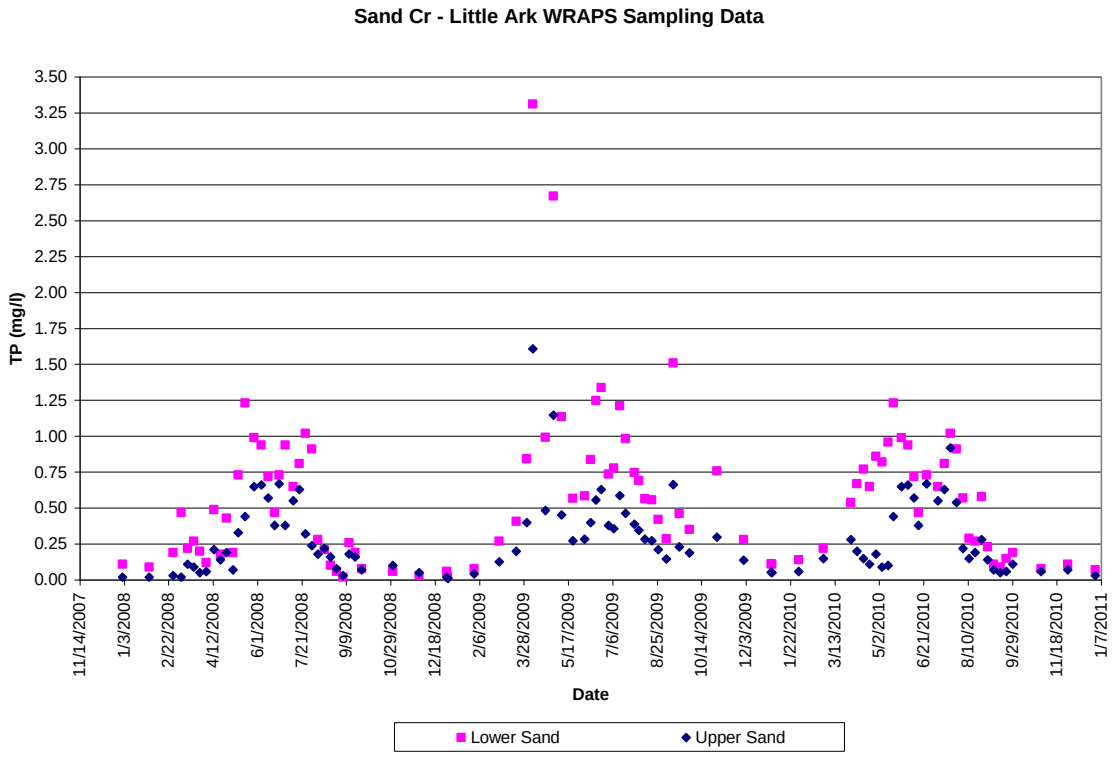


Figure 9b. Comparison of TP concentrations between lower and upper Sand Cr samples collected on the same day**.**

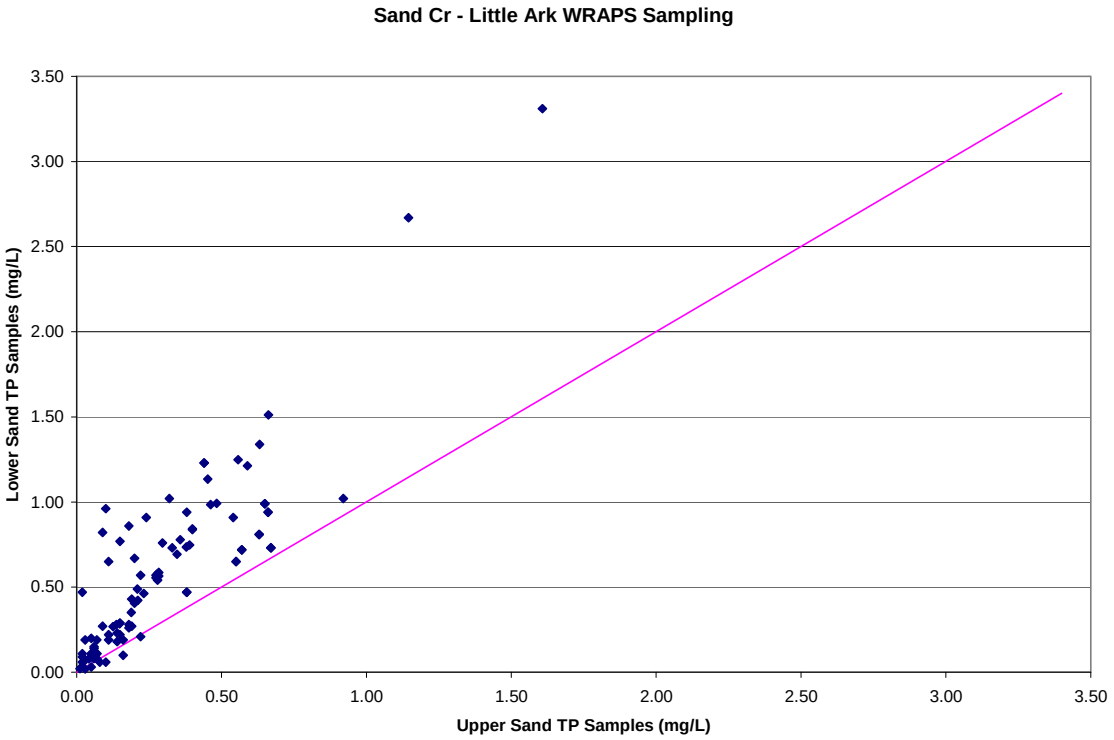


Table 4. Monthly average and median TP concentrations for Sand Creek WRAPS samples (2008-2010).

Month	Upper Sand TP Average (mg/l)	Upper Sand TP Median (mg/l)	Lower Sand TP Average (mg/l)	Lower Sand TP Median (mg/l)
January	0.03	0.03	0.09	0.10
February	0.10	0.13	0.23	0.22
March	0.16	0.11	0.42	0.41
April	0.41	0.19	1.01	0.67
May	0.35	0.39	0.88	0.98
June	0.54	0.57	0.81	0.73
July	0.52	0.54	0.87	0.81
August	0.22	0.22	0.42	0.42
September	0.16	0.14	0.30	0.19
October	0.15	0.10	0.30	0.08
November	0.09	0.07	0.14	0.11
December	0.03	0.03	0.08	0.07
All Samples	**0.29**	**0.21**	**0.58**	**0.54**

Figure 10a. Monthly TP concentrations for WRAPS sampling data on Sand Creek.

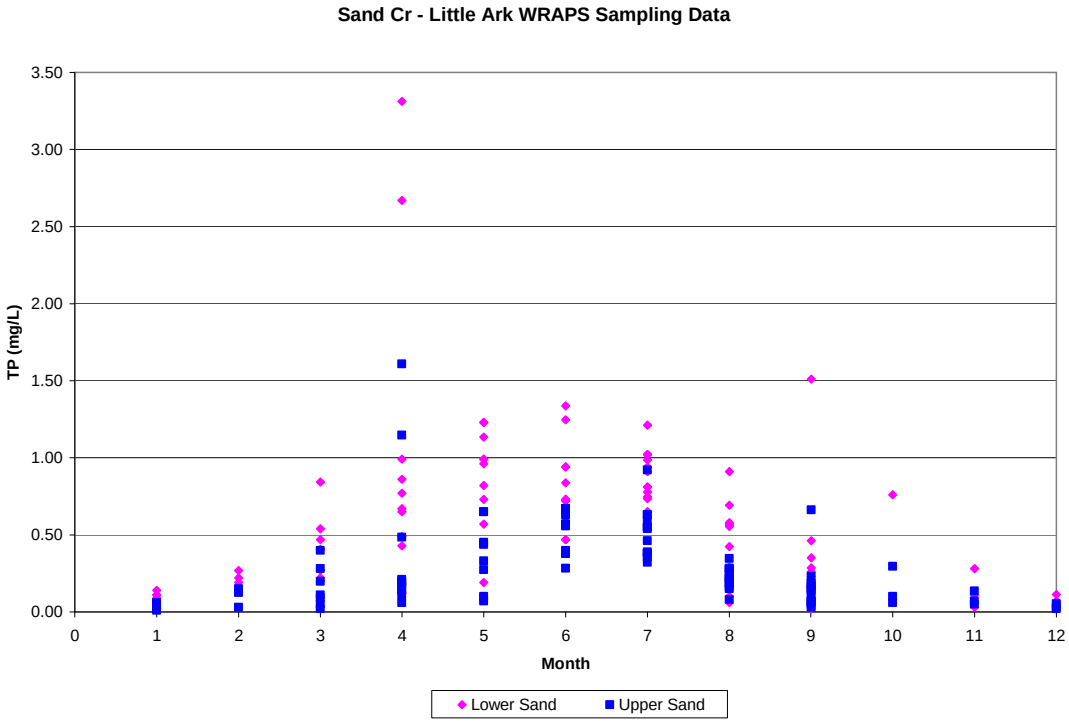


Figure 10b. Monthly TP concentration boxplots for WRAPS sampling data for the Upper and Lower Sand Creek sampling sets for select months (April-September).

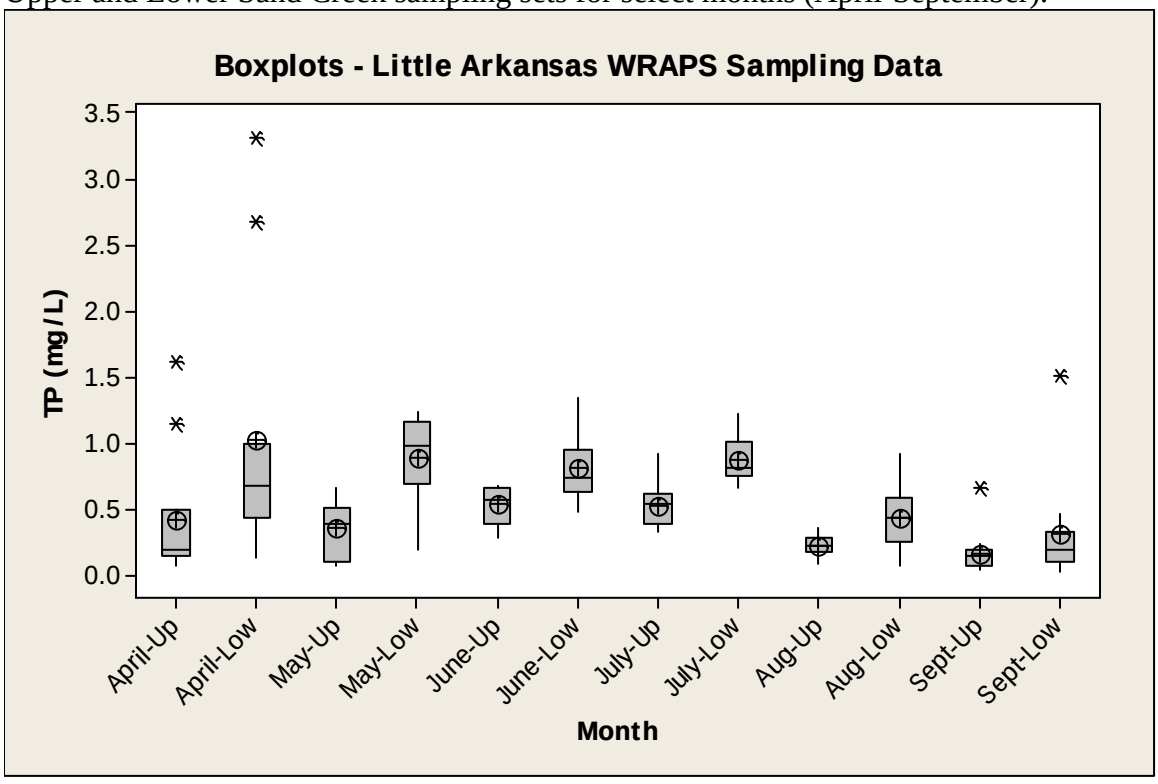
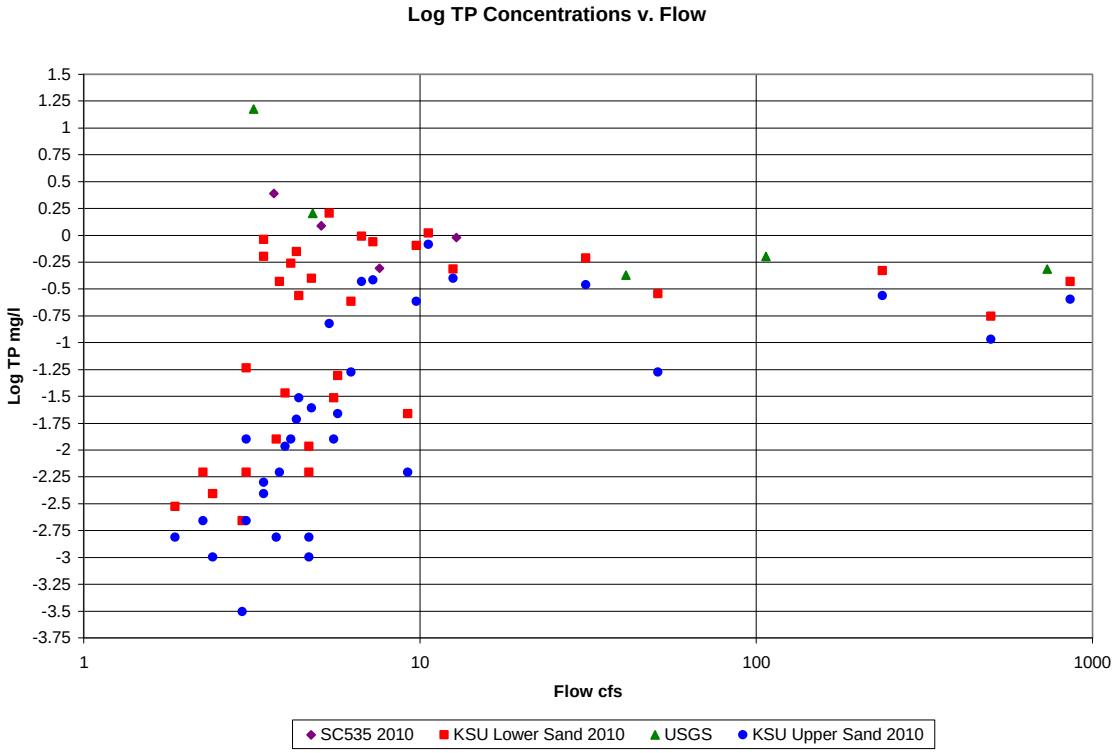


