SMOKY HILL-SALINE BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Smoky Hill River
Water Quality Impairment: Total Suspended Solids

Subbasin: Lower Smoky Hill **Counties**: Saline, Dickinson, Geary, Ottawa

HUC8:	**10260008**	**HUC10 (HUC12)**:	**03** (06, 07) **04** (03) **08** (01, 02, 03, 04, 05)
	10260015		**07** (04, 05)

Drainage Area: 406 square miles

Main Stem Water Quality Limited Segments:
10260008: Smoky Hill River (11, 12, 13) in Saline County, Smoky Hill River (10) in Saline and Dickinson Counties, Smoky Hill River (6, 9) in Dickinson County and Smoky Hill River (2) in Dickinson and Geary Counties, Smoky Hill River (1) in Geary County.
10260015: Solomon River (1), downstream of SC266 in Saline County.

Main Segment	**Tributaries**
Smoky Hill River (1)	Otter Creek (42) Lyon Creek (31)
Smoky Hill River (6)	Lone Tree Creek (41)
Smoky Hill River (13)	Dry Creek, East (43)

Designated Uses: For Smoky Hill River (1, 2, 6, 9, 10, 11, 12): Expected Aquatic Life Support; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply; Irrigation Use; Livestock Watering Use; Primary Contact recreation "C" (stream segment is not open to and accessible by the public under Kansas Law). Smoky Hill River (13) has the same designated uses with the exception of the contact recreation classification being Secondary Contact recreation "b" (stream segment is not open to and accessible by the public under Kansas Law).

For Lyon Creek (31): Classified as an Exceptional State Water with Special Aquatic Life Support; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply; Irrigation Use; Livestock Watering Use; Primary Contact recreation "C" (stream segment is not open to and accessible by the public under Kansas Law).

For Lone Tree Creek (41): Expected Aquatic Life Support.

For Otter Creek (42) and Dry Creek, East (43): Expected Aquatic Life Support; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply; Irrigation Use; Livestock Watering Use; Secondary Contact recreation "b" (stream segment is not open to and accessible by the public under Kansas Law).

For Solomon River (1): Expected Aquatic Life Support; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply; Irrigation Use; Livestock Watering Use; Primary Contact recreation "C" (stream segment is not open to and accessible by the public under Kansas Law).

303(d) Listings: 2010 Smoky Hill Basin Streams, Total Suspended Solids; 2010 Solomon Basin Streams, Total Suspended Solids.

Impaired Use: Aquatic Life Use Support

Water Quality Standard:

> Suspended Solids – Narrative: Suspended solids added to surface waters by artificial sources shall not interfere with the behavior, reproduction, physical habitat or other factor related to the survival and propagation of aquatic or semi-aquatic or terrestrial wildlife. (KAR 28-16-28e(c)(2)(B)).

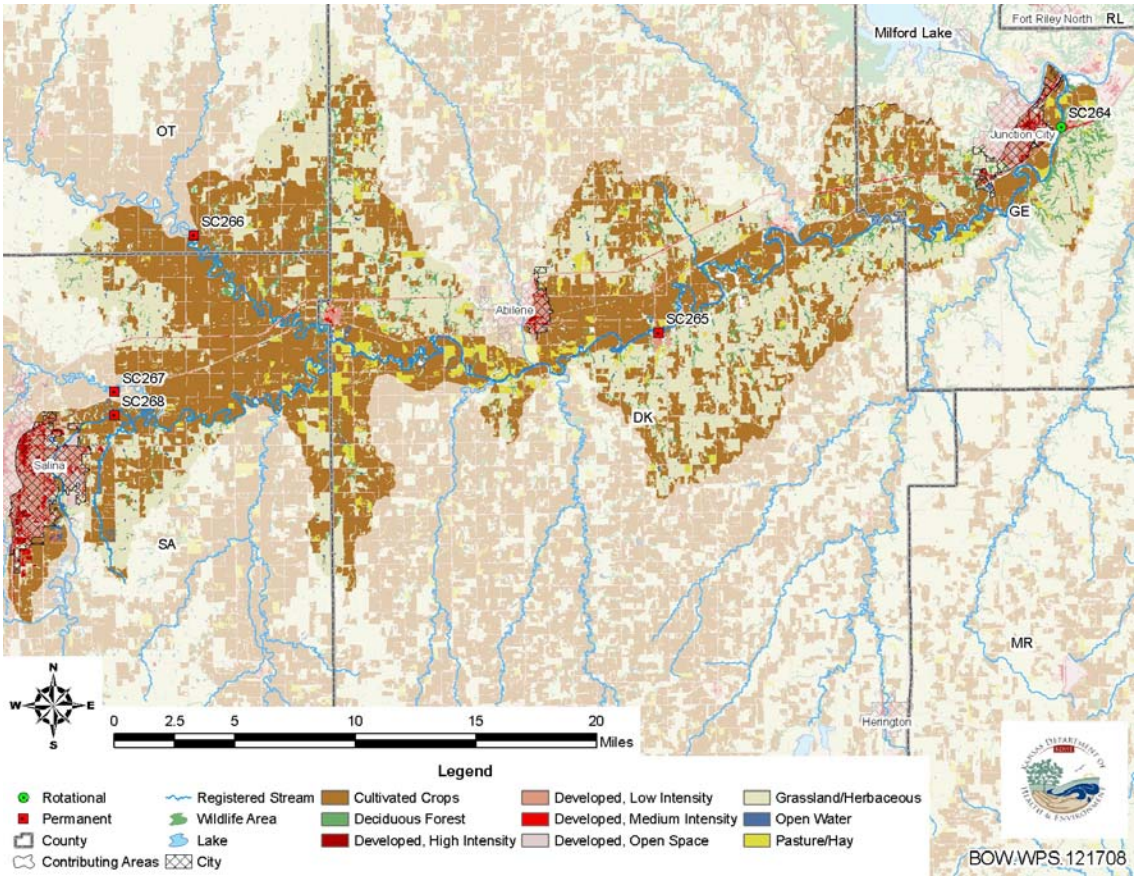

Figure 1- Land uses along the Smoky Hill River and lower Solomon River. The area included in this TMDL is highlighted, excepting the lands upstream of SC268, which includes the city of Salina. All other tributary waters are monitored independently, and are not included in this TMDL. Segment 102600151 is included in this TMDL because it is downstream from SC266 and is contributing to the TSS load at SC265 on the Smoky Hill River at Enterprise.

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Monitoring Sites: SC264 – Smoky Hill River at Junction City
Period of Record: 1973 – 2007
SC265 – Smoky Hill River at Enterprise
Period of Record: 1973 – 2009

Not included, but draining to the area included in this TMDL:
SC266 – Solomon River near Niles

USGS Gage Station(s): 06877600 – Smoky Hill River at Enterprise
Period of Record: 1970 – 2009
06857100 – Republican River at Junction City and
06879100 – Kansas River at Fort Riley used to estimate flow at SC264.
Period of Record: 1970 – 2009

Current Condition: Water quality with regard to total suspended solids (TSS) in the Smoky Hill River is consistently poor through all seasons (Table 1). Summary statistics from KDHE monitoring data indicates that in all seasons (except SC265 winter) the TSS median concentration at both stations included in this analysis exceeds 50 mg/L, and the overall median is also greater than 50 mg/L. Uncorrected summary statistics indicates that SC264 has higher TSS concentrations than SC265 with median values of 152 mg/L and 112 mg/L, respectively. A more detailed review of the data shows that the sampling record at SC264 is biased by a large number of samples collected during a relatively wet period during the late 1990's as part of the Governor's Water Quality Initiative and when data from SC264 and SC265 are paired with flow data (Figure 2), the regressions indicate that the trend line is lower at the downstream station (SC264).

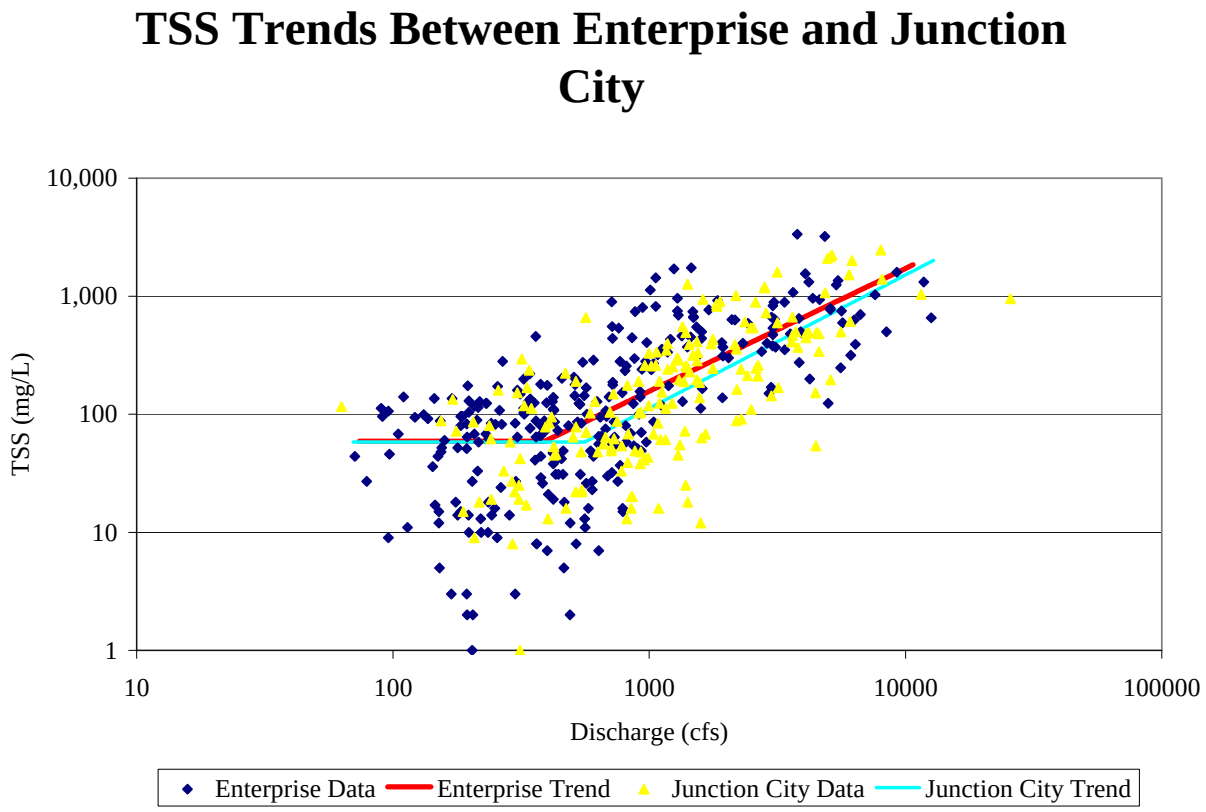

Figure 2- TSS data and trending at SC264 & SC265 for the period of record. Data points for Enterprise and Junction City are uncorrected TSS and discharge values. Trend lines were generated using the annual discharge model and regression equations described on page 21.

Because the water quality standard is narrative (K.A.R 28-16-28e(c)(2)(B), it is necessary to determine an appropriate screening value for TSS concentrations that are likely to fully support aquatic life uses. The 2008 Kansas 303(d) List of Impaired Waters used a screening value of 50 mg/L based on an extensive analysis of data collected by KDHE biological and chemical monitoring programs. Because this value is based on data that is otherwise unpublished, we revert in this document to the previously published suggestion from "Ambient Water Quality Criteria Recommendations" EPA 822-B-01-014 (2001) that turbidity not exceed 22.13 NTU. Because the water quality standard is specific to suspended solids, we convert the proposed endpoint of 22.13

NTU into TSS (mg/L) by comparison to a regression of NTU & TSS from four monitoring stations along the Smoky Hill River (SC264, SC265, SC268, SC514). The strong relationship (R^2 = 82.3%) is characterized on a log/log regression as Log10TSS = 0.482 + 0.903(Log10NTU) (Figure 3). The suggested turbidity value results in an acceptable concentration of 50 mg/L TSS as a long-term median value, which is used hereafter in this document to indicate an initial acceptable endpoint. Conversion of this concentration to daily loads shall be accomplished by application of a concentration limit to the mean daily flow measured by USGS gage stations. Application of the 50 mg/L endpoint shall pertain to median concentrations, as wide variation exists across the flow duration curve.

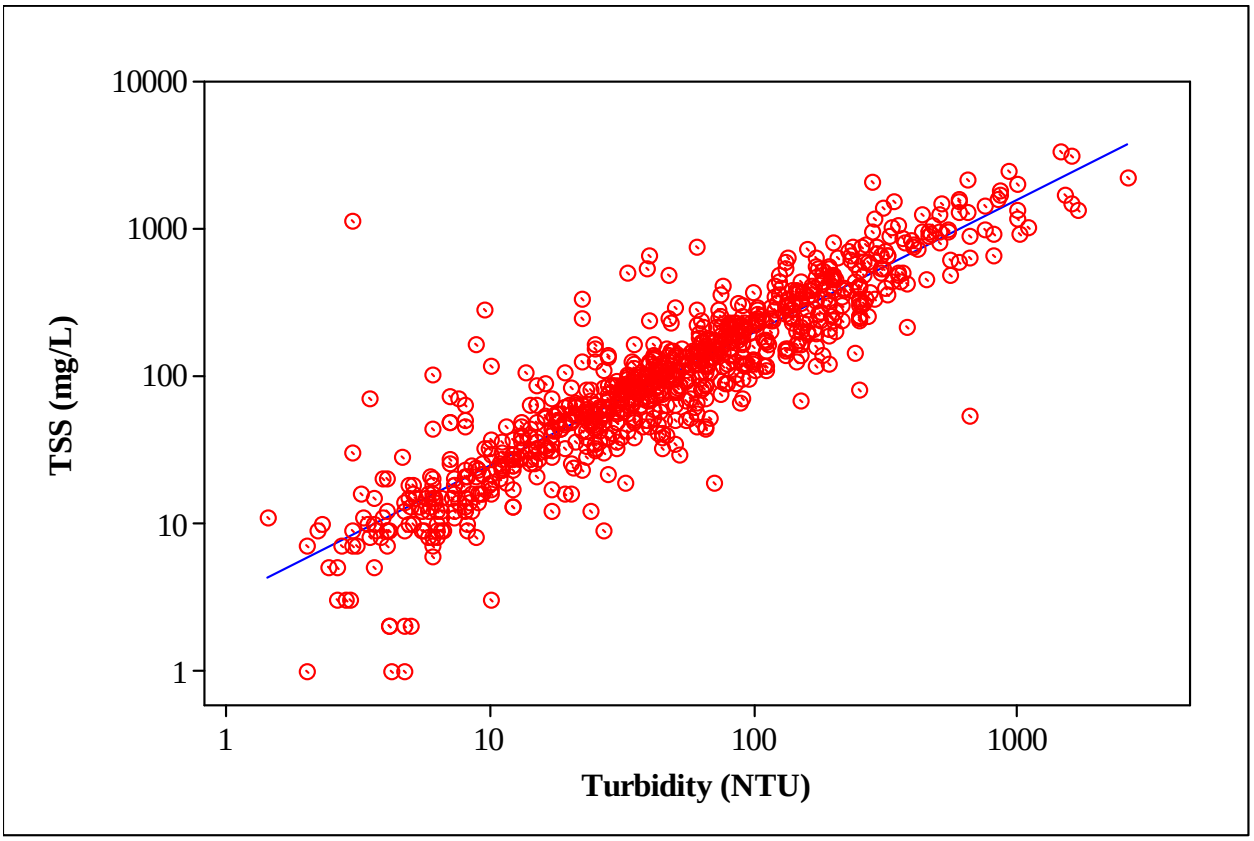

Figure 3- The regression line for Log10 turbidity and total suspended solids at the four mainstem Smoky Hill River monitoring locations downstream of Kanopolis Lake (SC264, SC265, SC268, SC514) for all data collected by KDHE. Log10TSS = 0.482 + 0.903(Log10NTU), R^2 = 82.3%. Period of record: SC265 & SC268, 1973-2009; SC264, 1973-2007; SC514, 1990-2009.

Average daily flows for the Smoky Hill River at Junction City were estimated by subtracting the average daily flow for the Republican River at Junction City (USGS Gage 06857100) from the average daily flow the Kansas River at Fort Riley (USGS Gage 06879100), for the period of record. USGS Gage 06879100, Kansas River at Fort Riley is downstream from the confluence of the Smoky Hill River with the Republican River. Hence, subtracting flows from the Republican River at Junction City from the flows in the Kansas River at Fort Riley accounts for the flow from Milford Lake releases into the Republican River that would not be seen at sampling site SC264 on the Smoky Hill River at Junction City.

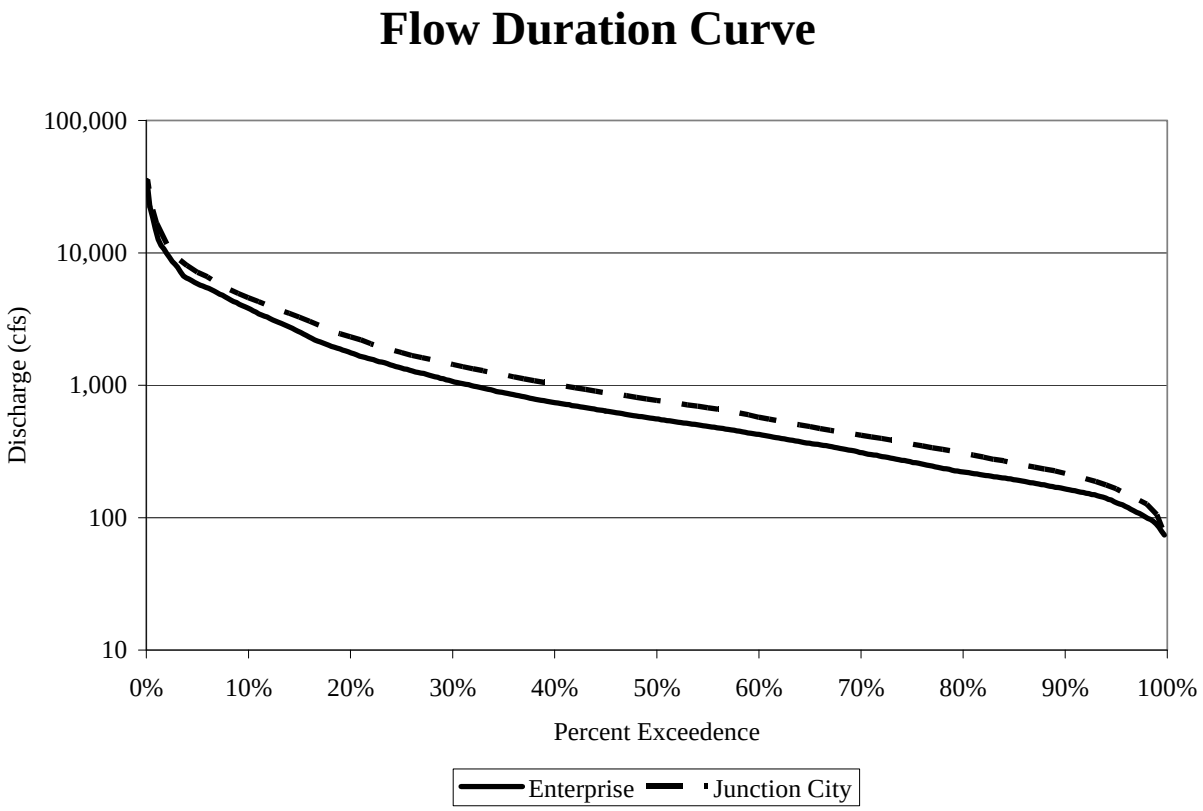

Figure 4- Flow duration curve for the Smoky Hill River at Enterprise as monitored by USGS station 06877600 and at Junction City as estimated by subtracting the average daily flow of the Republican River at Junction City (USGS Gage 06857100) from the average daily flow the Kansas River at Fort Riley (USGS Gage 06879100), for the period of record.

Site	Minimum Flow	Maximum Flow	90% Exceedence Flow	75% Exceedence Flow	Median Flow	25% Exceedence Flow	10% Exceedence Flow	Mean Flow	Period of Record
Solomon- Niles	22	26,200	53	77	153	424	1,320	516	1970-2009
Smoky Hill- Enterprise	51	46,200	165	262	557	1,350	3,820	1,489	1970-2009
Smoky Hill- JC	Unknown	63,000	217	360	768	1,770	4,592	1,869	1970-2009

Site	Minimum TSS	Maximum TSS	25%ile	Median	75%ile	Mean	Period of Record	Sample Size
Solomon- Niles	4	3,400	54	132	292	269	1973-2009	299
Smoky Hill- Enterprise	1	3,340	48	112	343	274	1973-2009	288
Smoky Hill- JC	1	2,460	56	152	390	319	1973-2009	177

Solomon- Niles	Minimum TSS	Maximum TSS	25%ile	Median	75%ile	Mean	Period of Record	Sample Size
Fall	7	2,900	35	102	192	216	1973-2009	93
Spring	15	2,290	73	126	267	240	1973-2009	72
Summer	42	3,400	158	296	565	470	1973-2009	85
Winter	4	524	14	25	80	63	1973-2009	49

Smoky Hill- Enterprise	Minimum TSS	Maximum TSS	25%ile	Median	75%ile	Mean	Period of Record	Sample Size
Fall	3	3,340	31	80	144	177	1973-2009	87
Spring	10	1,600	76	145	439	297	1973-2009	72
Summer	41	3,200	123	296	656	481	1973-2009	79
Winter	1	552	12	42	71	81	1973-2009	50

Smoky Hill- JC	Minimum TSS	Maximum TSS	25%ile	Median	75%ile	Mean	Period of Record	Sample Size
Fall	9	2,460	49	89	261	336	1973-2009	46
Spring	16	2,090	54	153	449	315	1973-2009	46
Summer	68	2,240	152	284	490	441	1973-2009	51
Winter	1	665	18	52	171	116	1973-2009	34

Table 1- Uncorrected summary statistics for TSS and discharge at stations included in this document as well as the outlet of the Solomon River as it enters the Smoky Hill River. All TSS values are in mg/L, all discharge values are in cubic feet per second.

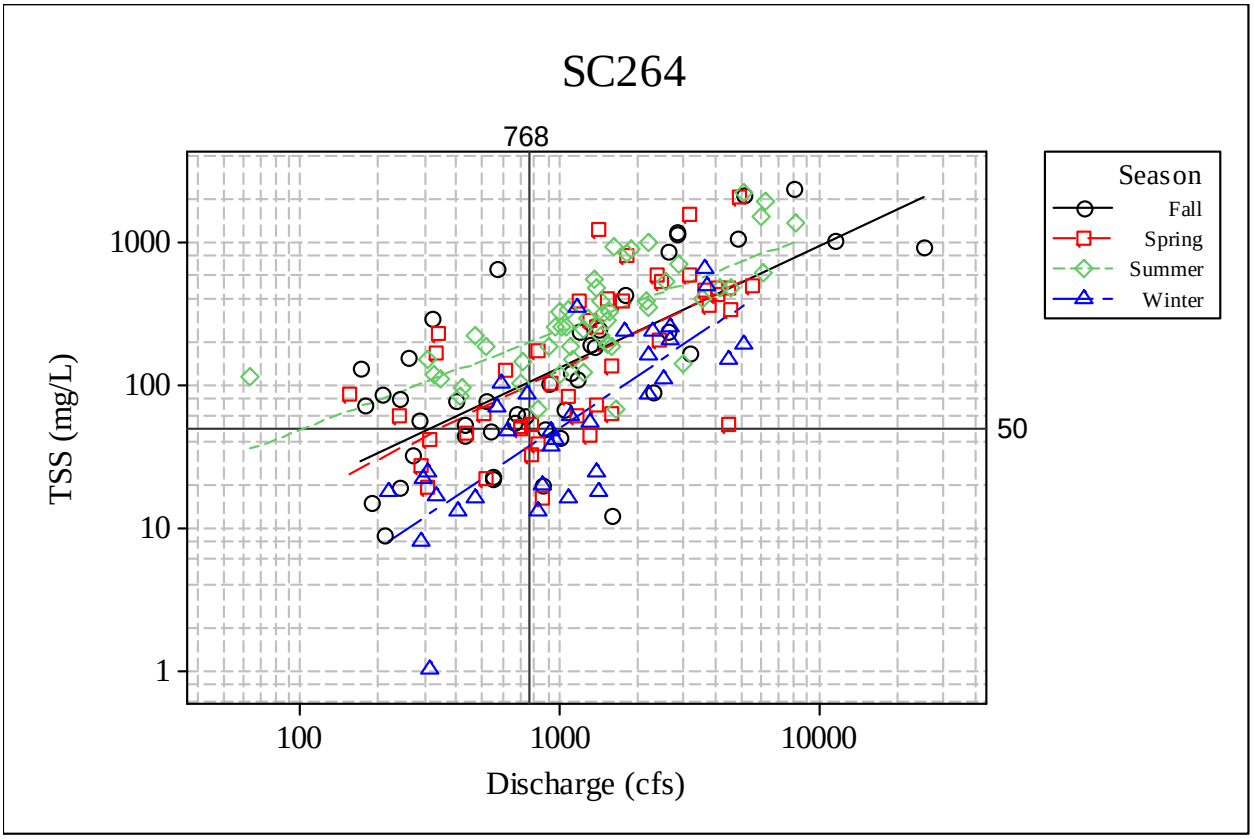

Figure 5- TSS concentrations at the Junction City sampling location (SC264) by estimated flow condition, for the period of record. Flow is estimated as the mean daily flow of the Kansas River at Fort Riley (USGS 06879100) minus the mean daily flow of the Republican River at Junction City (USGS 06857100). Because sampling efforts were not consistent over time a greater proportion of all samples were taken during the wet late 1990's than would be expected by a random distribution of samples over the period of record. As can be seen in this graph, relatively more (68%) of the samples were taken above median flow (738 cfs), and relatively few samples have been collected below median flow. Most samples plot above the 50 mg/L line, with a few exceptions from non-summer samples.

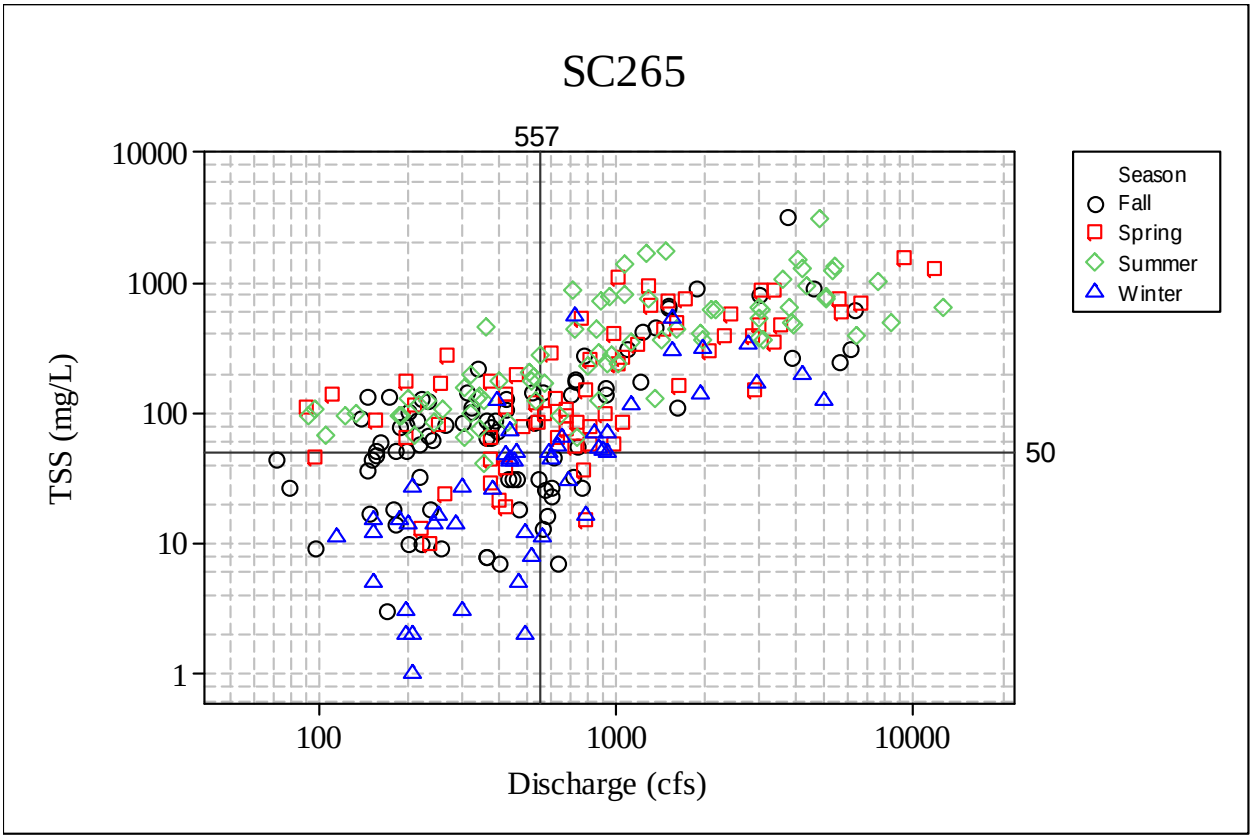

Figure 6- TSS concentrations at SC265, Smoky Hill River near Enterprise sampling location by flow condition on the Smoky Hill River at Enterprise, USGS 06877600, for the period of record. Most samples plot above the 50 mg/L line, with a few exceptions from non-summer samples.

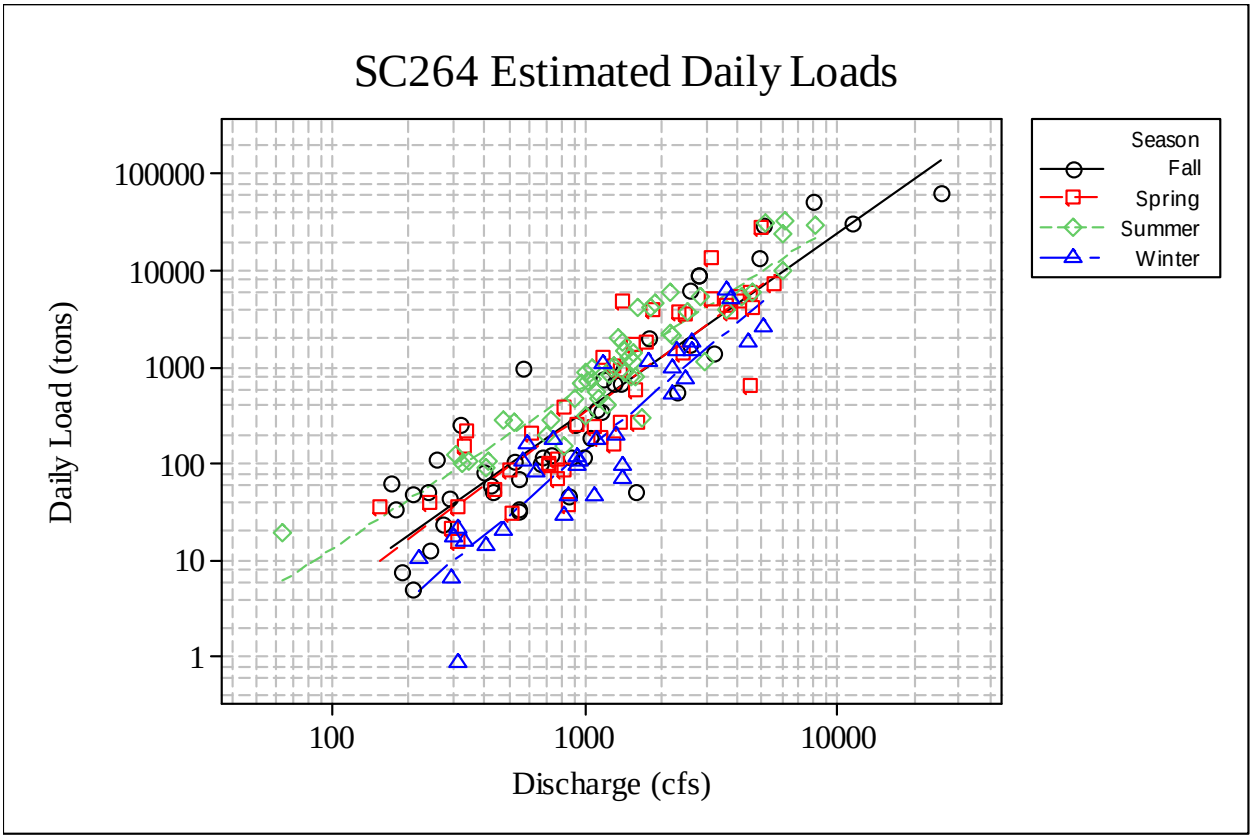

Figure 7- TSS Load (tons) as a function of discharge (cfs) at Junction City, for the period of record. Summer loads are typically higher for any given discharge value than all other seasons. Spring and fall regressions fall nearly on top of each other in the graph, while summer regression is greater than all other seasons and winter is less than all other seasons.