Figure 11. TP Concentrations in lower Sand Creek during 2010 for KDHE and WRAPS data and from USGS during 2007-2008.



When comparing all of the TP concentrations relative to the flow values between all of the available data, concentrations for samples obtained at SC535 are distinctively higher. However, isolating the common sampling year of 2010 between SC535 and the Sand Creek samples collected by the WRAPS group, the observed TP concentrations are comparable relative to the flow as seen in Figure 11. A summary of the three data sets based on the sampling year is detailed in Figure 12 and Table 5. Annual average TP concentrations in Sand Creek have declined in recent years.

Figure 12. Summary of annual TP averages for Lower Sand Creek.

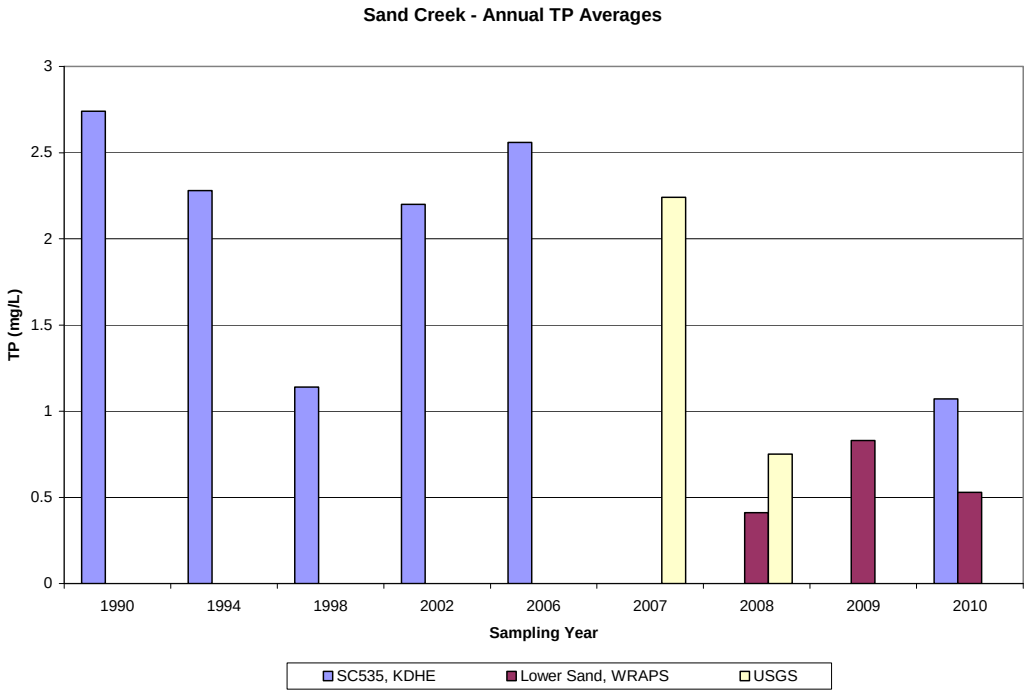


Table 5. Summary of annual TP concentration averages for Lower Sand Creek samples.

Year	Source	TP Annual Average (mg/L)
1990	SC535, KDHE	2.74
1994	SC535, KDHE	2.28
1998	SC535, KDHE	1.14
2002	SC535, KDHE	2.20
2006	SC535, KDHE	2.56
2007	USGS	2.24
2008	USGS	0.75
2008	Lower Sand, WRAPS/KSU	0.41
2009	Lower Sand, WRAPS/KSU	0.83
2010	Lower Sand, WRAPS/KSU	0.53
2010	SC535, KDHE	1.07

In the 2006, the KDHE stream probabilistic program sampled Sand Creek in Newton just below the Newton wastewater treatment plant. The sampling date for the probabilistic sampling site SPA075, coincided with three sampling dates at SC535. Figure 13 and Table 6 detail the concentrations for the three sampling dates in 2006 from the two KDHE sites and the TP concentrations associated from Newton's discharge around these same dates. The TP loads and concentrations from Newton are reduced under low flow conditions, ranging from 20-60% for these three samples in 2006. Under extremely low flow conditions, as suggested with the October 18, 2006 sample, the TP concentration at SC535 was only 21% lower than the concentration observed at the Newton probabilistic sampling site. The low flow TP concentration reductions from Newton to the sampling site SC535 are likely a function of both the flow condition and assimilation. The amount of the wastewater load reaching SC535 is considerably less under the low flow condition since much of the flow is lost to the alluvium in the watershed prior to reaching SC535. Any additional contribution to the stream, or interaction with groundwater, will help dilute the TP concentrations in Sand Creek when the flow leaving Newton is predominantly wastewater effluent. There is less dilution of the TP concentrations leaving Newton during the low flow condition when there is a lack of additional water to the stream system.

Figure 13. Comparative TP concentrations in Sand Creek during 2006.

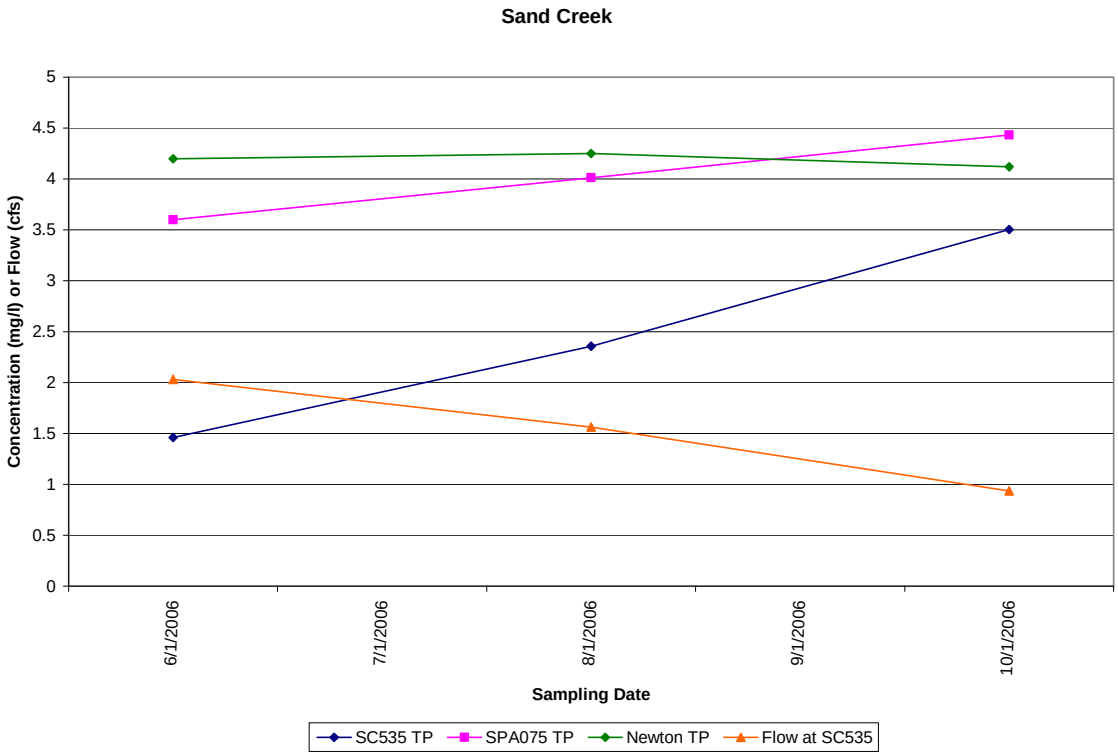


Table 6. TP concentrations for comparative sampling dates on Sand Creek from Newton, SPA075 and SC535.

Sampling Date	Newton Wastewater Discharge TP (mg/l)	SPA075 TP (mg/l)	SC535 TP (mg/l)
6/21/2006	4.2	3.60	1.46
8/16/2006	4.25		
8/23/2006		4.01	2.35
9/25/2006	4.27		
10/18/2006		4.43	3.50
10/23/2006	4.12		

There are three factors in place dictating phosphorus concentrations in the lower reaches of Sand Creek. The first factor is the effect of Newton's wastewater on the downstream hydrology and nutrient content. The second influence is nonpoint sources in proximity to Sand Creek that contribute direct loadings. The final influence is wet weather sources that dominate loading during runoff events, which includes the wet weather impacts of urban stormwater from Newton and runoff from nonpoint sources in the aftermath of rainfall. Stormwater runoff from Newton is viewed as a point source and would have to be distinguished from the rural nonpoint sources in the watershed.

Relationship between Phosphorus and Biological Indicators: The narrative criteria of the Kansas Water Quality Standards are based on indications of the prevailing biological community. Excessive primary productivity may be indicated by extreme swings in dissolved oxygen or pH as the chemical reaction of photosynthesis and respiration alter the ambient levels of oxygen or acid-base balance of a stream. The relationship between pH and stream temperature is illustrated in Figure 14. Higher pH values tend to occur during higher photosynthesis periods. Levels of pH at SC535 have never exceeded the pH criterion of 8.5, and as seen in Figure 15 do not have a discernable relationship with streamflow at SC535. On Sand Creek, dissolved oxygen tends to swing inversely to the ambient temperature of the stream as seen in Figure 16a, which also details the monthly average DO concentrations and temperature at SC535. Monthly averages for DO are below the 5 mg/L during the months of July and September. A Dissolved Oxygen TMDL was approved in 2007 for Sand Creek. Sestonic chlorophyll samples have been collected by KDHE the last two sampling years in Sand Creek (2006 & 2010), with an average chlorophyll of 8.4 µg/L and a median of 4.78 µg/L. Based on the limited Chlorophyll data in Sand Creek, chlorophyll concentrations are higher with increased flow. Higher chlorophyll concentrations are observed with lower TP concentrations. This is likely due to the higher flow conditions diluting the TP concentrations as the flow transports and flushes more chlorophyll (releasing attached chlorophyll). Chlorophyll data in Sand Creek is detailed in Figure 16b.

Figure 14. Relationship between pH and stream temperature at SC535.