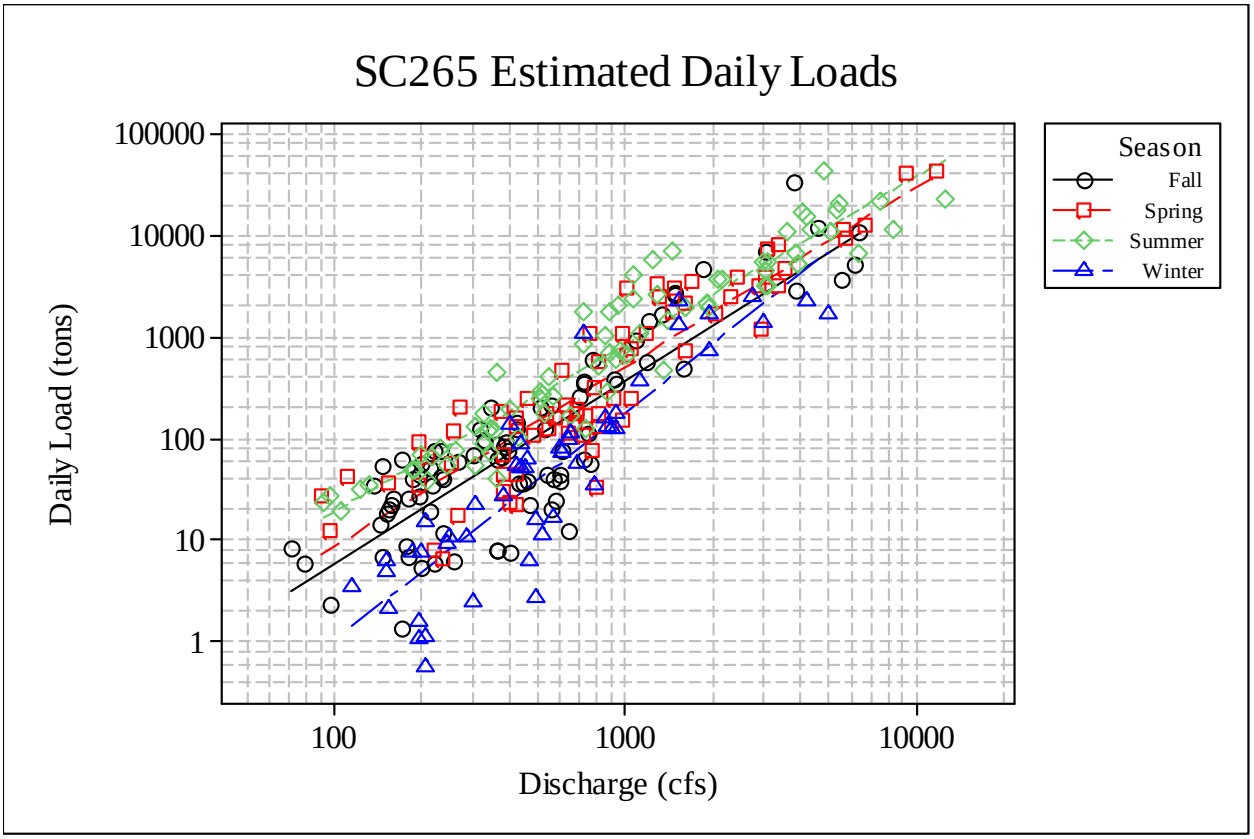

Figure 8- TSS Load (tons) as a function of discharge (cfs) at Enterprise for the period of record. Summer loads are typically higher for any given discharge value than all other seasons. Spring and fall regressions fall nearly on top of each other in the graph, while summer regression is greater than all other seasons and winter is less than all other seasons.

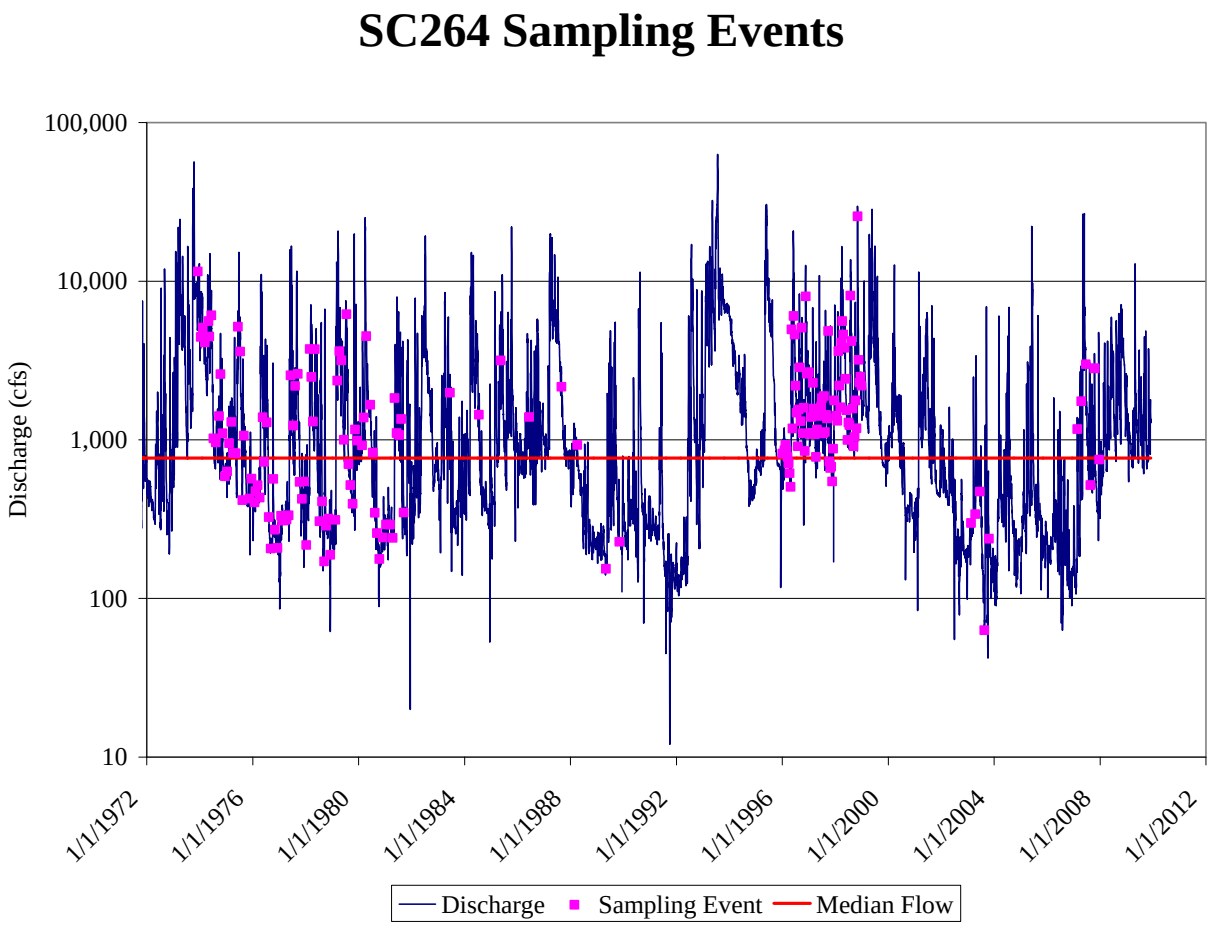

Figure 9- Estimated flow at the Junction City sampling location during the period of record. The Governor's Water Quality Initiative resulted in extensive sampling during a wet period in the late 1990's. This site was subsequently converted to a rotational site, visited only during every fourth year.

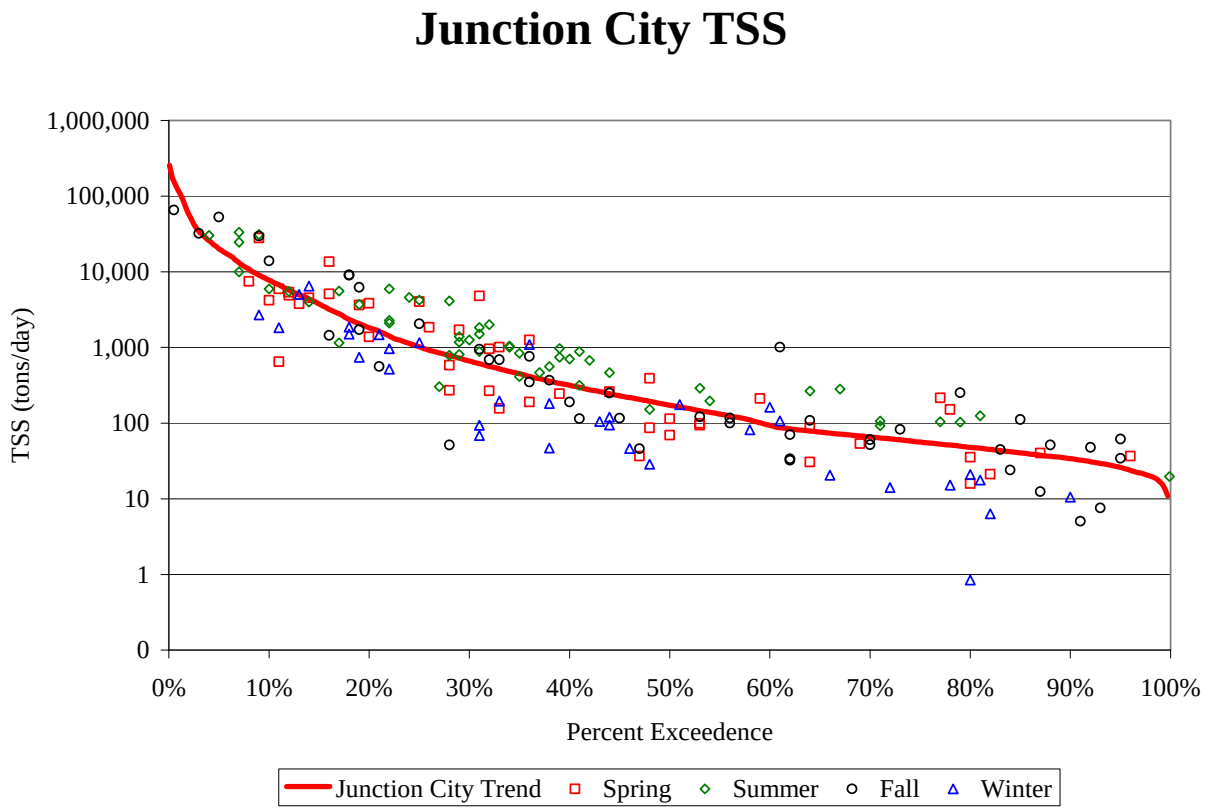

Figure 10- Existing KDHE samples at SC264 plotted by season and estimated loads, as calculated by multiplying sample concentration times the estimated USGS mean daily discharge, for the period of record. See figure 5 for discharge estimation calculation.

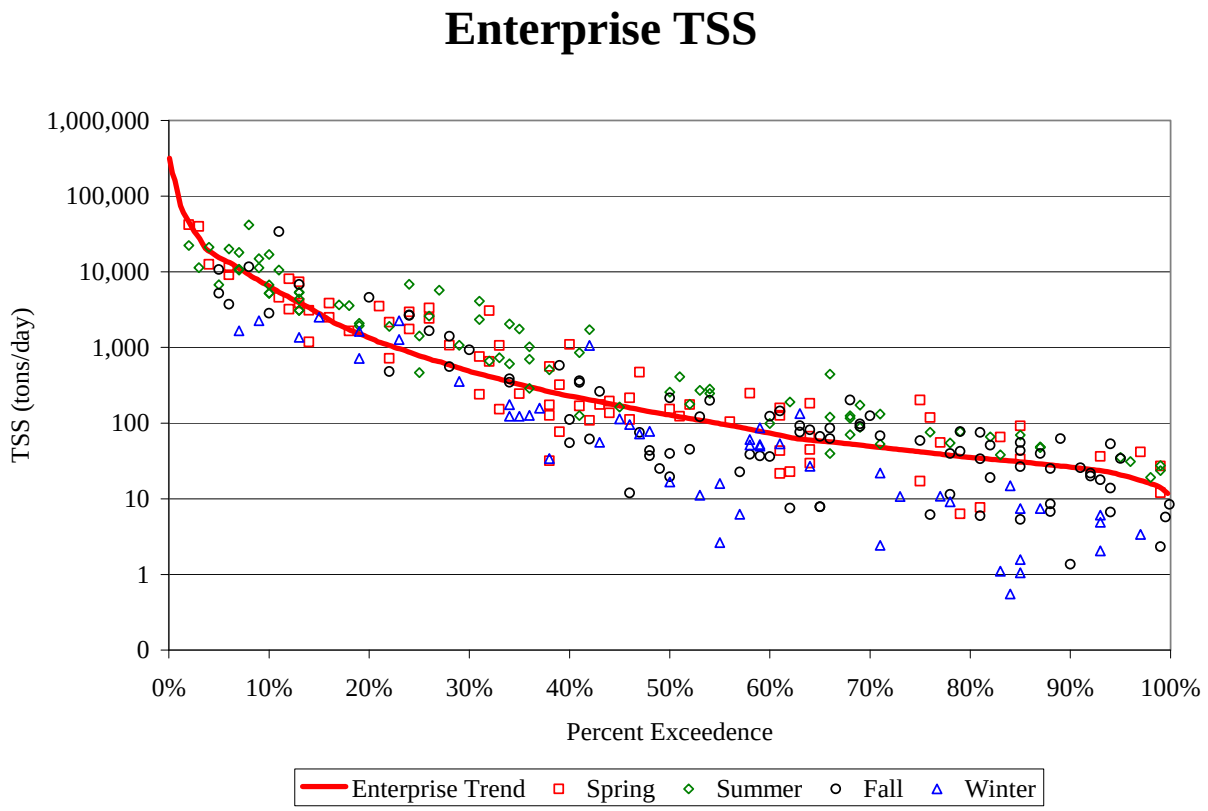

Figure 11- Existing KDHE samples at SC265 plotted by season and estimated loads, as calculated by multiplying sample concentration times USGS mean daily discharge, for the period of record.

Interim Endpoints of Water Quality (Implied Load Capacity) at Enterprise and Junction City over 2010 - 2015: This TMDL will be a phased TMDL, with interim endpoints for both sample locations expressed as a median concentration not to exceed 50 mg/L TSS to protect aquatic life. To accomplish this we adopted an approach of best available reference site to determine a relationship between discharge and TSS concentration that would adequately protect aquatic life in the Smoky Hill River at sampling sites SC264 and SC265. Both the Kansas River at Wamego (SC260) and the Republican River at Clay Center (SC503) are nearby, large river sites with the low median TSS values, and a regression of these sites was calculated to determine concentration limits for each daily discharge value (Appendix A). Although the calculations produced similar results, the Kansas River at Wamego (SC260) regression is somewhat more protective than the Republican River at Clay Center (SC503) regression. Based on the regression analysis, the interim endpoint shall be to reduce concentration of TSS on the Smoky Hill River at SC264 and SC265, at any given discharge value, to less than Log10TSS=(- 0.386 + 0.663*(Log10Discharge), with TSS measured in mg/L and discharge measured in cubic feet per second (Figures 28 &29). The use of the regression equation generated in the analyses of TSS in the Kansas River at Wamego (SC260) is intended to produce a TSS endpoint for SC264 and SC265 where the median concentration will not exceed 50 mg/L TSS over all flow conditions.