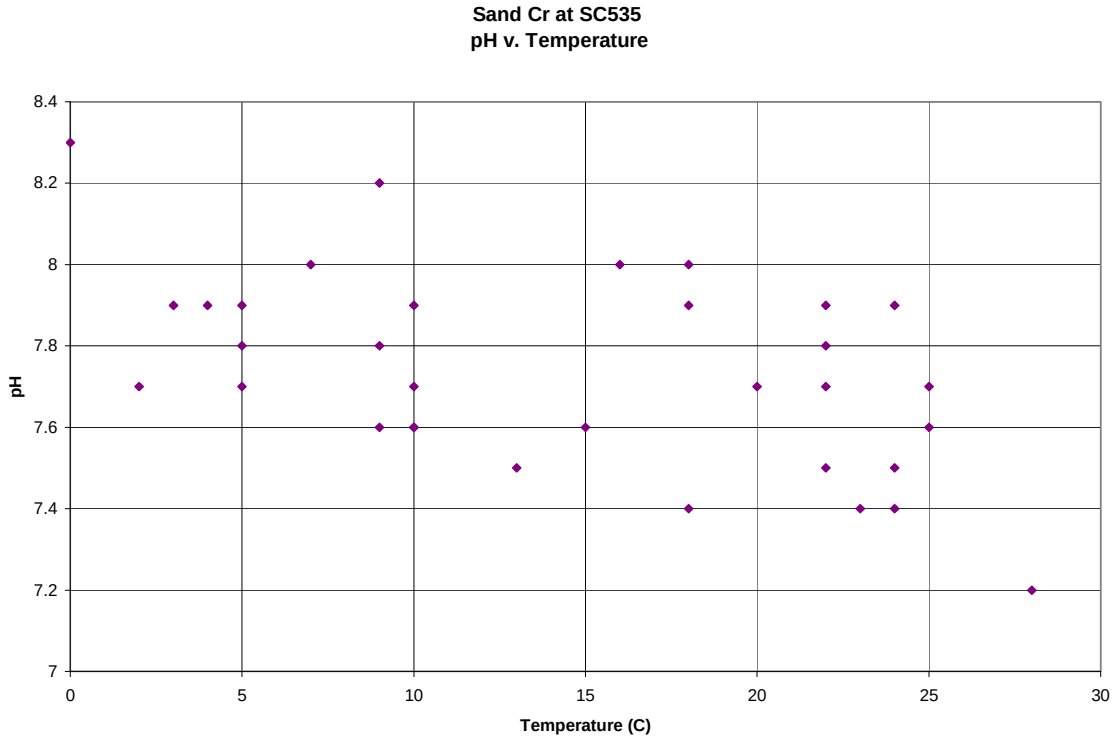


Figure 15. Relationship between pH and stream flow at SC535.

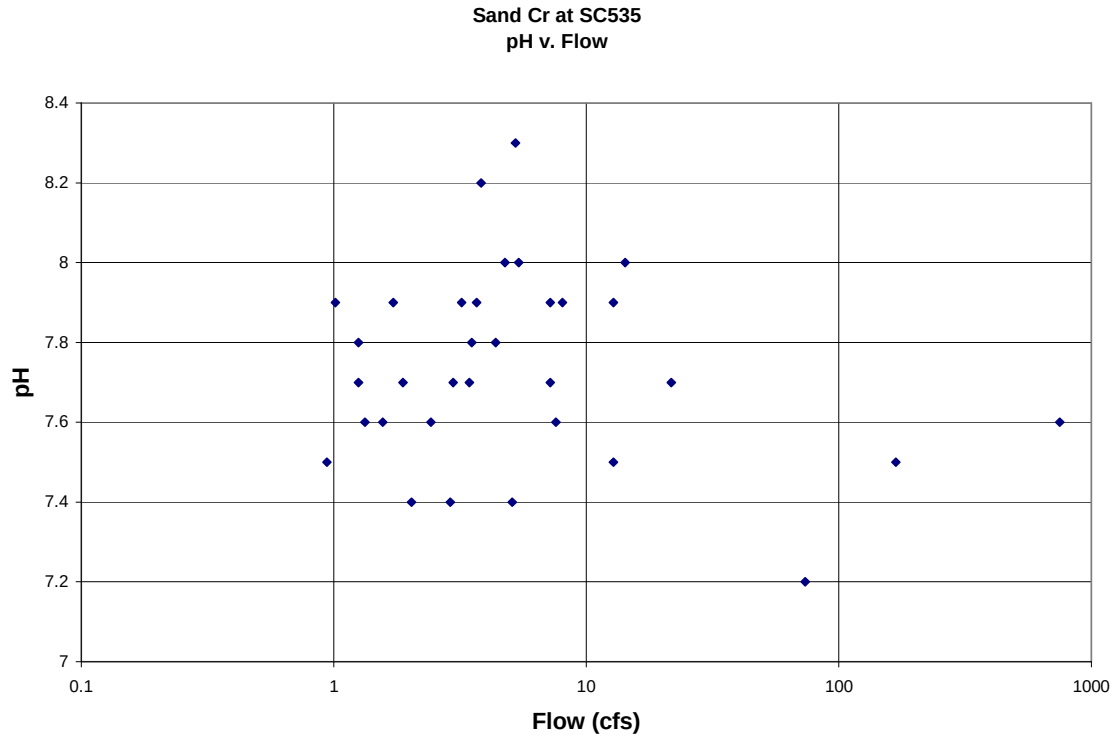


Figure 16a. Dissolved oxygen and stream temperature monthly averages at SC535.

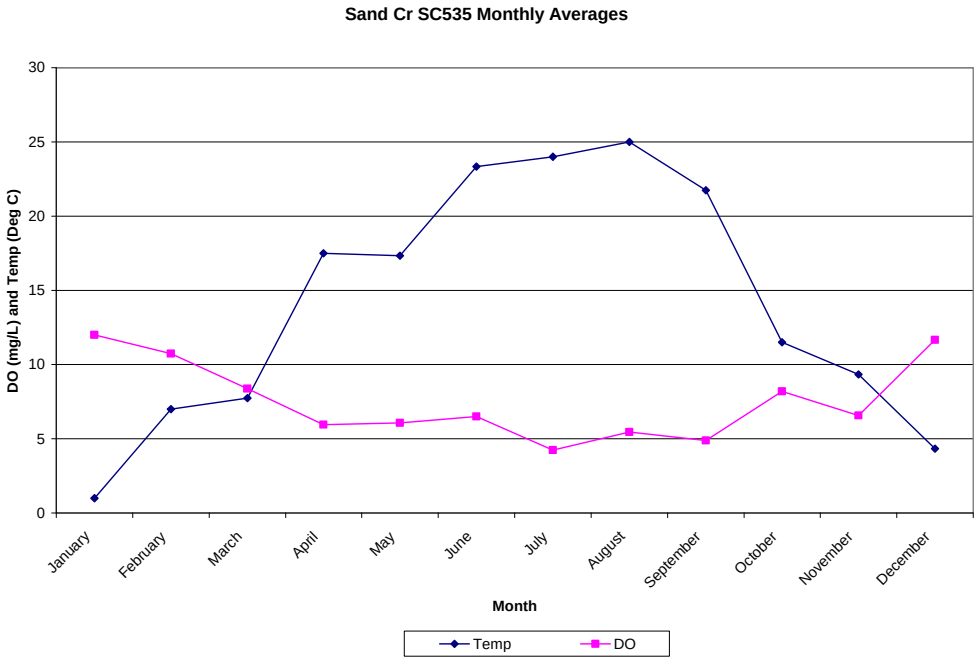
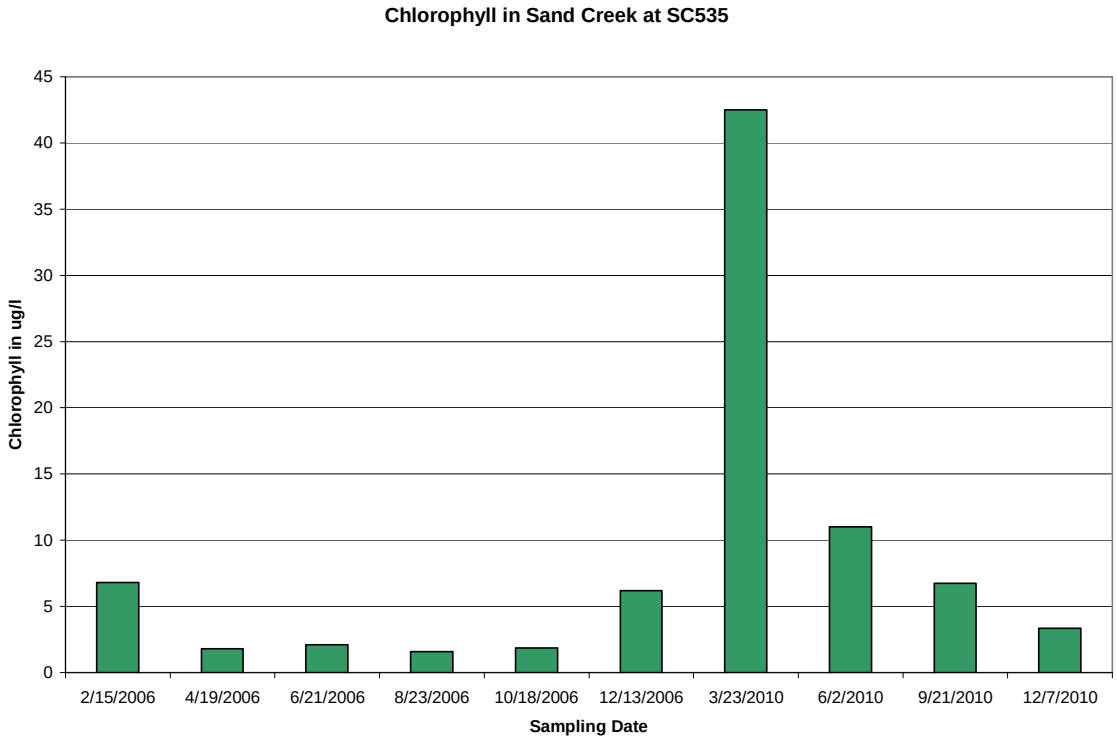


Figure 16b. Chlorophyll in Sand Creek at SC535



Current EPA philosophy is predicated on the lowest quartile of stream total phosphorus within an ecoregion as indicative of minimum impact conditions (in absence of reference streams). This generalization is not tied to specific biological conditions, but represents water quality protection policy guiding EPA's administration of clean water programs. Figure 17 displays the relationship between lower quartile phosphorus values and Macroinvertebrate Biotic Index (MBI) scores for streams within the four Level IV ecoregions within the Central Great Plains ecoregion of Kansas. Sand Creek resides largely within ecoregion 27d, the Wellington-McPherson Lowland area. Low MBI scores are indicative of high quality biological communities. Kansas protocol has been to delineate the boundaries between full and partial aquatic life support and between partial support and nonsupport as MBI scores of 4.5 and 5.4, respectively. The data of Figure 17, compiled by Region VII of EPA, does not show a definite relationship between the suggested EPA criteria and associated biological use. Conditions of full support span phosphorus levels of 0.070 to 0.160 mg/L. Partial support is indicative on streams with phosphorus levels of 0.020-0.430 mg/L. Apparently, other factors influence the biological community of macroinvertebrates beyond the ambient nutrient levels present in those Central Kansas streams.

A similar pattern emerges if an index of the selected families of water quality sensitive macroinvertebrates is used as the indicator of biological health. Figure 18 shows the lower quartile phosphorus levels versus the percent of individuals comprising Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies] (EPT). EPT percentages over 48% are viewed as signs of fully supporting environment of aquatic life, while percentages below 30% are deemed non-supportive. Once again, streams in the Central Great Plains show some resilience to higher phosphorus levels impacting clean water species. Identification of a specific threshold of phosphorus concentration is difficult to tie to desired biological conditions.

There are no current measurements from Sand Creek of benthic or attached periphyton which may predominate in fast flowing, shallow streams (EPA, 2000). Studies on streams in areas such as Montana suggest periphyton levels should remain below 150 mg/m^2. (Suplee, et al, 2009).

Figure 17. Lower quartile phosphorus levels and MBI scores for the Central Great Plains.