This interim endpoint shall be understood to potentially protect aquatic life from the harmful

effects of suspended solids and will serve as a numeric translator of the narrative criteria. Full compliance with water quality standards shall be evaluated by the Department (KDHE) based on recovery of aquatic life diversity.

3. SOURCE INVENTORY AND ASSESSMENT

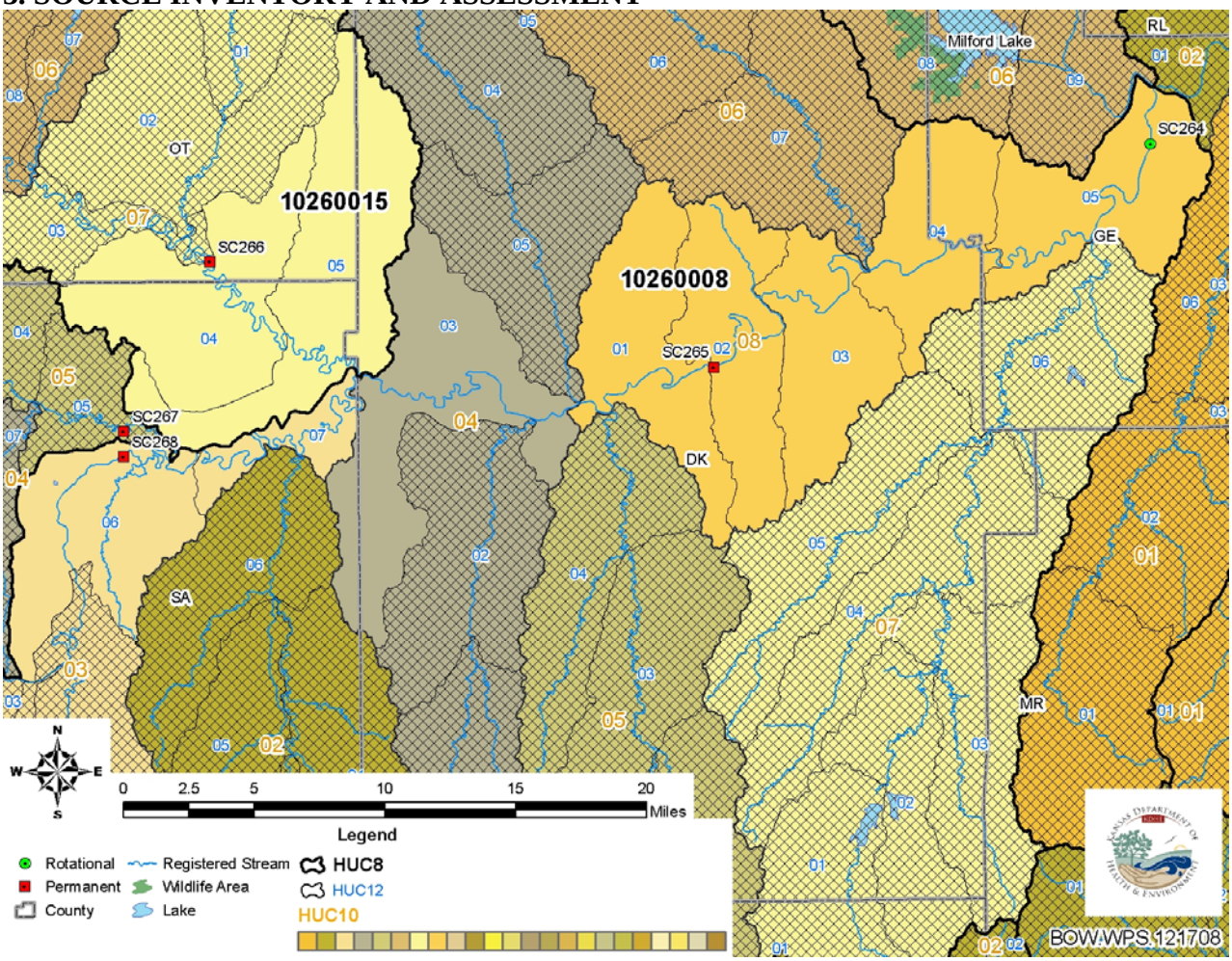

Figure 12- HUC12 boundaries in the TMDL area. HUC12 identification codes are constructed by appending the HUC10 and HUC12 sub-codes to the HUC8 code.

Land Use: Land use in this TMDL area (Table 2) is dominated by cropland uses, particularly in the alluvial valley of the major rivers, and grassland in the upland areas. Concentrations of developed land exist at Salina and Junction City, other developed lands are largely roads. The lands directly adjacent to the major rivers (Table 3) generally have concentrations of both timbered areas and cropland that exceed the HUC12 averages. The two most downstream HUC12s, 1026000808(04) & (05), have the least amount of cropland directly adjacent to the stream, which may partially explain the reduced TSS concentrations observed at SC264. Timbered lands are expected to be sources of reductions in sediment, and cropland is expected to result in increased sediment delivery, suggesting that these areas near the major rivers are contributors to the elevated TSS concentrations observed in the rivers. Erosion on cropland areas can be expected to be greater when gully formations (Figure 13) and low residue planting practices (Figure 14) occur.

HUC12	Grassland	Cropland	Forest	Open Water	Roads/ Developed	Wetlands
102600080306	24.3%	38.5%	2.6%	2.8%	30.5%	1.2%
102600080307	22.2%	59.9%	4.9%	8.0%	3.3%	1.7%
102600080403	40.2%	47.3%	4.2%	2.4%	4.7%	1.1%
102600080801	40.1%	45.3%	2.9%	2.0%	8.3%	1.3%
102600080802	46.3%	40.7%	3.7%	1.7%	6.1%	1.5%
102600080803	45.8%	39.3%	4.5%	2.1%	5.6%	2.4%
102600080804	40.9%	42.5%	6.0%	2.4%	5.4%	2.6%
102600080805	40.5%	26.2%	11.5%	3.8%	14.4%	3.6%
102600150704	33.0%	56.8%	3.0%	1.7%	4.8%	0.8%
102600150705	33.4%	54.0%	4.3%	1.4%	6.1%	0.6%

Table 2- Land use in the TMDL area by HUC12 extracted from the 2001 National Land Cover Dataset.

HUC12	Grassland	Cropland	Forest	Roads/ Developed	Wetlands
102600080306	19.9%	54.2%	9.9%	11.4%	4.6%
102600080307	15.1%	54.1%	19.2%	4.4%	7.1%
102600080403	21.7%	42.4%	18.2%	5.0%	12.6%
102600080801	14.5%	53.2%	10.7%	6.4%	15.3%
102600080802	11.3%	56.8%	15.2%	4.0%	12.8%
102600080803	13.8%	45.7%	17.2%	7.1%	16.3%
102600080804	10.3%	41.4%	20.9%	2.6%	22.6%
102600080805	18.2%	31.6%	27.7%	7.2%	15.3%
102600150704	4.6%	59.5%	25.7%	2.5%	7.7%
102600150705	10.7%	48.9%	27.1%	7.1%	6.2%

Table 3- Land use in a 300 foot buffer adjacent to the Solomon and Smoky Hill Rivers. Ibid.

Figure 13- Gully formation control on field adjacent to the Smoky Hill River.

Figure 14- Low residue cropping practices adjacent in the watershed. Visible on the left is an area of exposed soil where planted corn apparently failed to establish in a waterway, leaving a bare soil conveyance for overland flow.

Streambank erosion- Substantial areas of bank erosion (Figure 15, 16, 17 & 18) exist along the major rivers in this area. Banks are typically between 15 and 20 feet high, and sloughing/erosion are likely to contribute substantially to the TSS load at these monitoring stations. KDHE conducted a GIS analysis that overlay rectified 1978 topographic maps with aerial photography from 2002. Areas between the rivers locations in 1978 and the current edge of channel (Figure 19) were assumed to have eroded or sloughed into the rivers. Total estimated loss between 1978 and 2002 was measured at 1,150 acres, or approximately 1.8 square miles along the Smoky Hill River between Salina and Junction City. Visible in the 1978 topographic maps are the channel as originally drawn, and the areas outlined in purple were the change from the previous version of the map. No date was available to establish the original determination of the river location, so no attempt was made to quantify change between the 1978 version and the prior version. The 1978 version was rectified and projected with aerial photographs to determine actual river location at that time.

Figures 15, 16, 17, 18 (Clockwise)- Representative examples of major bank erosion sites along the Smoky Hill River. At Chapman, looking upstream; At Chapman looking downstream; Near Solomon looking downstream; Near Junction City looking downstream. In each example the

exposed bank extends hundreds of feet, and in most cases has other nearby areas where additional bare bank exists.

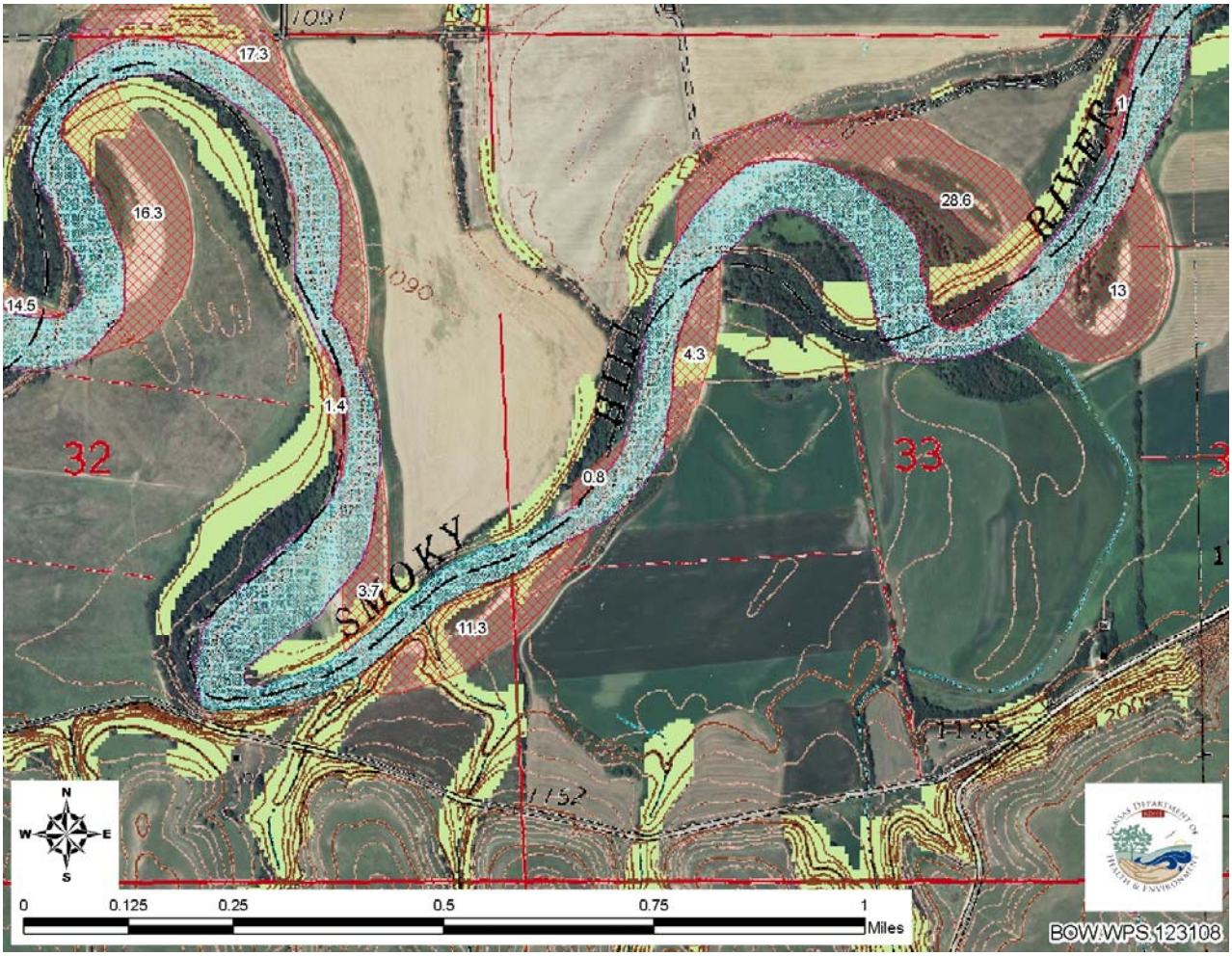

Figure 19- 1978 topographic lines and river boundaries overlain on a 2008 National Agricultural Imaging Program aerial photograph. Areas marked in red cross-hatch indicate locations of channel movement during the period. Numbers in cross hatched areas indicate acres lost to channel migration.

Recently the American Geographical Society issued Special Publication Number 42 "Historical Channel Changes of the Kansas River and its Major Tributaries" by Wakefield Dort, Jr (2009). This set of maps indicated that the during the late 1960's or early 1970s a significant section of the Smoky Hill River was channelized in and around the community of Salina (Figure 19). While this channelization is immediately monitored by SC268, the full impacts on the river are likely not fully evident until SC265 at Enterprise. The section of river that was channelized was previously 25.3 miles long, and is presently 8.5 miles long. This loss of channel length has likely contributed substantially to the bank instability observed along the Smoky Hill River between Salina and Junction City, primarily by increasing discharge strength due to reduced energy dispersion and increased channel slope. The channelized segment is shown in Figure 15. Prior to channelization this segment had an estimated overall channel slope of 1.46 feet per mile drop, after channelization this segment had an estimated overall channel slope of 4.35 feet per mile drop. By comparison, the

Smoky Hill River from the end of the channelized segment to the outlet in Junction City has an estimated overall channel slope of 1.47 feet per mile drop.

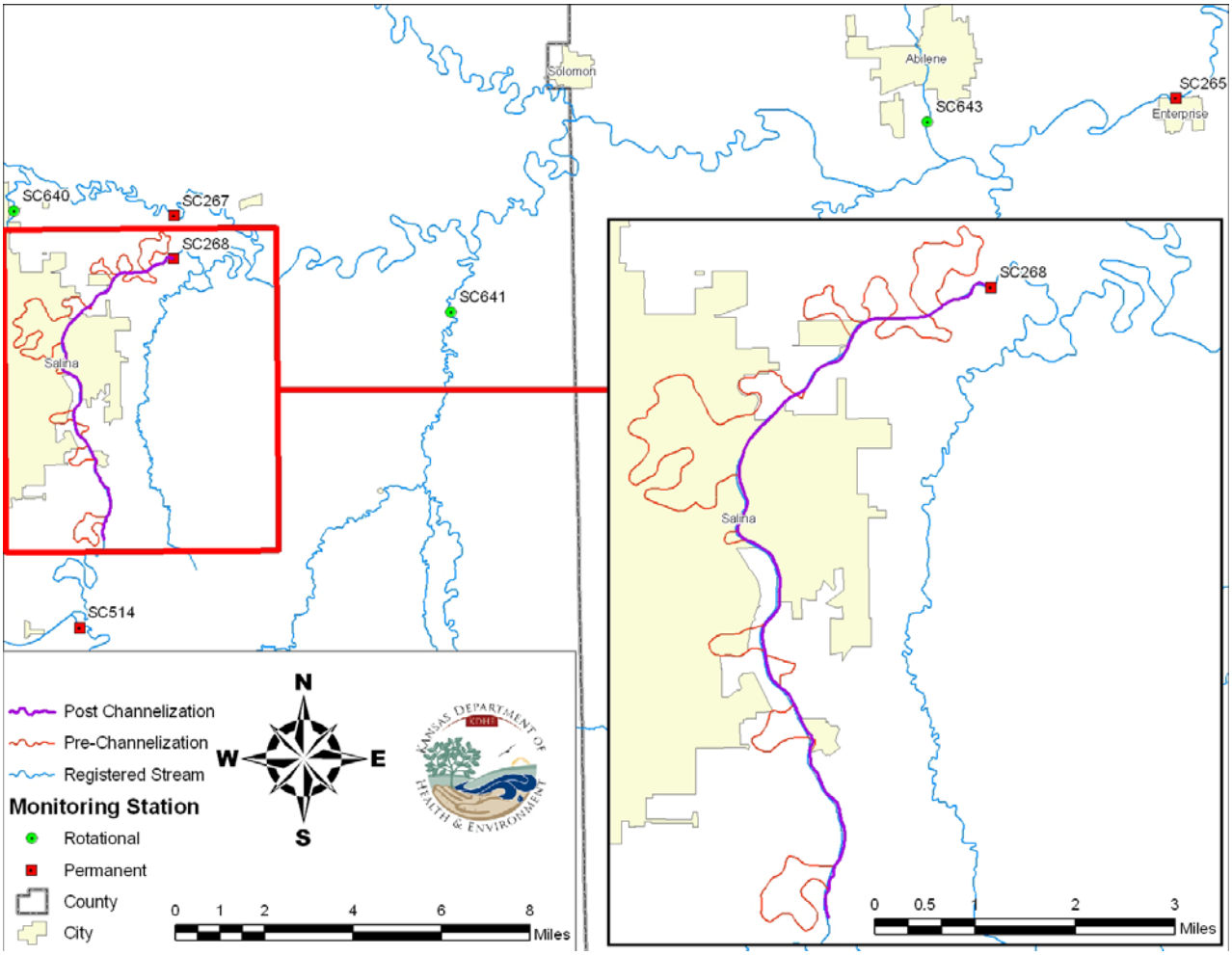

Figure 20- The Smoky Hill River near and in Salina was channelized during the late 1960's or early 1970s. This map shows the approximate location of the river prior to channelization and its approximate location in 2008.