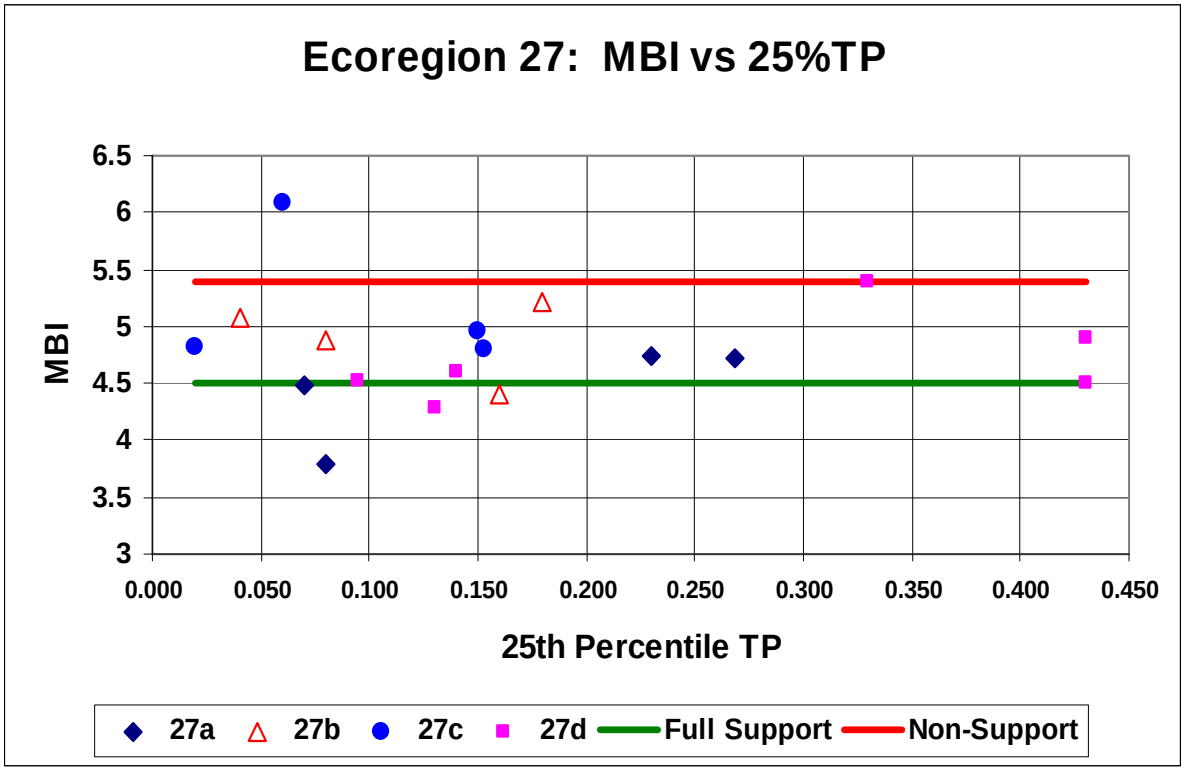
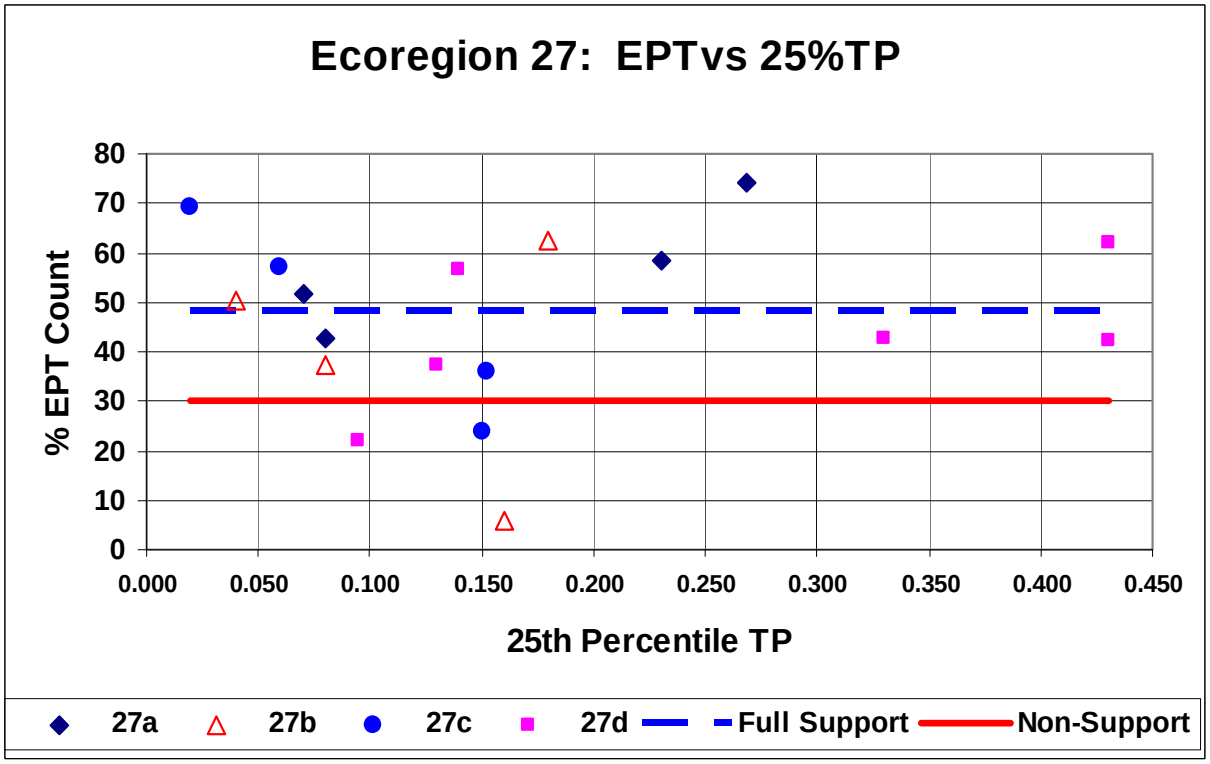


Figure 18. Phosphorus Levels and EPT Scores for Streams in the Central Great Plains.



Desired Endpoint: The ultimate endpoint of this TMDL will be to achieve the Kansas Water Quality Standards by eliminating any of the impacts to aquatic life, domestic water supply or recreation associated with excessive phosphorus and objectionable amounts of algae as described in the narrative criteria pertaining to nutrients. There are no existing numeric phosphorus criteria currently in Kansas. The current EPA suggested benchmarks for stream TP in the South-Central Cultivated Great Plains ecoregion is 0.067 mg/L TP over the 10-state aggregate of Level III ecoregions. A similar TP benchmark for the Central Great Plains was 0.090 mg/L, spanning from Nebraska to Texas.

Sand Creek resides in the 27d ecoregion, the Wellington-McPherson Lowlands. Comparable analysis of data from 2000-2010 and restricted to the Kansas stations in the Central Great Plains indicates the lower quartile value of median TP from 113 stations is 0.132 mg/L TP. Further analysis for the stations within the 27d ecoregion (1990-2011 for rotational sampling stations and from 2000-2011 for permanent fixed stations), indicates the value for the best 25% of medians from the 32 stations in the 27d ecoregion is 0.154 mg/L. The median concentration mean for the 32 stations in ecoregion 27d is 0.348 mg/L.

Four metrics will serve to establish if the biological community of Sand Creek reflects recovery, renewed diversity and minimal disruption by the impacts described in the narrative criteria for nutrients on aquatic life, recreation and domestic water supply.

1. Macroinvertebrate Biotic Index (MBI): A statistical measure that evaluates the effects of nutrients and oxygen demanding substances on macroinvertebrates based on the relative abundance of certain indicator taxa (orders and families): for Kansas, MBI values below 4.5 are indicative of fully supported aquatic life communities.
2. Ephermeroptera, Plecoptera and Trichoptera (EPT) abundance as a percentage of the total abundance of macroinertebrates; for Kansas, EPT percentages over 48% are indicative of fully supported aquatic life communities.
3. Periphyton density on substrate: The concentration of attached algae (measured by chlorophyll a) over a unit surface area. Suplee (2009) and others have suggested the range of acceptable conditions lies below a value of 150 mg/sq. meter.
4. Sestonic (floating) chlorophyll: The concentration of planktonic algae floating in the water column of the stream. Heiskary (2008) found that total chlorophyll values over 25 µg/l exceeded the threshold of biological disruption to aquatic communities in Minnesota streams. EPA (2000) notes a value in its Table 2 demarcating the boundary between stream mesotrophy and eutrophy at 30 µg/l. That same document also cites studies indicating sestonic chlorophyll levels over 8 – 15 µg/l are problematic. Measurements from 2006 and 2010 had a median concentration of 4.78 µg/l.

Therefore, the numeric endpoints for this TMDL indicating attainment of water quality standards on Sand Creek will be:

1. MBI values below 4.5
2. Percentage of Individuals comprising the EPT families exceeds 50%
3. Periphyton chlorophyll concentrations below 150 mg/square meter.
4. Maintain sestonic chlorophyll concentrations below 5 µg/l.

The endpoints have to initially be maintained over three consecutive years to constitute full support of the designated uses of Sand Creek. After standards are attained, simultaneous digression of these endpoints more than once every three years, on average, constitutes a resumption of impaired conditions.

The endpoints will be evaluated periodically as phosphorus levels decline in Sand Creek over time. This TMDL looks to establish management milestones for phosphorus concentrations in Sand Creek that would be the cue to examine the biological conditions of the creek. This TMDL establishes two milestones to achieve the ultimate endpoint of this TMDL. The first milestone will be a reduction of the median TP concentration at SC535 to 0.348 mg/L, based on the average of the median values of sampling stations within the 27d ecoregion. The second milestone will be targeted once the first milestone is reached. The second milestone will be a reduction of the TP median at SC535 to 0.154 mg/L, reaching a median equal to that of the best 25% of the stations within the 27d ecoregion. These milestones represent a reduction of the current TP median concentration by 83% and 92% for each milestone respectively.

Presuming the first Phase of reducing phosphorus levels on Sand Creek improves water quality but does not attain the biological indicators, a second phase of implementation will commence. Stage One will direct further reductions in wastewater phosphorus by Newton, while Stage Two installs treatment and practices on the tributaries to Sand Creek. In time, median phosphorus concentrations on Sand Creek should approach the lower quartile value of the stations within ecoregion 27d (0.154 mg/L) encompassing all flow conditions.

Achievement of the biological endpoints indicates any loads of phosphorus are within the loading capacity of the stream, water quality standards are attained and full support of the designated uses of the stream has been restored.

The endpoint for the upper portion of Sand Creek above Newton has previously been established in the Newton City Park Lake Eutrophication TMDL. The lake has only been sampled once since this TMDL was approved.

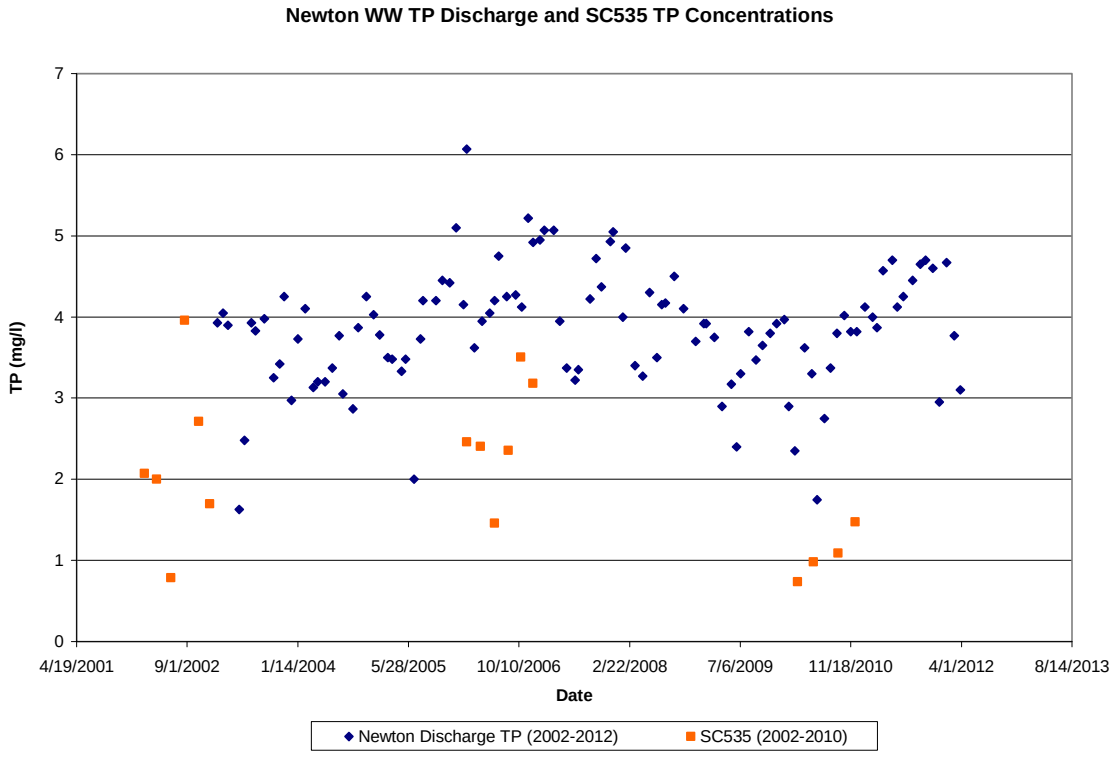
3. SOURCE INVENTORY AND ASSESSMENT

Point Sources: There are 13 permitted NPDES facilities located upstream of station SC535 in the Sand Creek watershed. The permitted facilities are categorized as follows: six “non-overflowing” facilities that are prohibited from discharging, three industrial facilities that are permitted to discharge, two municipal facilities, one MS4 stormwater permit, and one pretreatment permit associated with the discharge to a municipal wastewater treatment plant. The permitted facilities are detailed in Table 7. The Cities

of Newton and Walton are the only two municipal wastewater treatment plants in the Sand Creek watershed that are permitted to discharge.