KDHE developed a Spreadsheet Tool for Estimating Pollutant Load reductions (STEPL) model (Figure 23) of the area downstream of the three major federal reservoirs on the Smoky Hill, Saline & Solomon rivers upstream of the TMDL area. These control structures, Kanopolis Lake, Wilson Lake and Waconda Lake, likely act as effective sediment traps, releasing water that is low in suspended solids. A comparison of the load estimated by STEPL modeling and the load modeled as a discharge/measured TSS regression model (Figure 21) allows us to compare the potential contributions of upland sources and streambank/channel sources. The STEPL model was developed using 2007 National Agricultural Statistics Service crop cover data, and additional measured and estimated data as detailed in the appendix.

A regression based model of total annual loads and individual daily loads was built based on all available monitoring data and the discharge record for both SC264 and SC265. The regression

approach determines the central tendency of measured TSS for all flow conditions, then assigns TSS and discharge data to a full range of potential flows from 0% exceedence to 99.9% exceedence over the period of record in a year-like distribution (i.e. 365 estimated measurements).

The specifics of the methodology are similar to the approach taken for total phosphorus modeling in Banner et al. (2009), but are briefly explained here. A composite "year" was generated using percentile discharge data for all mean daily discharge values from water year 1971-2009. This generates 365 individual values, equivalent to the long-term range of values observed. Then using a segmented regression program, SegRegW, all log normalized discharge and TSS data for the site were analyzed to determine if a breakpoint occurred. For SC265 a breakpoint was found at Log10(Discharge(cfs))=2.44, or 275 cfs (Figure 21). The median value for all samples with discharge less than 275 cfs (59 mg/L) was assigned to each "day" of the "year" generated earlier. For "daily" discharges greater than 275 cfs a regression approach was used to estimate the concentration expected for a given discharge (Log10TSS = - 0.925 + 1.04 Log10Discharge, Adj. R^2 = 46.2, p=0.000). Because the regression produces values less than the current low flow median, all discharge values greater than 275 cfs and less than 396 cfs were also assigned 59 mg/L TSS concentration. Model "days" 364 & 365 generated regression based TSS concentration estimates that exceeded all measured samples, and were assigned the maximum recorded TSS concentration for the site, 3,340 mg/L. Model fitting may be somewhat less reliable for extreme high flows (<2% exceedence flows), for which no monitoring data were available. The same procedure was followed for SC264, but with values for low flow median, maximum measured value and regression equation adjusted to reflect the actual values for SC264.

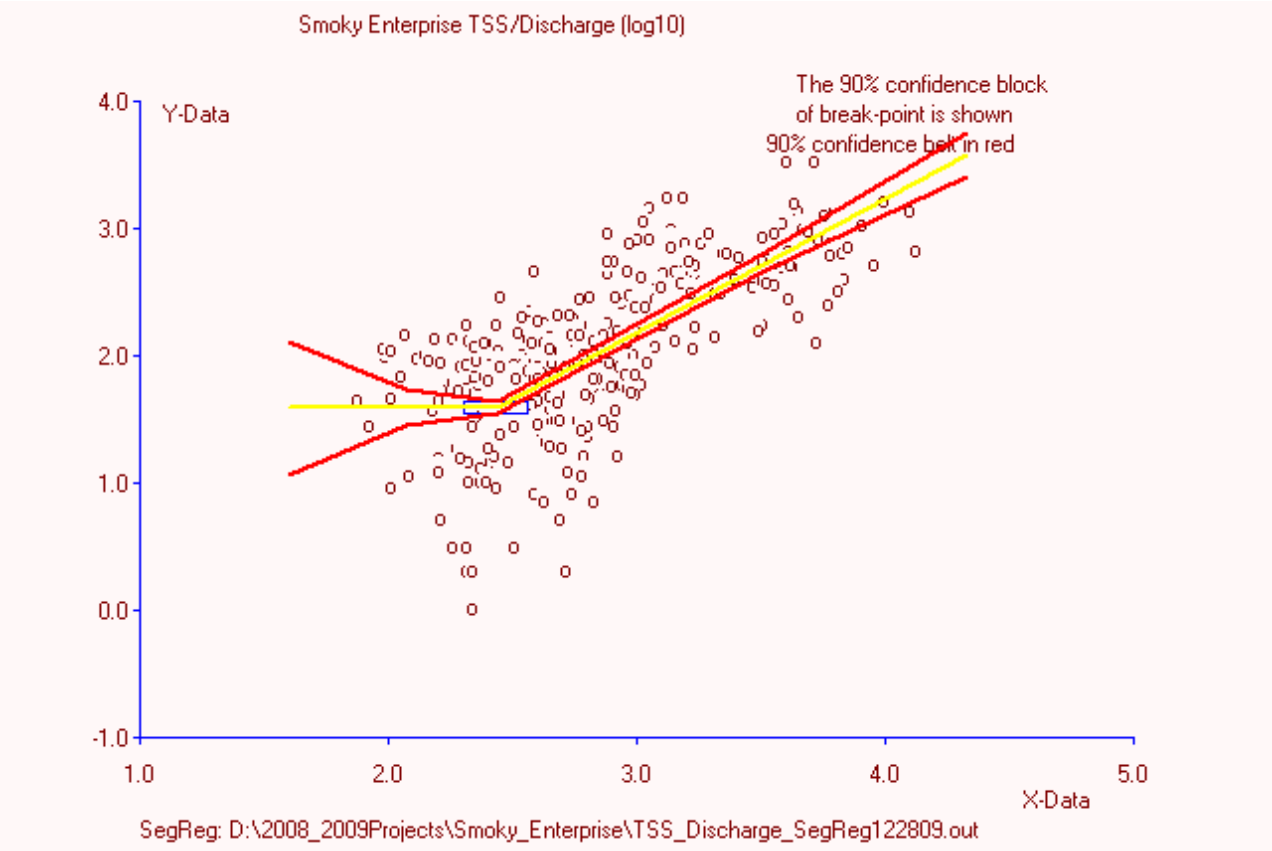

Figure 21- Breakpoint determination for the Smoky Hill River at Enterprise, as determined using the Log10 TSS (y-axis) concentration and the Log10 Discharge (x-axis) values.

Regression based model results generated an average annual total TSS load of 1.6 million tons per year (Figure 22). Using the regression model indicates that 77% of the annual TSS load observed at the Enterprise monitoring station will move during only 5% of the flow events, with substantially lower loads during the remaining 95% of the time when discharges are less than 6,000 cfs. It is likely that some of the sediment mobilized during the high flow events is deposited in the channel and is released over time, linking high flow and base flow concentrations as a yet un-specified relationship between the two conditions.

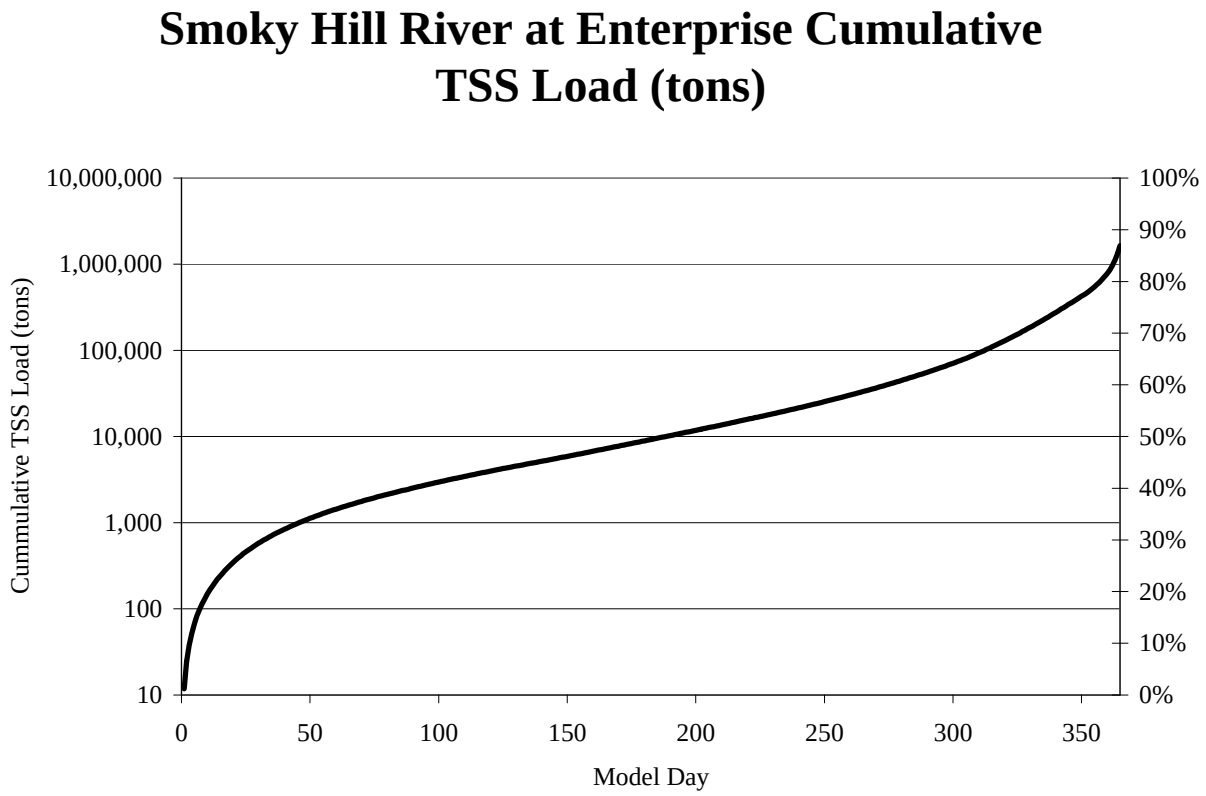

Figure 22– Regression modeled sediment load at the Enterprise gage and SC265 as a cumulative annual load.

STEPL estimated a total annual load of 504,000 tons of sediment eroded per year above the Enterprise gage (Figure 23). The regression model estimates an annual average load at Enterprise of 1.6 million tons/year. The wide disparity in the STEPL model estimate, which does not take into account streambank sources, and the measured/modeled data seen at Enterprise suggest that the primary source of sediment in the Smoky Hill River is from non-field sources, though field sources are still estimated to account for more than 1/4 of all sediment load in this system.

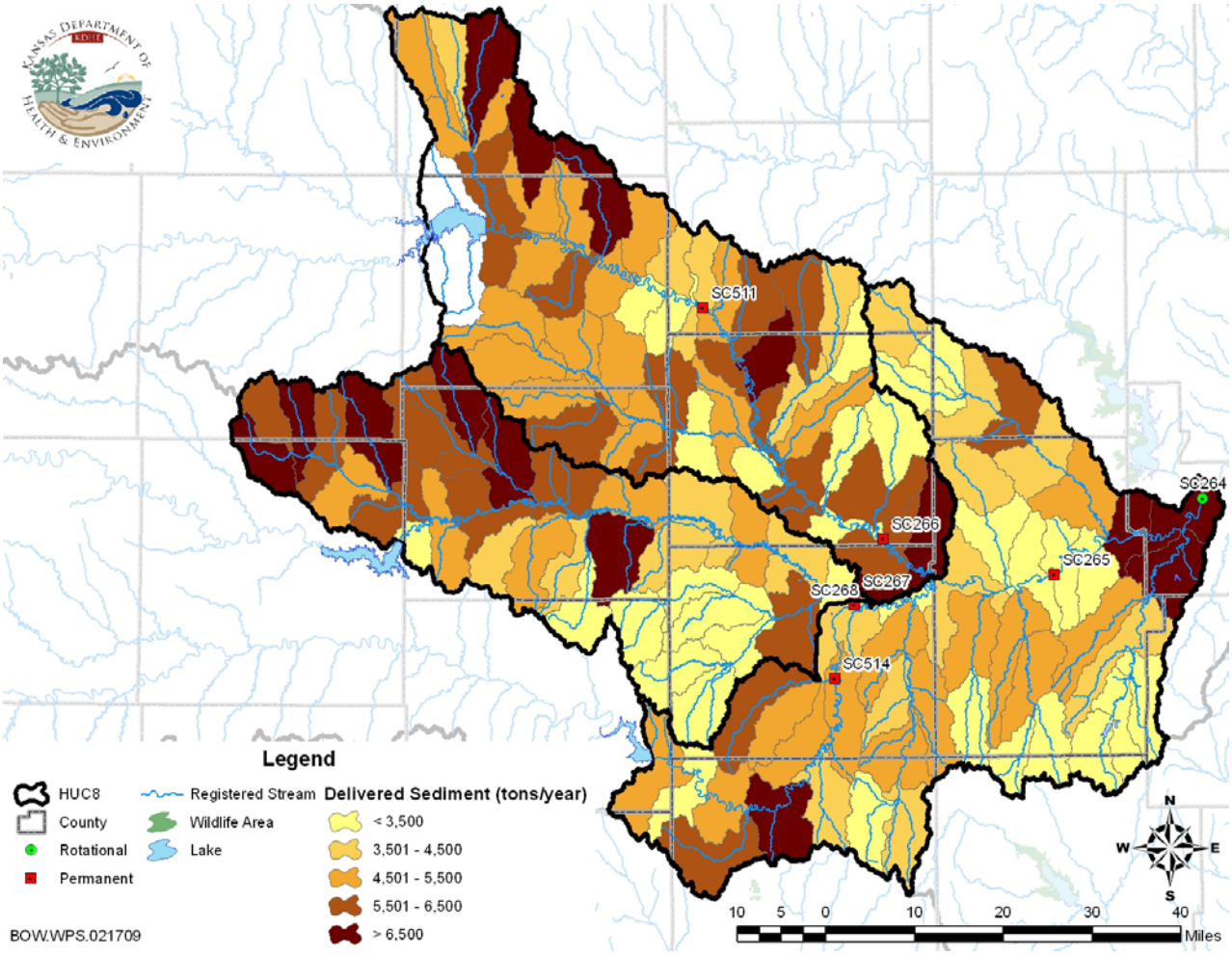

Figure 23 – STEPL modeled sediment delivery rates by HUC12 for all areas downstream of Kanapolis, Waconda and Wilson reservoirs.