The municipal NPDES permit for the City of Newton requires daily effluent flow measurements and monthly total phosphorus measurements from both the influent and effluent. The TP concentration average for the City of Newton from 2003-2012 is 3.85 mg/L with an average discharge flow of 2.13 MGD. Annual TP effluent concentration averages at Newton are detailed in Figure 19 and 20. The City of Newton began sampling their influent in 2009 and sample results indicate the influent TP concentration average from 2009-2012 is 4.84 mg/L. Figure 21 details the TP concentrations in the influent and effluent from 2009 through 2011. At times, the City of Newton routes a portion of their wastewater for either irrigation of a golf course or to a wetland area, particularly during the drier months. The City of Newton completed a cost and feasibility study as part of their compliance schedule in their permit to reduce effluent nutrient concentrations with a goal of 8.0 mg/L of Total Nitrogen and 1.5 mg/L for Total Phosphorus. A treatment plant upgrade is anticipated by 2015.

Figure 19. TP concentrations associated with the discharge from Newton wastewater treatment facility over 2003-2012 and comparative samples from SC535 (2002, 2006, and 2010).



The City of Walton facility is a three cell lagoon and currently does not monitor flow or total phosphorus concentrations.

The two concrete batch plants do not have any discharges on record. The BNSF Railway facility permit is associated with a groundwater remediation project. This facility reports limited discharge throughout the year and monitors TP in their effluent, though no detectable TP concentrations have been reported thus far.

Table 7. NPDES permitted facilities in the Sand Creek watershed above SC535.

KS Permit #	Facility	Design Flow (MGD)	Type/ Comment	Receiving Stream	Permit Expiration Date
M-LA13-IO01	NEWTON, CITY OF	3.0	MECHANICAL PLANT	SAND CR	12/31/2012
M-LA13-SN01	NEWTON, CITY OF	N/A	MS4	SAND CR	10/1/2009
M-LA17-OO01	WALTON, CITY OF	0.0379	LAGOON	SAND CREEK	6/30/2012
I-LA13-PO01	BNSF RAILWAY CO - NEWTON	0.00	Remediation	SAND CR VIA DITCH	2/28/2017
I-LA13-PR01	BUILDERS CONCRETE - NEWTON FACILITY	0.00	BUSINESS SITE	SAND CREEK	9/30/2012
I-LA13-PR02	PRESTRESSED CONCRETE - NEWTON FACILITY	0.00	BUSINESS SITE	MUD CREEK	9/30/2012
P-LA13-OO01	BUNTING MAGNETICS	0.00	Treated water goes to Sanitary Sewer	NEWTON MWWTP	6/30/2015
C-LA13-NO08	PAYNE OIL COMPANY, INC.	0.00	Non-Overflowing		3/31/2016
C-LA13-NO10	SCHMIDT INDUSTRIAL PARK WTF	0.00	Non Overflowing		11/30/2016
I-LA13-NO03	FULL VISION, INC.	0.00	Non-Overflowing		6/30/2016
I-LA13-NO08	APAC-KANSAS / SHEARS (PLANT #912)	0.00	Non-Overflowing		6/30/2011
I-LA13-NO09	ACH FOAM TECHNOLOGIES	0.00	Non-Overflowing		7/31/2011
M-LA13-NO03	CAMP HAWK	0.00	Non-Overflowing		7/16/2016

Figure 20. Average effluent TP concentration for the City of Newton WWTP.

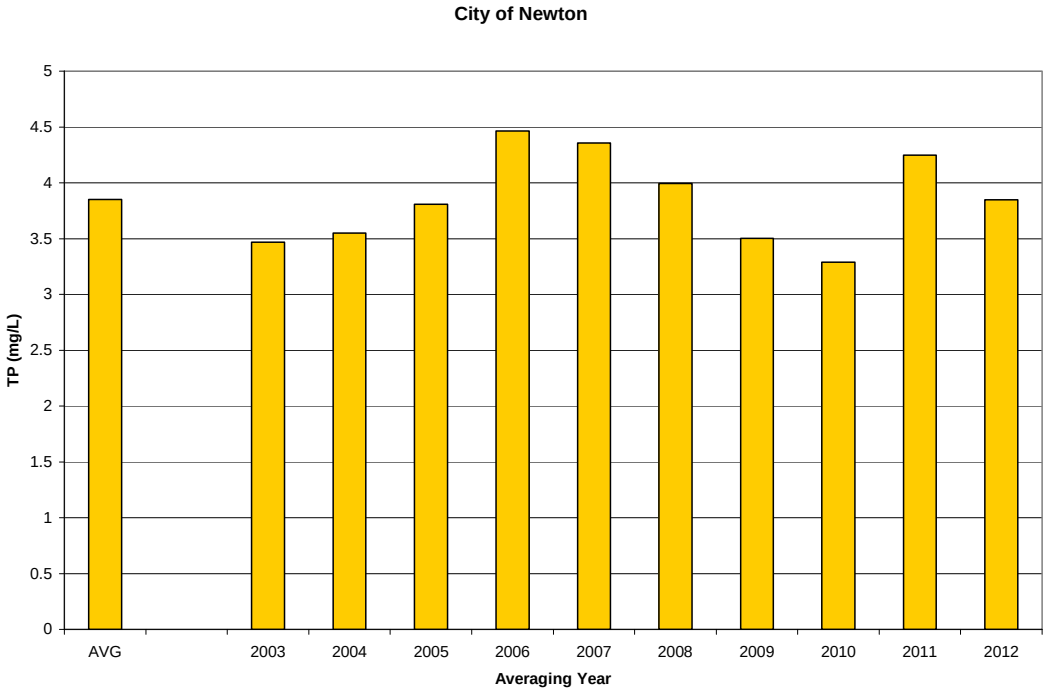
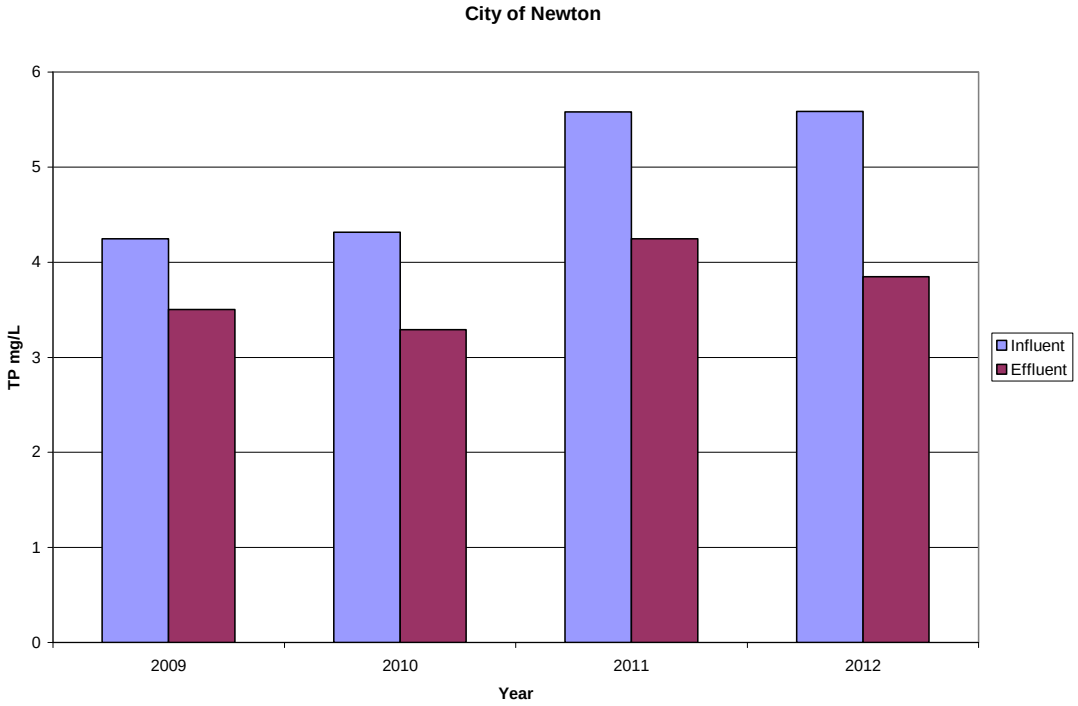


Figure 21. Average TP concentration comparison for the City of Newton's influent and effluent concentrations.



Comparison data from samples collected as SC535 and from the Newton WW plant discharge on similar sampling dates during 2006 and 2010 are seen in Figure 22. Based on these samples, the ratio between the Newton WW discharge TP concentration and the TP concentration observed at SC535 represents the assimilative capacity of Sand Creek. The average assimilative ratio is 0.48, indicating that the Newton WW facility's TP concentration is reduced by 52% at SC535. During 2006, The concentration being discharged at Newton was reduced by 43% at SC535, indicating less assimilation took place due to lower flow conditions. During 2010, the discharge concentration was reduced by 68% at SC535 indicating higher flows diluted the wastewater effluent. Figures 23 and 24 detail the respective concentrations during these events in 2006 and 2010. Reduced upstream TP loading will be indicative as the TP concentrations approach the TP target concentrations, which will result in favorable biological support throughout the stream. The calculated assimilative ratio additionally will be utilized to document TP reductions during the implementation of this TMDL.

Figure 22. Relationship between TP concentrations at SC535 and Newton WWTP for comparative sampling dates.

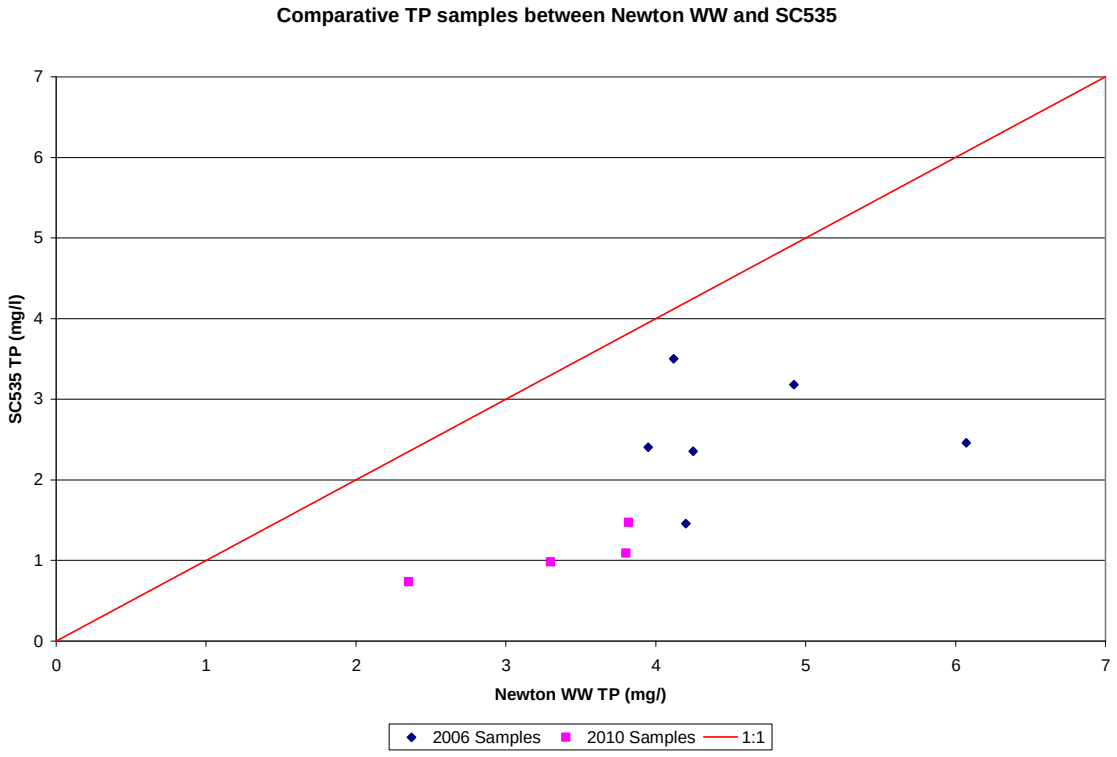


Figure 23. Comparative sampling dates in 2006 relative to streamflow between SC535 and Newton.