Bed load/Resuspension- An unknown quantity of TSS is the result of resuspension of fine materials located on the river bed (Figure 24). No determination was possible at this time of the age or origin of the bed silt, or the rate of supply and release. The river was historically described as a "clear" with a "gentle current" that "abounds on<sic> fish of different variety" (General Land Office Surveyor's Notes, December 6, 1857), suggesting that a sand/gravel bottom was the historic condition, with relatively low rates of bed silt supply. This conclusion is corroborated by a recent KDHE analysis (Angelo et al., 2009) of the unionid mussel population at Grandview Plaza, just downstream of Junction City, where ¾'s of the historic species diversity has been extirpated. One third of the extirpated species are described as likely to occur only in sand/gravel bottom systems (Cummings & Meyer, 1992), with other absent species generally described as "mud/sand/gravel" large river species. These factors suggest that absent a new supply of bed silt the existing legacy load in the channel would eventually wash out, eliminating this source of TSS.

Figure 24- Current channel bed condition along much of the Smoky Hill and Solomon Rivers is similar to the material seen in this photograph from the Smoky Hill River. Some rock, sand and gravel is present, typically overlain with a layer of fine, silty/clay material.

Upstream/Contributing Tributaries- Nearly all tributaries and upstream portions that contribute to the discharge and TSS load in this segment of river are monitored by KDHE monitoring stations (Table 5 &6, Figure 25). While gage data are not available for all monitoring stations, USGS estimated flow (Perry et al., 2004) can be used to estimate loads originating from segments without gages. To ensure consideration of both typical flows and high flows, a two pronged approach was adopted to estimate the relative sources of the TSS load observed at the outlet of the Smoky Hill River (at the junction of the river with the Republican at Junction City). Table 5 shows the load estimated by use of median concentrations and median flows. Table 6 shows the same calculations done with average concentrations and average flows. Both tables show similar results, with the majority of the load originating in the river reaches monitored at Enterprise and the Solomon River at Niles. Based on the median estimates the largest contributors to the total load observed at SC264 are the Solomon River at Niles (SC266) and the mainstem of the Smoky Hill River between Salina and Enterprise (SC265) and the portions of the Solomon River downstream from Niles. Collectively these two monitoring stations represent 73.29%, or nearly three-quarters of the load that passes Junction City.

The small tributary waters in some cases have high TSS concentrations (SC515- Chapman Creek, SC512- Salt Creek) but the smaller flows on these streams result in substantially smaller contributions to the load observed at Junction City. The estimated median concentration at SC264 was adjusted to account for non-random sample distribution, and is likely lower than that observed at SC265, though the absolute load at Junction City is higher in part due to a larger discharge. The monitoring station at Niles will have a separate TMDL developed for TSS. The primary source of TSS load in this area is likely the channel of the Smoky Hill and Solomon Rivers as monitored by SC265, where nearly 46% of the load observed at Junction City originates, though some load does originate in upstream/contributing tributaries.

Site	Site Name	Median Flow (cfs)	TSS overall median (mg/L)	Estimated load (tons/day)	% of Flow	% of Load	Tons a Second/day/foot^3
SC667	Limestone Creek	6.76	31	0.57	0.88%	0.29%	0.08
SC511	Solomon at Glascow	97	76	19.88	11.75%	9.82%	0.20
SC651	Pipe Creek	6.37	36	0.62	0.83%	0.31%	0.10
SC512	Salt Creek	14	87	3.28	1.82%	1.67%	0.23
SC266	Solomon at Niles	153	132	54.47	4.64%	15.88%	0.36
SC513	Saline at Beverly	50	87	11.73	6.51%	5.96%	0.23
SC640	Mulberry Cr	7.9	34	0.72	1.03%	0.37%	0.09
SC267	Saline near New Cambria	58	110	17.34	0.07%	2.48%	0.30
SC514	Smoky at Mentor	128	84	29.00	16.67%	14.74%	0.23
SC268	Smoky at Salina	173	67	31.18	5.80%	1.11%	0.18
SC641	Gypsum Creek	19.73	43	2.29	2.57%	1.16%	0.12
SC642	Holland Cr	8.06	33	0.72	1.05%	0.36%	0.09
SC644	Turkey Cr	12.38	35	1.17	1.61%	0.59%	0.09
SC643	Mud Cr	11.64	40	1.26	1.52%	0.64%	0.11
SC265	Smoky at Enterprise	557	112	168.24	15.78%	30.12%	0.30
SC515	Chapman Cr	26	66	4.63	3.39%	2.35%	0.18
SC516	Lyons Cr	33	40	3.56	4.30%	1.81%	0.11
SC264	Smoky at Junction	768	95	196.76	19.79%	10.33%	0.26

Table 5- Upstream sediment concentrations and estimated median flow. All data presented in "% of Flow" and "% of Load" were generated by division of the unique contribution of the monitored area to the total load observed at SC264. Median TSS was generated using a regression equation (TSS at SC264 = 0.3132 + 0.84728TSS at SC265) derived from pairing TSS data from sampling that occurred on the same day at SC265 and SC264, eliminating the bias introduced from the increased sampling at SC264 due to the Governor's Water Quality Initiative in the 1990s.

Site	Site Name	Mean Flow (cfs)	TSS overall Mean (mg/L)	Estimated load (tons/day)	% of Flow	% of Load	Tons a Second/day/foot^3
SC667	Limestone Creek	30.73	145	12.03	1.64%	1.03%	0.39
SC511	Solomon at Glascow	450	167	202.90	22.43%	16.29%	0.45
SC651	Pipe Creek	33.74	96	8.71	1.81%	0.74%	0.26
SC512	Salt Creek	70	142	26.73	3.75%	2.28%	0.38
SC266	Solomon at Niles	516	269	374.68	-2.02%	12.66%	0.73
SC513	Saline at Beverly	212	161	92.01	11.34%	7.85%	0.43
SC640	Mulberry Cr	83	57	12.77	4.44%	1.09%	0.15
SC267	Saline near New Cambria	308	278	230.65	0.70%	10.74%	0.75
SC514	Smoky at Mentor	355	128	122.68	18.99%	10.47%	0.35
SC268	Smoky at Salina	368	141	139.84	0.70%	1.46%	0.38
SC641	Gypsum Creek	82.83	154	34.41	4.43%	2.94%	0.42
SC642	Holland Cr	43.01	47	5.46	2.30%	0.47%	0.13
SC644	Turkey Cr	79.37	56	12.04	4.25%	1.03%	0.15
SC643	Mud Cr	45.39	48	5.91	2.43%	0.50%	0.13
SC265	Smoky at Enterprise	1489	274	1100.29	2.48%	24.35%	0.74
SC515	Chapman Cr	94	142	35.98	5.03%	3.07%	0.38
SC516	Lyons Cr	107.9	60	17.36	5.77%	1.48%	0.16
SC264	Smoky at Junction	1869	232	1171.64	9.53%	1.54%	0.63

Table 6- Upstream sediment concentrations and estimated mean flow. All data presented in "% of Flow" and "% of Load" were generated by division of the unique contribution of the monitored area to the total load observed as SC264. Mean TSS was generated using a regression equation (TSS at SC264 = 0.3132 + 0.84728TSS at SC265) derived from pairing TSS data from sampling that occurred on the same day at SC265 and SC264, eliminating the bias introduced from the increased sampling at SC264 due to the Governor's Water Quality Initiative in the 1990s.

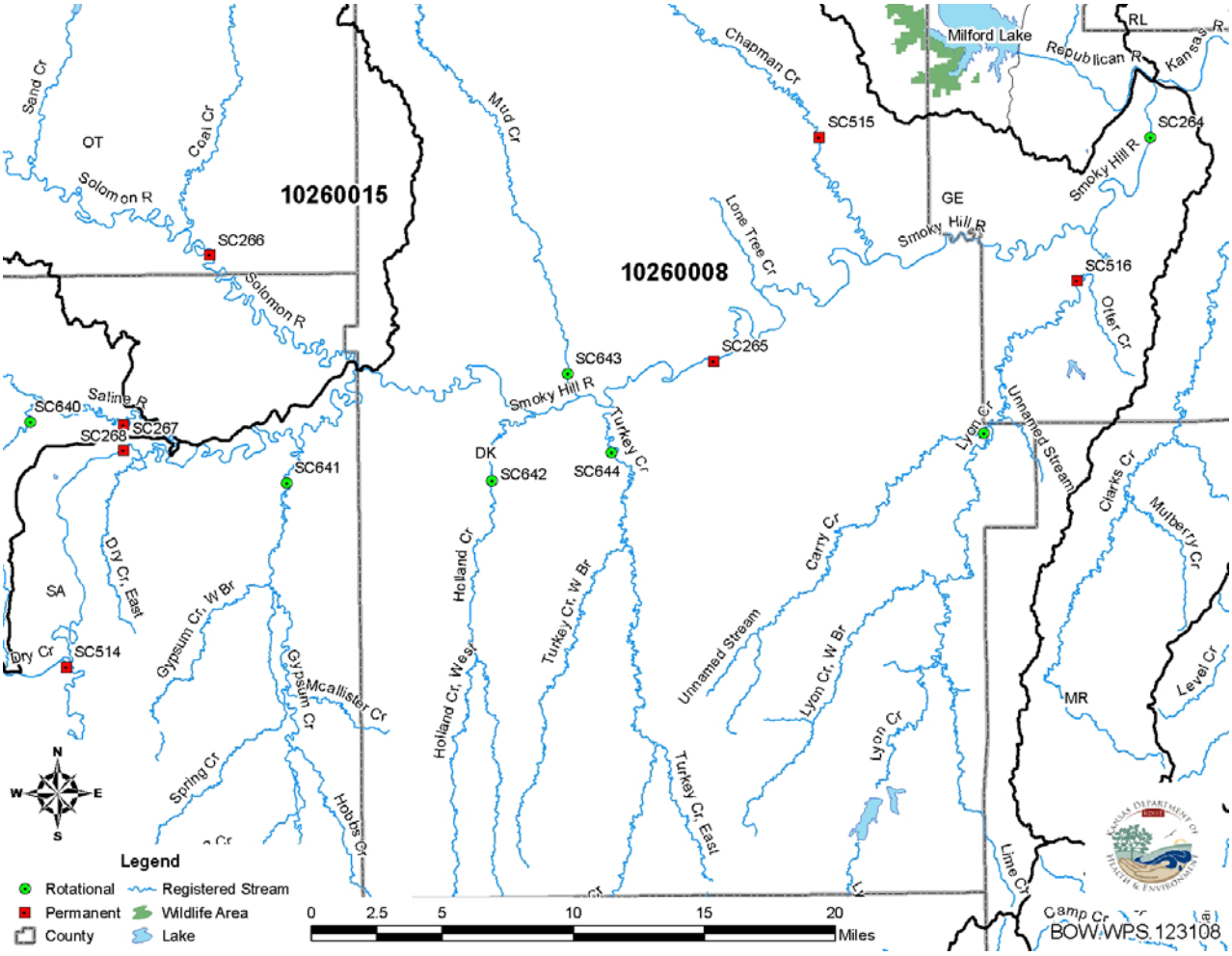

Figure 25- KDHE monitoring stations on the Smoky Hill River and tributaries.

Livestock Waste Management Systems: Twenty three small confined animal feeding operations (CAFOs) (Figure 26, Appendix B) exist within the TMDL area, none of which hold a federal discharge permit (NPDES) number. The largest number are small beef operations (18) with less than 1,000 head at all times. According to the USDA National Agricultural Statistics Service, on January 1, 2010 cattle inventories for Saline, Dickinson and Geary counties were 40,000, 49,000 and 15,000 head, respectively. Along with the swine, dairy and chicken facilities the permitted and certified beef CAFO facilities are likely to contribute relatively little to the sediment loads observed in the Smoky Hill River due to existing pollution prevention and containment requirements, which include containing all runoff from a 25 year-24 hour storm.

Smaller livestock operations in the watershed likely consist of range livestock, of which is predominantly cattle in this region. Rangeland cattle are unlikely to contribute to the TSS loads within the watershed since these cattle are ranging on permanent grassland vegetation.

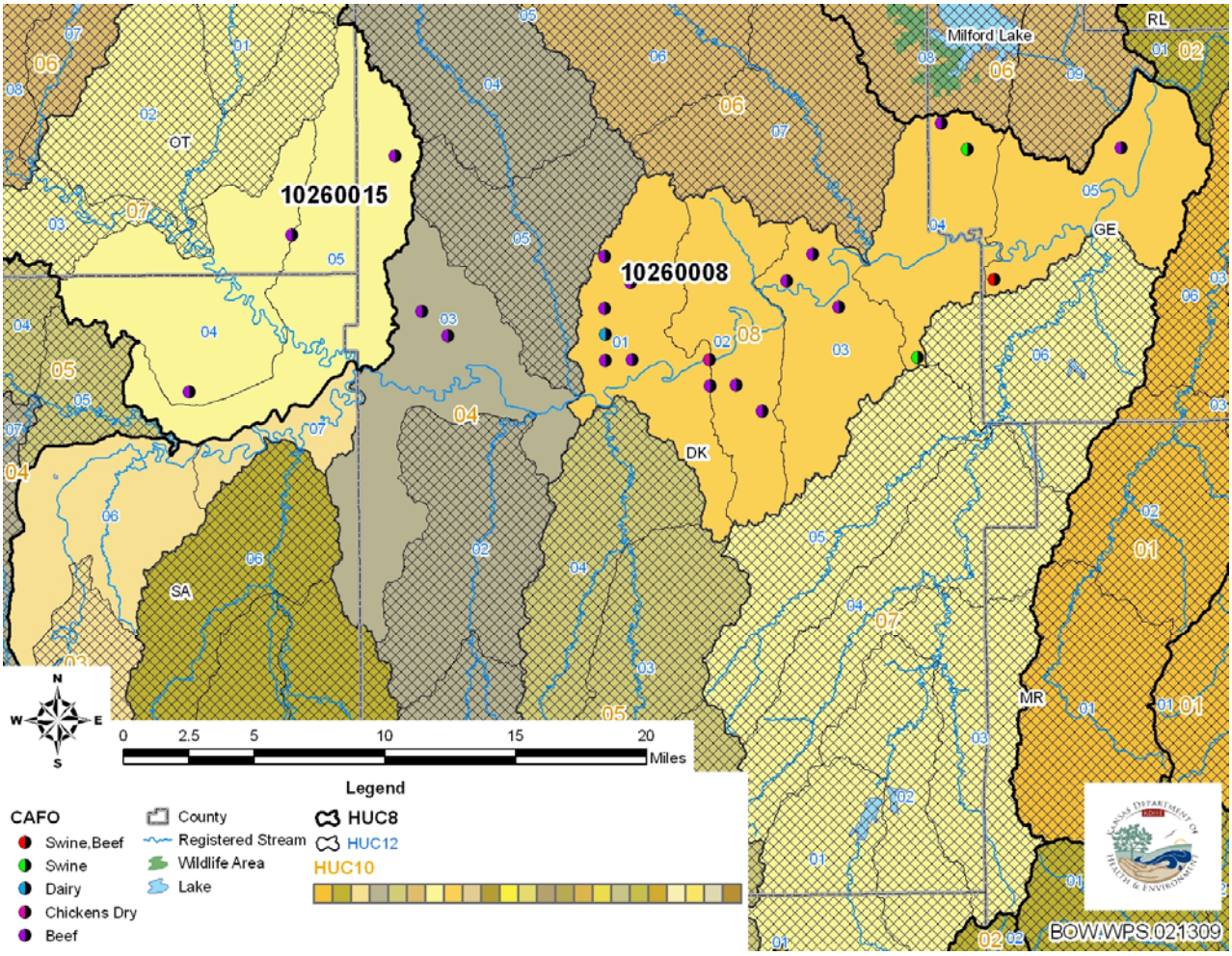

Figure 26. CAFOs within the Smoky Hill River at Enterprise and Junction City watershed.

NPDES: Fifteen facilities with NPDES permits (Figure 27) exist within the TMDL area. Seven are industrial facilities, one is an MS4 general (stormwater) permit for Junction City, and the remainder are municipal wastewater treatment facilities. These facilities are unlikely to contribute significantly to the TSS load observed in the Smoky Hill river due to a combination of factors, including limited discharge (quarry and concrete), small discharge volumes (< 1 cfs) on lagoon facilities, and highly effective treatment for removal of suspended materials on mechanical plants that typically report TSS effluent concentrations well below their permit limits (Appendix C).