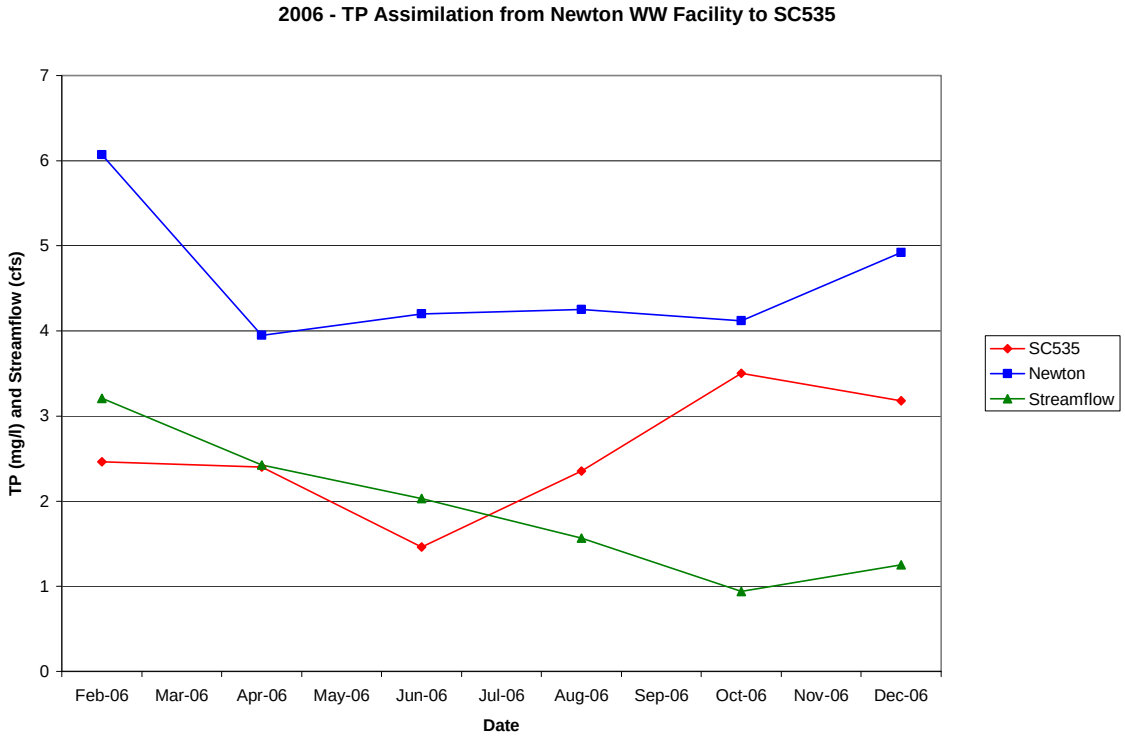
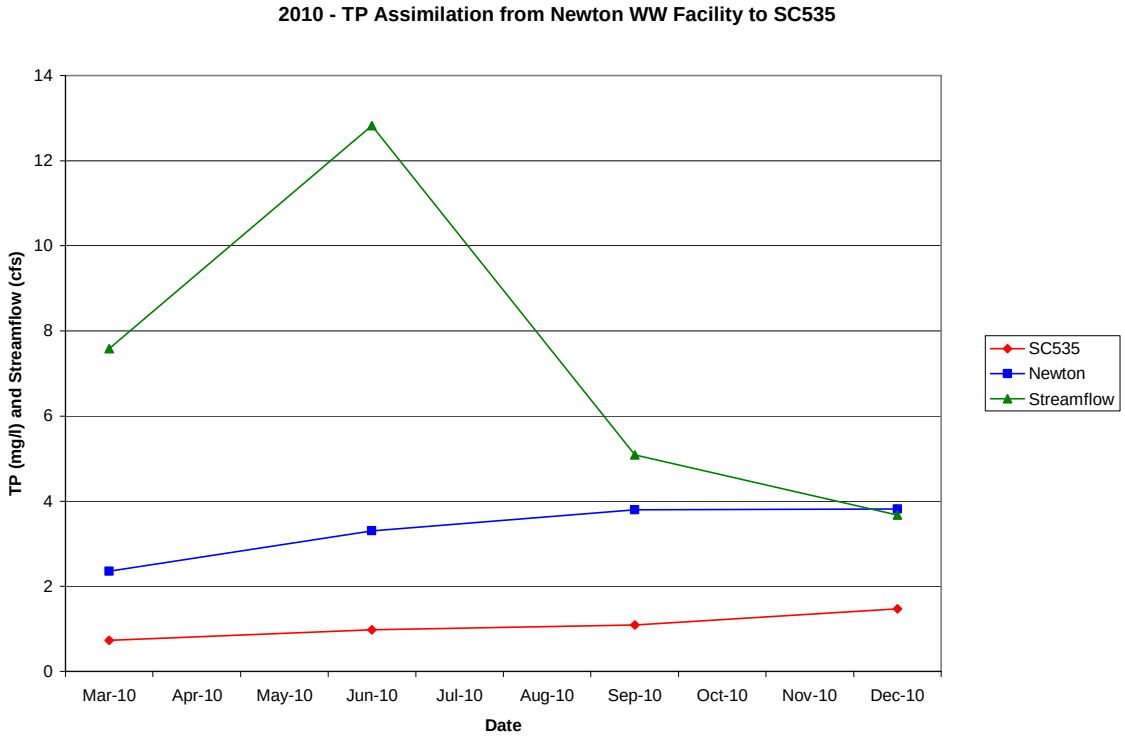


Figure 24. Comparative sampling dates in 2010 relative to streamflow between SC535 and Newton.



Livestock and Waste Management Systems: There are 16 certified or permitted confined animal feeding operations (CAFOs) within the Sand Creek watershed (see Appendix A). All of these livestock facilities have waste management systems designed to minimize runoff entering their operation and detain runoff emanating from their facility. These facilities are designed to retain a 25-year, 24-hour rainfall/runoff event as well as an anticipated two weeks of normal wastewater from their operations. Typically, this rainfall event coincides with streamflow that occurs less than 1-5% of the time. It is unlikely TP loading would be attributable to properly operating permitted facilities, though extensive loading may occur if any of these facilities were in violation and discharged.

Though the total potential number of animals is approximately 7,505 head in the watershed, the actual number of animals at the feedlot operations is typically less than the allowable permitted number.

According to the 2007 Agriculture Census, there are 829 farms with 338,598 acres of farmland in Harvey County and 974 farms with 599,022 acres of farmland in Marion County. According to the 2010 Kansas Farm Facts, there are 24,000 head of cattle in Harvey County and 59,000 head of cattle in Marion County.

Population Density: According to the 2010 Census Block information, the watershed has 22,290 people, with a population density of 204.5 people/square mile. There are approximately 21,127 people residing within the cities of Walton, North Newton, and Newton within the watershed. Population changes from 2000 to 2010 census show that the population of both Newton and North Newton have increased by 1,942 and 237 people respectively. The population of the City of Walton has declined by 49 people from 2000 to 2010.

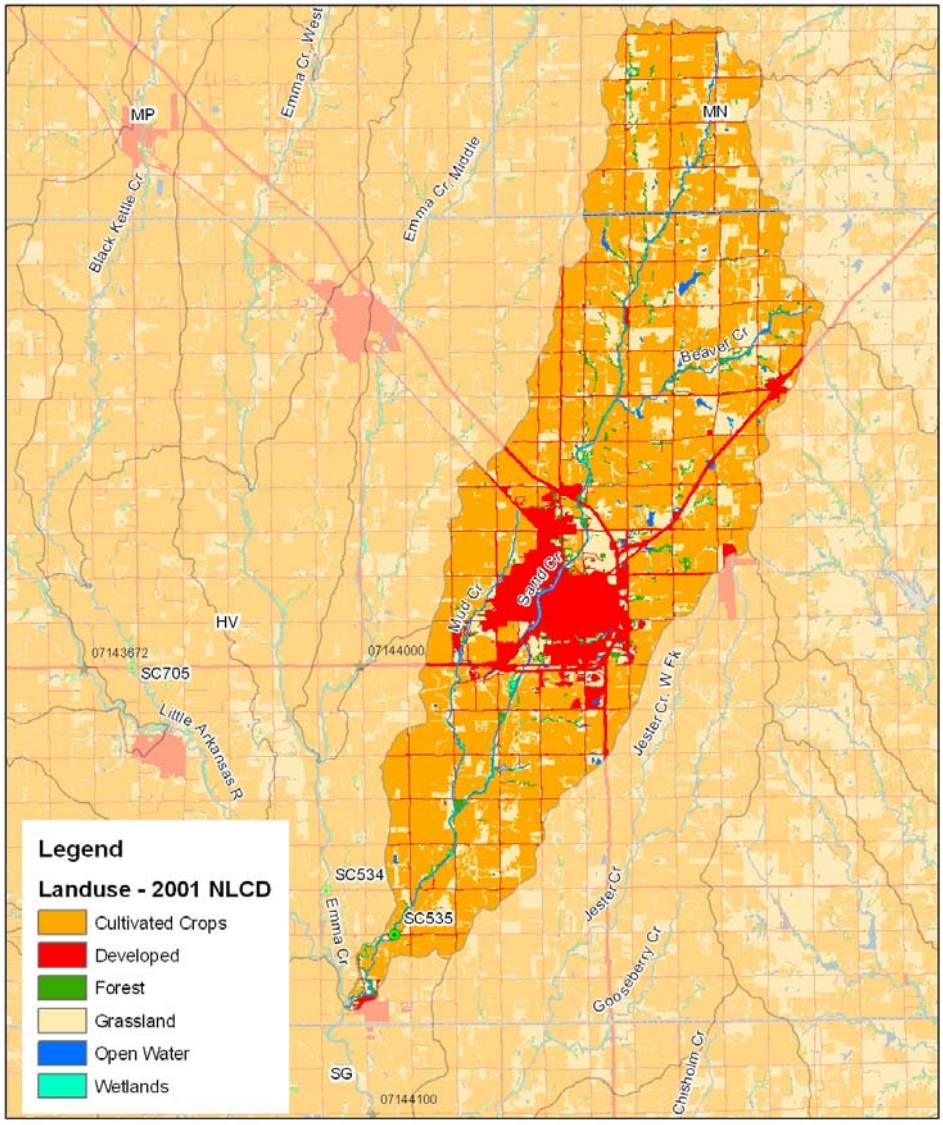
On-Site Waste Systems: Households outside of the municipalities that operate wastewater treatment facilities are presumably utilizing on-site septic systems. Based on the populations of Newton, North Newton, and Walton relative to the watershed population, there are an estimated 1,163 people being served by on-site waste systems in the watershed. The Spreadsheet Tool for Estimating Pollutant Load (STEPL) was utilized to identify the number of septic systems within the HUC12s within the watershed. According to STEPL, there are approximately 305 septic systems within the Sand Creek watershed with an anticipated failure rate of 0.93%. Since 95% of the population within the watershed is located within the cities served by wastewater treatment plants, failing on-site septic systems do not likely contribute to the total phosphorus impairment within the Sand Creek watershed.

Land Use: Land use within the Sand Creek watershed is dominated by cropland (63.5%) according to the 2001 National Land Cover Data (NLCD). Grassland and developed areas comprise 18.8% and 13.6% of the watershed respectively. The land use percentages and acres within the watershed are in Table 8 and are further illustrated in the land use map (Figure 19). Runoff from the cropland and developed areas could contribute significant sources of total phosphorus loading.

Table 8. Landuse acres and percentages in the Sand Creek watershed.

Land Use	Acres	Percent
Cropland	39131	63.5
Grassland	11608	18.8
Developed	8363	13.6 (8% is Newton)
Forest	1725	2.8
Open Water	414.3	0.7
Wetlands	366.5	0.6

Figure 25. Landuse Map for the Sand Creek watershed.



Contributing Runoff: The Sand Creek watershed has a mean soil permeability value of 0.40 inches/hour, ranging from 0.01 to 2.65 inches/hour according to the NRCS STATSGO database. About 98% of the watershed has a permeability value less than 1.71 inches/hour, which contributes to runoff during low rainfall intensity events. According to an USGS open-file report (Juracek, 2000), the threshold soil permeability values are set at 3.43 inches/hour for very high, 2.86 inches/hour for high, 2.29 inches/hour for moderate, 1.71 inches/hour for low, 1.14 inches/hour for very low, and 0.57 inches/hour for extremely low soil-permeability. As the watersheds' soil profiles become saturated, excess overland flow is produced. The majority of the nonpoint source nutrient runoff will be associated with cropland areas throughout the watershed that are in close proximity to the stream corridors.

Background Levels: Phosphorus is present over the landscape, in the soil profile as well as terrestrial and aquatic biota. Wildlife can contribute phosphorus loadings, particularly if they congregate to a density that exceeds the assimilative capacity of the land or water.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

The endpoint for this TMDL is based on the biological condition as described in the Desired Endpoint section. This TMDL will be established in Phases and Stages to progressively reduce phosphorus loadings and ambient concentrations with periodic assessment of the biological endpoints on the lower reaches of Sand Creek, which is detailed in Table 9. The initial phase will entail reductions in phosphorus levels of the Newton wastewater that should translate to median concentrations approaching the TP median concentration for ecoregion 27d at SC535. Reduced upstream TP loading will be indicative as the TP concentrations approach the TP target concentrations, which will result in favorable biological support throughout the stream. Additionally, riparian management in areas adjacent to cropland and livestock management in the vicinity of streams within the watershed should reduce nonpoint source loads under conditions of moderate flows as part of Stage Two.