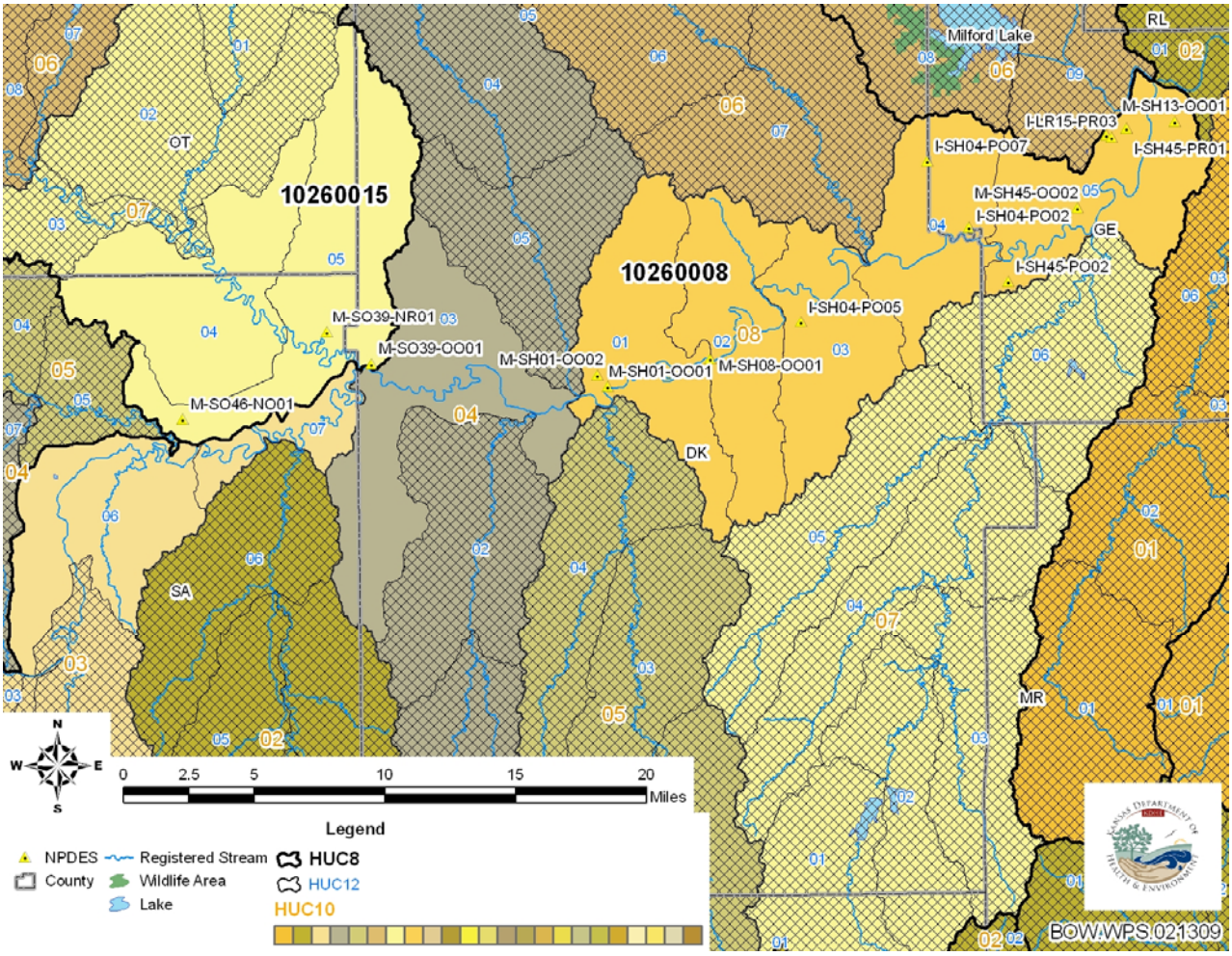

Figure 27 – Permitted NPDES facilities in the TMDL area.

Contributing Runoff: Soil permeability values across the watershed, based on NRCS STATSGO database, indicate the average soil permeability of the watershed is 0.88”/hour, with nearly 88% of the watershed having a soil permeability of less than 1.3”/hour which contributes to runoff during very low to low rainfall intensity events. According to a USGS open-file report (Jaracek, 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. Runoff is primarily generated as infiltration excess with rainfall intensities greater than soil permeability. As the watersheds’ soil profiles become saturated, excess overland flow is produced.

Population Density: The watershed’s population density is 135.7 people/square mile with the populations for the counties and cities within the TMDL area summarized in Table 7. Salina, which contains nearly 90% of the population in Saline County, is not included in this TMDL. Data from the 2000 and 2010 US Census shows an increase in population for all of the counties and cities included in the SC264 and SC265 watershed with the 2010 population of Grandview Plaza in Geary County surpassing the 2040 population projection. Junction City, the largest city in the watershed, is projected to grow by 24% by 2040.

County	City	2000 Population (US Census)	2010 Population (US Census)	2040 Projections (KWO)	% Change from 2000 to 2040
Saline		**53,600**	**55,606**	**67, 287**	**20%**
Dickinson		**19,342**	**19,757**	**25,833**	**25%**
	Abilene	6,543	6,844	10,634	39%
	Chapman	1,241	1,158	1,868	34%
	Enterprise	836	827	1,306	36%
	Solomon	1,072	1,095	1,557	31%
Geary		**27,845**	**34,362**	**34,852**	**20%**
	Grandview Plaza	1,184	1,752*	1,447	18%*
	Junction City	18,886	23,353	24,841	24%

Table 7. Population data for Counties and major Cities within the TMDL area. Percent increase is based on 2000 US Census figures and the 2040 projections published by the KWO. *Actual population exceeds 2040 projection.

On-Site Waste Systems: Based on 2000 census data about 10% of the households in Saline and Geary Counties and 29% of the households in Dickinson County utilize septic or other on-site systems. Because of their small flows and loads, failing on-site septic systems would be a minor source of sediment loadings within the watershed and would not contribute to the suspended solids impairment along the Smoky Hill River.

Background Levels: Some TSS load is expected from natural sources in rivers of all sizes. The overall background level without the impacts of bank erosion/sloughing and overland flow erosion events is likely a very small portion of the total load that occurs in this river.

Critical Conditions/Seasonality- TSS concentrations are highest in the summer months, though they begin to rise during the spring. TSS loads generally exceed acceptable levels during all seasons, and the impacts of sediment on aquatic life are likely present through the year. Strategies that reduce TSS loads during their peak periods will likely also result in reductions during other seasons.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

TSS is the primary pollutant of concern in this TMDL area and is allocated as follows, details in figures 28 & 29, table 7 & daily values in Appendix.

Point Sources: Point source dischargers in this area effectively remove most of the suspended material entering their treatment works. They generally contribute only a small portion of the total flow in the river, and report TSS monitoring data that frequently falls below the KDHE reporting limit for stream chemistry monitoring. These NPDES permitted facilities are included in the TMDL for reporting purposes, but are unlikely to be contributing to the impairments observed in the Smoky Hill River, and should be expected to maintain the current high quality treatment for suspended materials they demonstrate through their required monitoring data. Waste load allocations are determined by multiplying design flow times the permit limit, and as design flows

are singular values assigned in the permit, the waste load allocation remains constant over all flows. One municipal stormwater (MS4) permit exists in the TMDL area, Junction City. Junction City makes up approximately 3% of the watershed that is contributing TSS load at station SC264, therefore, the MS4 permit has been assigned a wasteload allocation of 3% of the TMDL for the Smoky Hill River at Junction City which is a conservative estimate as it applies to all flow conditions (Table 8).

Nonpoint Sources: Water quality violations are predominantly due to nonpoint source pollutants. Reduction of TSS concentrations to less than 50 mg/L in the rivers should protect water quality and maintain the designated uses. To reduce total suspended solids concentrations to this level will require a reduction of loading by at least 93 tons/day at median flow (557 cfs), reflecting a median concentration of 27 mg/L for SC265. Recognizing that at high flows attainment of 50 mg/L may not be attainable, non-point sources are allocated by application of the current regression based equation developed on data from the Kansas River at Wamego (Appendix). Because flows in the Smoky Hill River at $\geq$ 75% flow exceedance are less than the minimum observed flow in the Kansas River at Wamego (427 cfs), the median concentration for those flows has been set at 22 mg/L, the solution to the regression at 427 cfs. Over time the average annual reduction in TSS loads required to meet this TMDL is 88%. For flows less than the 5%ile flows (6,000 cfs) the average annual reduction in TSS loads required to meet this TMDL is 83%. If a 50 mg/L concentration limit was applied at all flows, the required reduction would be 95% of average annual TSS loads.

Defined Margin of Safety: The margin of safety for this TMDL is explicitly set at 10% of the TMDL at SC264 and SC265 for all flow conditions. In addition, the assignment of 22 mg/L TSS at Flows >75% flow exceedance is conservative and adds another, implicit, margin of safety to the TMDL.

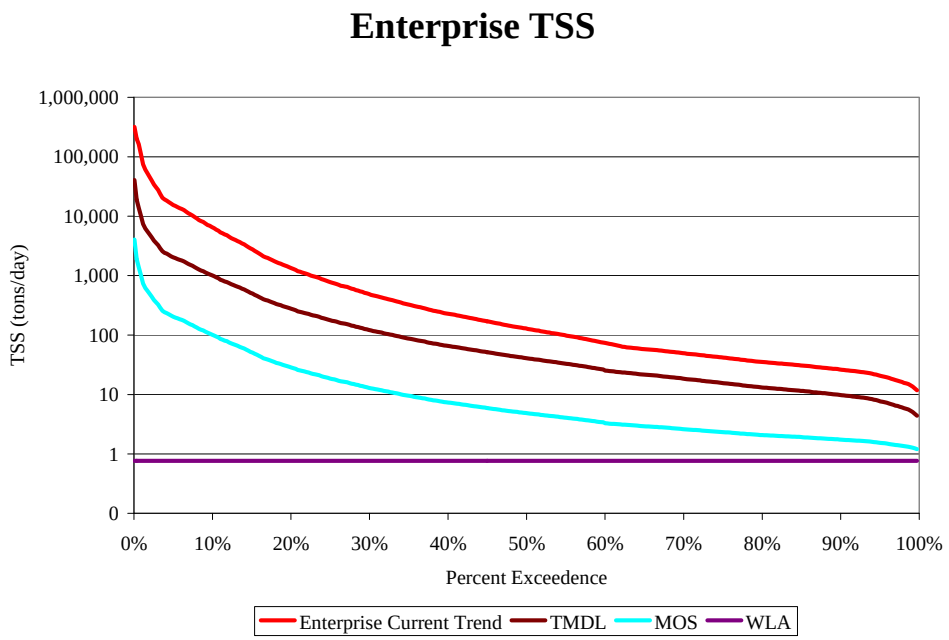

Figure 28- The TMDL for SC265, including wasteload allocation, margin of safety and the total maximum daily load across all flow conditions. A red trendline for current samples is included for reference.

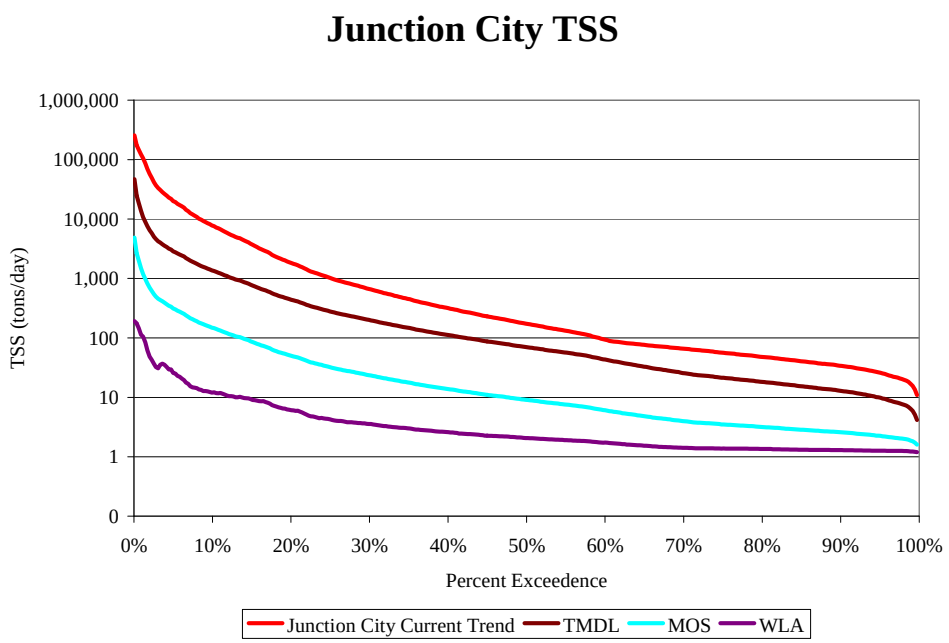

Figure 29- The TMDL for SC264, including wasteload allocation, margin of safety and the total maximum daily load across all flow conditions. A red trendline for current samples is included for reference.WLA increases with increasing discharge to allocate the Junction City stormwater permit a load proportional to the percent of the watershed draining in that city (3%) as applied to

the acceptable increase in the load between Enterprise and Junction City.

Smoky Hill-Enterprise	NPDES Q (cfs)	WLA (tons/day)	Discharge (cfs)	MS4 WLA (tons/day)	LA (tons/day)	MOS (tons/day)	TMDL (tons/day)	Median Conc.
90% Exceedence	4.79	0.41	165	NA	8.41	0.98	9.80	22
75% Exceedence	4.79	0.41	262	NA	13.60	1.56	15.56	22
50% Exceedence	4.79	0.41	557	NA	36.40	4.09	40.90	27
25% Exceedence	4.79	0.41	1,350	NA	160.04	17.83	178.28	49
10% Exceedence	4.79	0.41	3,820	NA	904.44	100.54	1,005.39	97

Smoky Hill- JC	NPDES Q (cfs)	WLA (tons/day)	Discharge (cfs)	MS4 WLA (tons/day)	LA (tons/day)	MOS (tons/day)	TMDL (tons/day)	Median Conc.
90% Exceedence	9.08	0.82	217	0.39	10.39	1.29	12.89	22
75% Exceedence	9.08	0.82	360	0.64	17.78	2.14	21.38	22
50% Exceedence	9.08	0.82	768	2.09	59.89	6.98	69.78	34
25% Exceedence	9.08	0.82	1,770	8.39	242.55	27.97	279.73	59
10% Exceedence	9.08	0.82	4,592	40.91	1185.71	136.38	1363.82	110

Table 8. Pollutant load allocations for SC264 and SC265 at specified discharge values.

State Water Plan Implementation Priority: Because SC265 has among the highest median TSS concentration statewide, and because this river contributes to the publicly accessible recreation resources on the Kansas River downstream, this TMDL will be a **High Priority** for implementation.

Unified Watershed Assessment Priority Ranking: This TMDL area lies within the Lower Smoky Hill and Solomon River Watersheds (HUC 8: 10260008 and 10260015) with a priority ranking of 35 and 23 (Medium Priority for restoration).

Priority Areas: Implementation of land use practices should be targeted to those areas within 300 feet of the Smoky Hill and Solomon Rivers.

5. IMPLEMENTATION

Desired Implementation Activities

Stabilization of actively eroding streambanks and re-establishment of a wooded riparian corridor along the Smoky Hill and Solomon Rivers will substantially reduce TSS loading in this area. Conversion of cropland in sensitive areas, particularly areas within 300 feet of the rivers, to permanent vegetation has the potential to limit new loading from these areas with high delivery potential for newly eroded soils.

Implementation Programs Guidance

Non-Point Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for reduction of siltation runoff from agricultural or road construction activities

b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.

c. Provide technical assistance on road construction activities in vicinity of streams.

d. Support the development, assessment, planning and implementation of a developing WRAPS to comprehensively reduce the loading and delivery of pesticides, sediment and nutrients to the stream system throughout its watershed.
e. Incorporate this TMDL into the Lower Smoky Hill WRAPS and the Lower-Lower Smoky Hill WRAPS 9-Element Plan.