Once the concentrations at Station SC535 approach the Phase One target of a median concentration of 0.348 mg/L, intensive assessment of macroinvertebrate diversity and phytoplankton will be made to determine compliance with the narrative nutrient criteria. Presuming one or more of the biologic endpoints are not met at the end of Phase One, Phase Two will commence. Additional reductions in loads and phosphorus concentrations will be accomplished through enhanced implementation of controls on point and nonpoint sources. The desired target levels are comparable to the median concentrations seen on the best streams in ecoregion 27d. Newton wastewater will undergo enhanced nutrient removal and the management of riparian activities will be extended to urban stormwater contributing areas and along tributaries adjacent to cropland throughout the watershed. A second intensive biological assessment will be made once median phosphorus levels approach that seen at the regional benchmarks of 0.154 mg/L of TP.

The established TMDL is detailed in Figure 26 and 27 relative to the current seasonal observed loads.

Table 9. Sand Creek TP TMDL Phases, Milestones and Actions.

TMDL Phase / Stage	TP Milestone at SC535	Anticipated Action	Biological Endpoint
I-1 (NPDES)	0.348 mg/L	Newton WW BNR and Enhance Disposal by Irrigation; Newton MS4	MBI < 4.5 EPT > 50% Periphyton < 150 mg/m^2 Chlorophyll < 5 µg/L
I-2 (Nonpoint Source)	0.348 mg/L	Riparian and Livestock Management	
II-1 (NPDES)	0.154 mg/L	Newton WW ENR; Newton MS4	
II-2 (Nonpoint Source)	0.154 mg/L	Targeted Tributary Riparian Management adjacent to cropland	

Point Sources: The Wasteload Allocation (WLA) is associated with the wastewater treatment facilities for the Cities of Newton and Walton to manage any local effects below their respective outfalls. The phosphorus loads from Walton typically do not reach station SC535 under drier conditions. Also under dry conditions, the majority of the stream flow reaching SC535 consists almost entirely of the effluent from Newton.

The initial Phase One WLA for the City of Newton is based on the design flow of 3.0 MGD with an effluent TP concentration of 1.5 mg/L, which reflects the utilization of Biological Nutrient Removal processes. No modifications or treatment or removal processes are anticipated for the lagoon system associated with the City of Walton. Therefore, the WLA for the City of Walton is based on the design flow of 0.0379 MGD with a discharge concentration of 2.0 mg/L, an effluent TP concentration commonly seen from Kansas lagoon systems. Table 10 details the wasteload allocations within the Sand Creek watershed.

Table 10. Phase One Wasteload Allocations for the Sand Creek watershed.

Facility	Total Phosphorus WLA – Daily Load (lbs/day)	WLA – Annual Load (lbs/year)
City of Newton	37.6	13,724
City of Walton	0.63	230

Figure 26. Sand Creek Phase One TP TMDL at SC535.

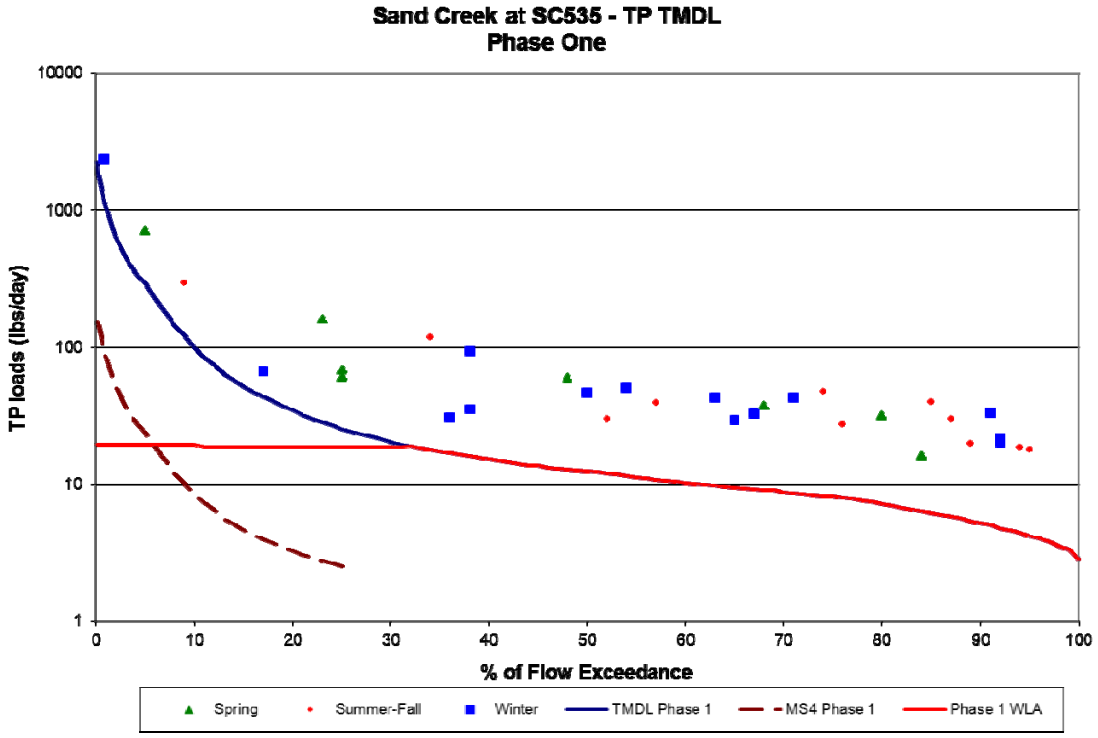
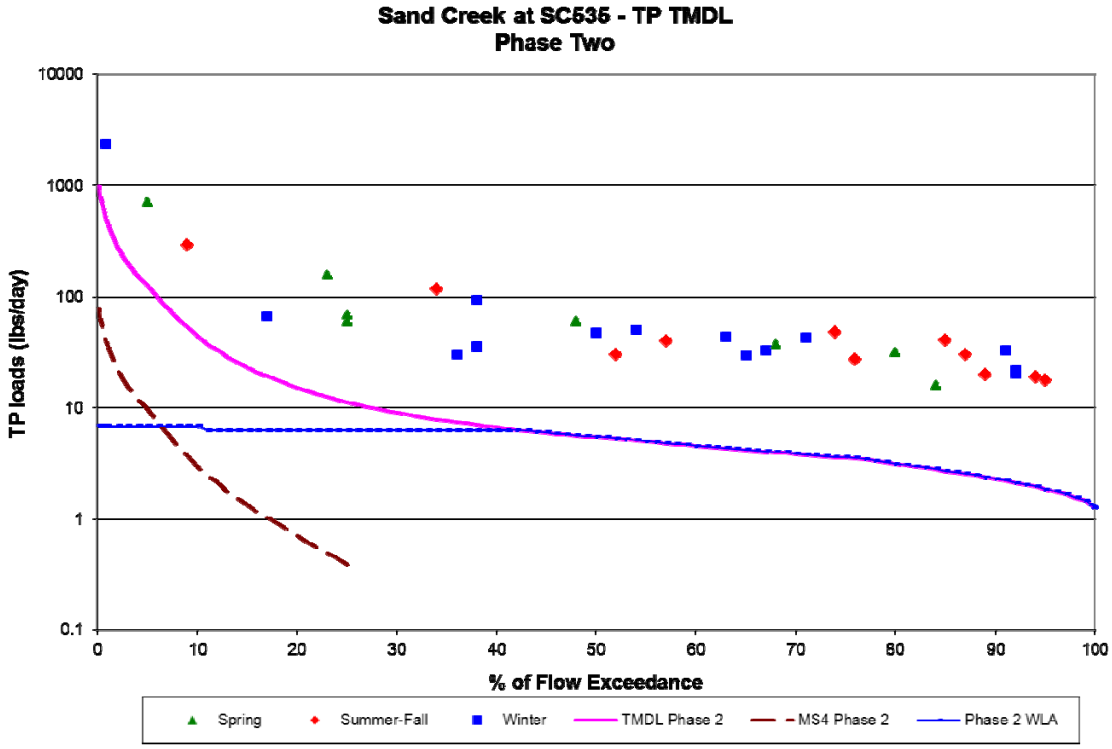


Figure 27. Sand Creek Phase Two TP TMDL at SC535.



Use of wastewater for irrigation and efficient operation of the treatment processes at Newton will assist lowering phosphorus loading and concentrations seen at SC535. As Biological Nutrient Removal upgrades are made to the Newton facility, further consideration for Enhanced Nutrient Removal at the City of Newton should be evaluated and planned to accommodate Phase II. In addition, consideration of assimilation rates of wastewater phosphorus, wasteload trading opportunities among cities, opportunities to further irrigate with wastewater and actual efficiency in phosphorus removal by the mechanical and lagoon systems should be evaluated, along with resulting downstream total phosphorus concentrations at SC535. The calculated assimilation ratios will be utilized to track TP reductions during the implementation of this TMDL. Newton may choose to invest in ENR initially and forego BNR treatment.

Phase Two would commence if biological information indicated the impacts identified in the narrative criterion for nutrient were still occurring after Phase One implementation was complete. Should the stage II milestone become the new goal, the wasteload allocation for Newton will be reduced to reflect a typical annual average effluent concentration of 0.5 mg/L from Enhanced Nutrient Removal. In addition, urban best management practices would be focused to reduce nutrient loads delivered to Sand Creek by stormwater generated within the jurisdictional limits of Newton under the purview of their MS4 permit.

Actual wasteloads attributed to ambient concentrations seen downstream under normal conditions are anticipated to be much less (~50%) than the allocations of Table 10 because of absorption to sediments and absorption by biota. Table 11 outlines the expected impact of these Wasteload Allocations at SC535. Under the driest flow conditions, wasteloads will be largely reduced through, efficient treatment, transit losses along the channel and alternative disposal such as irrigation, so that they match up with the overall Load Capacity. In-stream wasteloads are chiefly defined by the lesser of the Load Capacity at the low flow condition or the anticipated reduced (~50%) wasteload allocations, and applied to all wet conditions. These arriving wasteloads are expected to decline with each Phase of the TMDL and associated upgrade in wastewater treatment. The wasteload from Walton is only likely to reach SC535 during the high flow condition (10%). The MS4 allocation remains at 8% of the load allocation.

Table 11. Load Capacities and Allocations (lbs/day) arriving at SC535 on Sand Creek under the two TMDL phases.

Phase I						
Percent Flow	Sand Cr Flow (cfs) w/ Newton @ Design Flow	Current Condition (lbs/day) w/Newton @ Avg Flow	Load Capacity (lbs/day)	WLA (lbs/day)	LA (lbs/day	MS4 Allocations (lbs/day)
75%	4.32	68.67	8.11	8.11	0	0
50%	6.58	93.56	12.37	12.37	0	0
25%	13.39	168.10	25.16	18.7	5.94	0.52
10%	52.63	598.36	98.90	19.33	73.20	6.37

Phase II					
Percent Flow	Sand Cr Flow (cfs) w/Newton @ Design Flow	Load Capacity (lbs/day)	WLA (lbs/day)	LA (lbs/day	MS4 Allocations (lbs/day)
75%	4.32	3.59	3.59	0	0
50%	6.58	5.47	5.47	0	0
25%	13.39	11.14	6.24	4.51	0.39
10%	52.63	43.77	6.87	33.95	2.95

MS4 Stormwaters: The Wasteload Allocation for the MS4 stormwater is provided by proportioning the remaining load capacity, after accounting for the NPDES WLA, between MS4 and nonpoint source loads. This was done by assuming load contributions would arise from the developed areas within the HUC12 of the MS4 permitted area for the City of Newton. Thus, the MS4 WLA is based on the proportion of developed land in the Newton HUC12, which accounts for 8% of the area of the Sand Creek watershed. The MS4 allocation is therefore 8% of the Load Allocation and only applies to flows above the 25% flow exceedance at SC535 since normal flows reflect the Newton effluent. The MS4 allocations are observed in Table 11 for the 25% and 10% flow exceedance values as well as detailed in Figure 20a and 20b.

Nonpoint Source Load Allocations: The load allocation for nonpoint sources is the remaining load capacity after assimilated wasteloads for NPDES wastewater and MS4 stormwater have been accounted (Table 11). Nonpoint sources are assumed to be very minimal at times when the flow is dominated by the Newton wastewater. The load allocation grows proportionately during higher flow conditions as wet weather ensues.

Defined Margin of Safety: The Margin of Safety provides some hedge against the uncertainty in phosphorus loading into Sand Creek, predominantly from the point source dischargers in the watershed. This TMDL uses an implicit margin of safety, relying on conservative assumptions to be assured that future wasteload allocations will not cause further excursion from the nutrient criteria. First, design flows are used for the two municipal wastewater discharge facilities to set wasteload allocations, although current monitoring data indicates Newton does not discharge at this rate. Additionally, four biological endpoints are used to assess the narrative criteria and have to be maintained for three consecutive years before attainment of water quality standards can be claimed. Finally, because there is often a synergistic effect of phosphorus and nitrogen on instream biological activity, concurrent efforts by Newton to reduce nitrogen content of its wastewater should complement the effect of phosphorus load reduction in improving the biological condition of Sand Creek.

State Water Plan Implementation Priority: Phase One priority is focused on wastewater treatment at Newton and riparian management along the lower reaches to

effectively reduce the phosphorus loading to the creek. Phase Two priorities will expand nonpoint source abatement along Sand Creek, Mud Creek and Beaver Creek. Additionally, further reduction in wastewater phosphorus loads at Newton will occur. Due to the need to reduce the high nutrient loads in the Sand Creek watershed, which contributes to further impairments on the Little Arkansas River, this TMDL will be High Priority for implementation.

Nutrient Reduction Framework Priority: This watershed lies within the Little Arkansas Subbasin (HUC8: 11030012) which is one of the 16 priority HUC8's under the Kansas Nutrient Reduction Framework.

Priority HUC12s: The City of Newton lies within the HUC12, 110300120406. Since this TMDL is initially driven by the implementation of point source treatment improvements, this is the top priority HUC12 within the watershed. The segment between Newton's outfall and Sedgwick is the highest priority. The initial priority for nonpoint source and MS4 is the segment above Newton City Park Lake on Sand Creek. Other nonpoint source priority areas can be further identified based on the cropland areas adjacent to the streams within the watershed. This priority HUC12 is additionally identified in the approved 9-element WRAPS plan within the Little Arkansas WRAPS critical targeted areas for nutrients.

5. IMPLEMENTATION

Desired Implementation Activities

1. Implement and maintain conservation farming, including conservation tilling, contour farming, and no-till farming to reduce runoff and cropland erosion.
2. Improve riparian conditions along stream systems by installing grass and/or forest buffer strips along the stream and drainage channels in the watershed.
3. Perform extensive soil testing to ensure excess phosphorus is not applied.
4. Ensure land applied manure is being properly managed and is not susceptible to runoff by implementing nutrient management plans.
5. Install pasture management practices, including proper stock density to reduce soil erosion and storm runoff.
6. Ensure proper on-site waste system operations in proximity to the main stream segments.
7. Ensure that labeled application rates of chemicals are being followed and implement runoff control measures.
8. Make operational changes in wastewater treatment at Newton and alternative disposal such as irrigation and, if necessary, install enhanced nutrient reduction technology to reduce wasteloads.
9. Renew state and federal permits and inspect permitted facilities for permit compliance.
10. Facilitate urban stormwater management in Newton to abate pollutant loads.

NPDES and State Permits - KDHE

a. Monitor influent into and effluent from the discharging permitted wastewater treatment facilities, as well as TP levels in Sand Creek, while encouraging wastewater reuse and irrigation disposal and ensure compliance and proper operation to control phosphorus levels in wastewater discharges.
b. Establish applicable permit limits and conditions on the upgraded treatment plants in 2015 after implementation of the recommended nutrient reduction treatment option from the 2010 study.
c. Reduce runoff in Newton through stormwater management program and MS4 permit; particularly urban runoff entering city lake on Sand Creek.
d. Interact with Little Arkansas WRAPS on opportunities to offset load reductions between Newton and agricultural producers within the watershed.
e. Establish nutrient reduction practices among urban homeowners to manage application on lawns and gardens, through the Newton stormwater management program.
f. Inspect permitted livestock facilities to ensure compliance.
g. New livestock permitted facilities will be inspected for integrity of applied pollution prevention technologies.
h. New registered livestock facilities with less than 300 animal units will apply pollution prevention technologies.
i. Manure management plans will be implemented, to include proper land application rates and practices that will prevent runoff of applied manure.

Nonpoint Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for reduction of phosphorus runoff from agricultural activities as well as nutrient management.
b. Provide technical assistance on practices geared to the establishment of vegetative buffer strips.
c. Provide technical assistance on nutrient management for livestock facilities in the watershed and practices geared towards small livestock operations, which minimize impacts to stream resources.
d. Support the implementation efforts of the Little Arkansas WRAPS and incorporate long-term objectives of this TMDL into their 9-element watershed plan.
e. Engage City of Newton to discuss stormwater load trading opportunities.

Water Resource Cost Share and Nonpoint Source Pollution Control Program – KDA-DOC

a. Apply conservation farming practices and/or erosion control structures, including no-till, terraces, and contours, sediment control basins, and constructed wetlands.
b. Provide sediment control practices to minimize erosion and sediment transport from cropland and grassland in the watershed.

c. Install cropland and grassland in the watershed.
d. Implement manure management plans.

Riparian Protection Program – KDA-DOC

a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
b. Develop riparian restoration projects along targeted stream segments, especially those areas with baseflow.
c. Promote wetland construction to reduce runoff and assimilate sediment loadings.
d. Coordinate riparian management within the watershed and develop riparian restoration projects.

Buffer Initiative Program – KDA - DOC

a. Install grass buffer strips near streams.
b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

Extension Outreach and Technical Assistance – Kansas State University and Little Arkansas WRAPS

a. Educate agricultural producers on sediment, nutrient, and pasture management.
b. Educate livestock producers on livestock waste management, land applied manure applications, and nutrient management planning.
c. Provide technical assistance on livestock waste management systems and nutrient management planning.
d. Provide technical assistance on buffer strip design and minimizing cropland runoff.
e. Encourage annual soil testing to determine capacity of field to hold phosphorus.
f. Educate residents, landowners, and watershed stakeholders about nonpoint source pollution.
g. Promote and utilize the Little Arkansas WRAPS efforts at pollution prevention, runoff control and resource management.

Timeframe for Implementation: Reduction strategies for Newton wastewater should be evaluated by mid-2013 with subsequent planning , design, and construction of any necessary enhanced biological nutrient reduction completed within the next permit cycle after 2017. Urban stormwater and rural runoff management should commence in 2013 in Newton. Pollutant reduction practices should be installed within the priority subwatersheds before 2015, with follow-up implementation, including other subwatersheds over 2016-2020. If biological conditions warrant, Phase Two implementation will begin in 2022 and continue through 2032.

Targeted Participants: The primary participants for implementation will be the City of Newton wastewater and stormwater programs and agricultural and livestock producers

operating immediately adjacent to the Sand Creek and tributaries within the priority sub watersheds above Newton. Watershed coordinators and technical staff of the WRAPS, along with Conservation District personnel and county extension agents should assess possible sources adjacent to Sand Creek, Mud Creek, and Beaver Creek. Implementation activities to address nonpoint sources should focus on those areas with the greatest potential to impact nutrient concentrations adjacent to these creeks.

Targeted Activities to focus attention toward include:

1. Overused grazing land adjacent to the streams.
2. Sites where drainage runs through or adjacent to livestock areas.
3. Sites where livestock have full access to the stream as a primary water supply.
4. Poor riparian area and denuded riparian vegetation along the stream.
5. Unbufferred cropland adjacent to the stream.
6. Conservation compliance on highly erodible areas.
7. Total row crop acreage and gully locations.
8. High-density urban and residential development in proximity to streams and tributary areas.
9. Residents of Newton should be informed on fertilizer and waste management through the Newton Stormwater Management Program to reduce urban runoff loads.

Milestone for 2016: In accordance with the TMDL development schedule for the State of Kansas, the year 2016 marks the next cycle of 303(d) activities in the Lower Arkansas Basin. At that point in time, phosphorus data from SC535 should show indications of declining concentrations relative to the pre-2011 data, particularly at baseflow conditions. By this date, the city of Newton should be implementing the appropriate treatment to decrease the phosphorus content of its wastewaters.

Delivery Agents: The primary delivery agent for program participation will be the City of Newton, KDHE, the Little Arkansas WRAPS, and Kansas State Extension.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollution:

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.

2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

3. K.S.A. 2002 Supp. 82a-2001 identifies the classes of recreation use and defines impairment for streams.

4. K.A.R. 28-16-69 through 71 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.

5. K.S.A. 2-1915 empowers the Kansas Department of Agriculture, Division of Conservation to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.

6. K.S.A. 75-5657 empowers the KDA, Division of Conservation to provide financial assistance for local project work plans developed to control nonpoint source pollution.

7. K.S.A. 82a-901, et. seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

8. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the Kansas Water Plan, including selected Watershed Restoration and Protection Strategies.

9. The *Kansas Water Plan* and the Lower Arkansas Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority implementation.

Funding: The State Water Plan annually generates $16-18 million and is the primary funding mechanism for implementing water quality protection and pollution reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watershed and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are located within a High Priority WRAPS area and should receive support for pollution abatement practices that lower the loading of sediment and nutrients

Effectiveness: Use of Biological Nutrient Removal technology has been well established to reduce nutrient levels in wastewater, including phosphorus. Additionally, nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. In addition, the proper implementation of comprehensive livestock waste management plans has proven effective at reducing nutrient runoff associated with livestock facilities.

6. MONITORING

Future stream sampling will occur at rotational station SC535 every fourth year, with 2014 being the next scheduled sampling year. Monitoring of tributary levels of TP during runoff events by the WRAPS will help direct abatement efforts toward major nonpoint sources. Monitoring of TP below the Newton outfall in Sand Creek will help assess improvements in their nutrient removal processes. Monitoring of TP should be a condition of the Newton MS4 permit.

Commencing before 2015, macroinvertebrate and periphyton sampling will occur at accessible locations on lower Sand Creek. The stream will be evaluated for possible delisting, after Phase One implementation in 2022. If the four biological endpoints are achieved over 2018-2021, the conditions described by the narrative nutrient criteria will be viewed as attained and Sand Creek will be moved to Category 2 on the 2022 303(d) list. If they are not, Phase Two of this TMDL begins in 2022.

Once the water quality standards are attained, the adjusted ambient phosphorus concentrations on Sand Creek will be the basis for establishing numeric phosphorus criteria through the triennial water quality standards process to protect the restored biological and chemical integrity of Sand Creek.

7. FEEDBACK

Public Notice: An active Internet Web site is established at http://www.kdheks.gov/tmdl/index.htm to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Lower Arkansas Basin. Public Hearing: A Public Hearing on this TMDL was held on September 4, 2013 in Newton to receive public comments. The City of Newton provided comments on this TMDL. KDHE provided a written response to the comments on October 24, 2013.

Basin Advisory Committee: The Lower Arkansas River Basin Advisory Committee met to discuss the TMDLs in the basin on May 31, 2012 in Hutchinson, September 12, 2012 in Halstead and on April 3, 2013 in Hutchinson.

Milestone Evaluation: In 2017, evaluation will be made as to the degree of implementation that occurred within the watershed. Subsequent decisions will be made through the Little Arkansas River WRAPS, regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303(d) Delisting: Sand Creek will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2012-2021. Therefore, the decision for delisting will come about in the preparation of the 2022-303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision would come in 2013, which will emphasize implementation of WRAPS activities. At that time, incorporation of this TMDL will be made into the WRAPS. Recommendations of this TMDL will be considered in the Kansas Water Plan implementation decisions under the State Water Planning Process for Fiscal Years 2012-2021.

January 27, 2014

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Appendix A. Permitted and Registered CAFO Facilities in Sand Creek Watershed.

Permit	Facility County	Animal Totals	Permit Animals	WLA
1132	Harvey	950	Beef	0
A-NEMN-BA32	Marion	400	Beef	0
A-LAMN-BA03	Marion	180	Beef	0
A-LAHV-BA22	Harvey	300	Beef	0
A-LAHV-BA07	Harvey	50	Beef	0
A-LAHV-BA02	Harvey	40	Beef	0
A-LAHV-BA17	Harvey	980	Beef	0
A-LAHV-BA06	Harvey	450	Beef	0
A-LAHV-BA04	Harvey	100	Beef	0
A-WAHV-BA08	Harvey	100	Beef	0
A-LAHV-BA12	Harvey	50	Beef	0
A-LAHV-SA05	Harvey	375	Swine,Beef	0
A-LAHV-M011	Harvey	120	Dairy	0
A-LAHV-L001	Harvey	750	Sheep,Goats	0
A-LAHV-C004	Harvey	2000	Beef	0
A-LAHV-S036	Harvey	300	Swine	0