Water Resource Cost Share & Non-Point Source Pollution Control Programs - SCC

a. Apply conservation farming practices, including terraces and waterways
b. Provide sediment control practices to minimize erosion and sediment transport

Riparian Protection Program - SCC

a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
b. Develop riparian restoration projects

Buffer Initiative Program - SCC

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

CRP Enrollment- NRCS

a. Enroll highly erodable lands in the conservation reserve program (CRP).
b. For lands coming out of the CRP program, efforts should be made to enroll in other Farm Bill programs to maintain their stability, and generally to support their continuation as grasslands with permanent cover.

Extension Outreach and Technical Assistance - Kansas State University

a. Educate agricultural producers on sediment and pasture management
b. Provide technical assistance on buffer strip design and minimizing cropland runoff

Hydraulic Capacity and Bank Stability Investigation- Kansas Water Office

a. Sponsor a study to determine the impact of the Salina area river channelization on downstream bank stability.
b. Investigate what steps may be taken to increase channel length to reduce hydraulic forces.
c. Investigate the ongoing impacts from existing channel stabilization structures in the Smoky Hill River.

Time Frame for Implementation: Bank stabilization and re-forestation within a 300 foot buffer along the Smoky Hill and Solomon Rivers should occur through 2020. During 2010-2020 monitoring of flow adjusted TSS concentrations should show reductions.

Delivery Agents: The primary delivery agents for program participation will be the Geary, Dickinson, & Saline County Conservation Districts for programs of the State Conservation Commission and the Natural Resources Conservation Service. Producer outreach and awareness

will be delivered by Kansas State Extension. The Lower Smoky Hill WRAPS group and the Lower Lower Smoky Hill WRAPS group shall provide and coordinate/deliver services for implementation efforts in this area.

Targeted Participants: Primary participants for implementation shall be land-owners with property abutting the Smoky Hill and Solomon Rivers, upstream involvement from the City of Salina, and other parties who have interests in the river course.

Milestone for 2020: The year 2020 marks the quintile of the fifty-year implementation window for the watershed. At that point in time, sampled data from SC264 and SC265 will be reexamined to confirm the impaired status of the rivers. Should impairment remain, more aggressive techniques will be examined to remove potential sources of sediment from the river.

Reasonable Assurances:

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

1. 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.

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

3. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.

4. 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.

5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan.*

6. The *Kansas Water Plan* and the Smoky Hill 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 in implementation.

Funding: The State Water Plan Fund 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 watersheds 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 is a **High Priority** consideration. Priority should be given to activities which reduce loadings of sediment to the rivers by 2020.

Effectiveness: Reduction of bank sloughing and erosion will substantially reduce the total load of TSS in this area.

6. MONITORING

KDHE will continue to monitor water quality on the prescribe schedule at each of these monitoring stations. SC265 will continue to be sampled bi-monthly, and SC264 will be sampled in 2011, 2015 and 2019. Because the major impairment of this river results in aquatic life impacts, ongoing monitoring of both arthropod invertebrates and unionid mussels will continue to determine if any observed reduction in stream TSS concentrations correspond to improvements in diversity and abundance of desirable forms of aquatic life including recolonization of locally extirpated species from nearby refugia.

7. FEEDBACK

Public Meetings: An active Internet Web site was established at http://www.kdheks.gov/tmdl/index.htm to convey information to the public on the general establishment of TMDLs in the Smoky Hill-Saline Basin.

Public Hearing: A Public Hearing on this Smoky Hill Basin TMDLs was held in Assaria on February 11, 2010.

Basin Advisory Committee: The Smoky Hill Basin Advisory Committee met in Hays to discuss these TMDLs on 7/7/09, 10/1/09 & 3/4/10.

Milestone Evaluation: In 2020, evaluation will be made as to implementation of management practices to minimize the nonpoint source runoff contributing to this impairment. Subsequent decisions will be made regarding the implementation approach, priority of allotting resources for implementation and the need for additional or follow up implementation in this watershed 2018 with consultation from the Smoky Hill Basin WRAPS teams.

Consideration for 303d Delisting: The Smoky Hill and Solomon Rivers will be evaluated for delisting under Section 303d, based on the monitoring data over 2010-2020. Therefore, the decision for delisting will come about in the preparation of the 2022-303d list. While TSS concentrations will be evaluated as consideration for delisting of these waters, ultimate delisting shall be dependent on demonstration of full aquatic life support, as measured by macroinvertebrate sampling, and recovery of extirpated unionid mussel species. Should the endpoints in this TMDL fail to result in full aquatic life support, this TMDL will be revisited and revised with more stringent limits needed to fully support aquatic life.

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 2010, 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 2010-2020.

Revised May 13, 2011

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Appendix A. Regression models for TSS and discharge in comparison rivers.

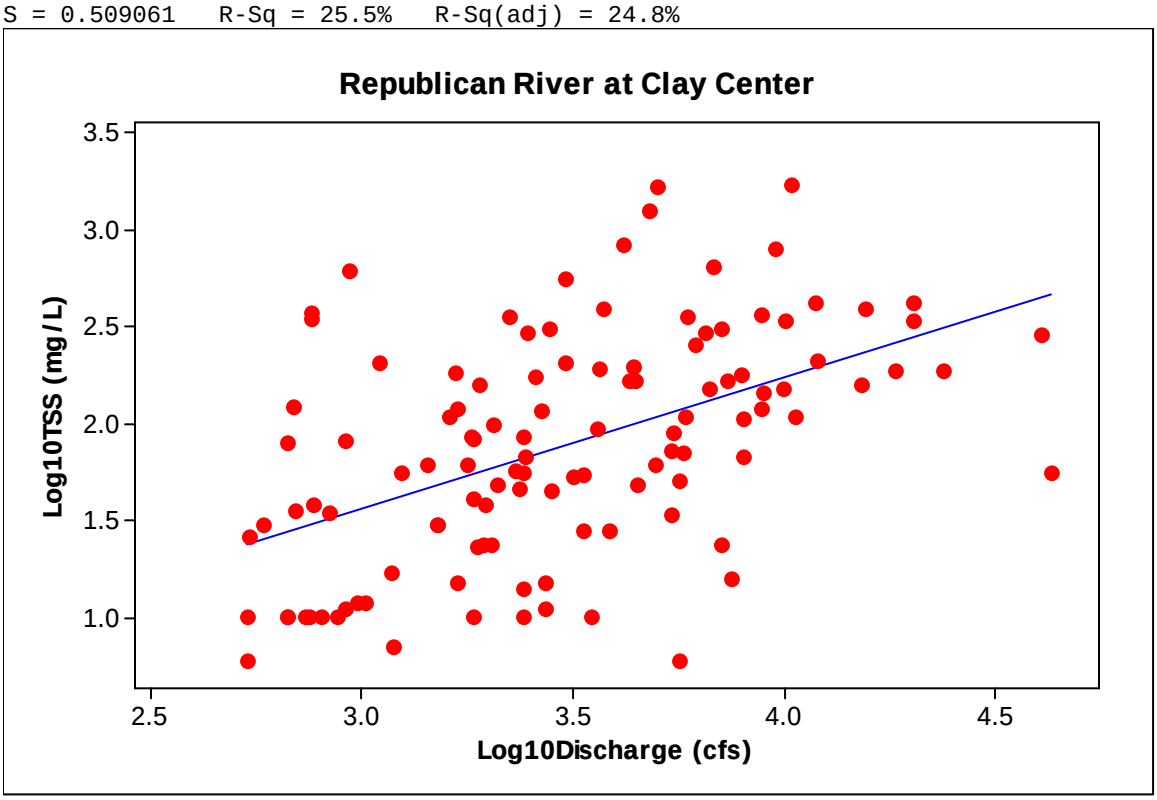
Republican River at Clay Center

TSS Data: SC503, Period of Record 1990 – 2009
Flow Data: USGS Gage 0685660, Period of Record 1990 – 2009

```
The regression equation is
Log10TSS = - 0.472 + 0.679 Log10Discharge


Predictor          Coef  SE Coef      T      P
Constant        -0.4719   0.3826  -1.23  0.220
Log10Discharge   0.6787   0.1092   6.22  0.000


S = 0.509061   R-Sq = 25.5%   R-Sq(adj) = 24.8%
```



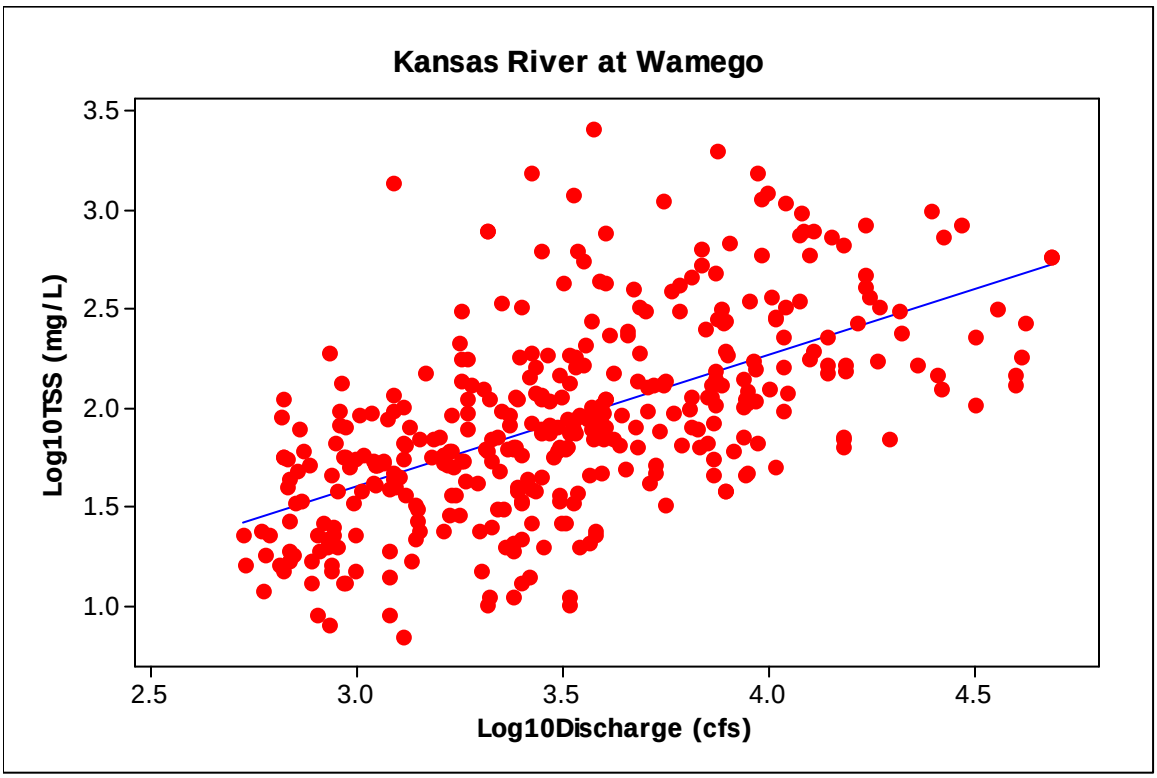
Kansas River at Wamego

TSS Data: SC260, Period of Record 1973 – 2009
Flow Data: USGS Gage 06887500, Period of Record 1973 – 2009

```
The regression equation is
Log10TSS = - 0.386 + 0.663 Log10Discharge


Predictor          Coef  SE Coef      T      P
Constant        -0.3858   0.1640  -2.35  0.019
Log10Discharge  0.66330  0.04638  14.30  0.000


S = 0.394429   R-Sq = 35.2%   R-Sq(adj) = 35.0%
```



Appendix B. CAFO facilities within the TMDL watershed.

KS Permit Number	County	Total Animals	Animal Type	WLA (tons/day)
A-SASA-BA11	Saline	300	Beef	0
A-SODK-BA01	Dickinson	600	Beef	0
A-SHDK-B013	Dickinson	950	Beef	0
A-SHDK-B017	Dickinson	990	Beef	0
A-SHDK-BA03	Dickinson	600	Beef	0
A-SHDK-BA12	Dickinson	870	Beef	0
A-SHDK-BA23	Dickinson	50	Beef	0
A-SHDK-BA31	Dickinson	300	Beef	0
A-SHDK-BA48	Dickinson	40	Beef	0
A-SHDK-BA49	Dickinson	70	Beef	0
A-SHDK-BA50	Dickinson	100	Beef	0
A-SHDK-BA53	Dickinson	600	Beef	0
A-SHDK-BA54	Dickinson	80	Beef	0
A-SHDK-BA59	Dickinson	299	Beef	0
A-SHDK-M012	Dickinson	140	Dairy	0
A-SHDK-MA04	Dickinson	50	Dairy	0
A-SHDK-PA01	Dickinson	20000	Chickens	0
A-SHDK-SA02	Dickinson	1000	Swine	0
A-SHDK-6966	Dickinson	140	Beef	0
660	Geary	0	Beef	0
A-SHGE-BA01	Geary	120	Beef	0
A-SHGE-S002	Geary	1100	Swine, Beef	0
A-SOOT-BA04	Ottawa	400	Beef	0

Appendix C. NPDES permits in the TMDL watershed.

Facility	KS Permit #	NPDES #	Type	Design Flow (MGD)	Receiving Stream	Avg Flow (MGD)	Avg. Monthly TSS Limit (mg/L)	Avg Monthly TSS (mg/L)	Permit Expires
Solomon WWTF	M-SO39-OO01	KS0085979	3-Cell Lagoon	0.110	Solomon River	Not Monitored	80	53.8	12/31/2013
Abilene WWTF	M-SH01-OO02	KS0098647	Aerobic Digestion	3.0	Smoky Hill River	0.634	30	22.0	12/31/2014
Enterprise WWTF	M-SH08-OO01	KS0027502	3-Cell Aerated Lagoon	0.091	Smoky Hill River	0.056	80	17.8	2/28/2014
Junction City SW WWTF	M-SH45-OOO2	KS0092151	Activated Sludge	2.5	Smoky Hill River	0.68	30	16.4	8/31/2014
Grandview Plaza WWTF	M-SH13-OO01	KS0116521	3-Cell Lagoon	0.192	Smoky Hill River	Not Monitored	80	51.1	4/30/2014
New Cambria WWTF	M-SO46-N001	KSJ000609	2-Cell Lagoon	N/A	--	No Discharge	No Limit	Not Monitored	3/31/2015
Junction City Stormwater*	M-LR15-SN01	KS044010	Stormwater	N/A	Lower Republican River	Not Monitored	No Limit	Not Monitored	9/30/2009 *
Saline County Rest Area	M-SO39-NO01	KSJ000285	2-Cell Lagoon	N/A	--	No Discharge	No Limit	Not Monitored	5/31/2015
Scoular Elevator	I-SH33-PO08	KS0090336	Activated Carbon	0.0394	Smoky Hill River	.0213	No Limit	Not Monitored	7/31/2012
Hamm – Kelly #95	I-SH04-PO05	KS0093955	Stormwater and Pit Dewatering	N/A	Smoky Hill River	No Discharge	45	No Discharge	6/30/2014
Bayer – KS Falls S Quarry	I-SH04-PO07	KS0097756	Stormwater and Pit Dewatering	N/A	Smoky Hill River	Not Monitored	No Limit	Not Monitored	12/31/2014
Bayer – KS Falls N Quarry	I-SH04-PO02	KS0001813	Stormwater and Pit Dewatering	N/A	Smoky Hill River	Not Monitored	No Limit	Not Monitored	12/31/2014
Bayer – Pollard Quarry	I-SH45-PO02	KS0098116	Stormwater and Pit Dewatering	N/A	Smoky Hill River	Not Monitored	No Limit	Not Monitored	12/31/2014
Midwest Concrete	I-LR15-PR03	KSG110171	Concrete Plant w/ Retention Basin	N/A	Republican River	No Discharge	100	No Discharge	9/30/2012
Meier's Ready Mix	I-SH45-PR01	KSG110132	Concrete Plant w/ Retention Basin	N/A	Smoky Hill River	No Discharge	100	No Discharge	9/30/2012

*Permit is pending renewal. --Receiving stream not available.