

KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Mill Creek Watershed

Water Quality Impairment: Biology

Replacing TMDLs on TSS & Nutrients and Oxygen Demand Impact on Aquatic Life

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Lower Kansas

County: Johnson

HUC 8: 10270104

HUC 11 (HUC 14): 060 (040 & 050) (**Figure 1**)

Ecoregion: IX-Southeastern Temperate Forested Plains and Hills, Central Irregular Plains, Osage Cuestas (40b)

Drainage Area: 74.2 miles²

Main Stem Segment: 39, starting at confluence of Kansas River, headwaters in Johnson County near Olathe

Tributary Segments: Little Mill Creek (78)
Clear Creek (383)
Hays Creek (406)

Designated Uses: Expected Aquatic Life Support, Primary Contact Recreation 'C' on Mill Creek; 'B' on Little Mill and Clear Creeks and Secondary Contact Recreation 'b' on Hays Creek. All but Hays Creek are designated for Domestic Water Supply, Food Procurement, Groundwater Recharge, Industrial Water Supply, Irrigation Use and Livestock Watering.

Impaired Use: Expected Aquatic Life Support for Segment 39

Water Quality Standard: Nutrients--Narrative: 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. (KAR 28-16-28e(c)(2)(A)).

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

Figure 1. Mill Creek Watershed in Johnson County



2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303d: Not Supporting Aquatic Life

Monitoring Sites: Station 251 near Shawnee

Period of Record Used: Stream Chemistry: 1985–2007; Biological Monitoring: 1993-1999

Flow Record: Data from 2002-2007 from Mill Creek near Shawnee (USGS Station 06892513)

Table 1: Historic Averages and Ranges of Parameters on Mill Creek

Parameter	Historic Average & Range (93-99-Biological data; 85-07 – chemical data)
Macroinvertebrate Biotic Index (MBI)	5.29 (4.52 – 6.13)
# Ephemeroptera, Plecoptera, and Trichoptera (EPT) Taxa	5 (3 - 8)
Biochemical Oxygen Demand (BOD) / Total Organic Carbon (TOC)*	2.78 mg/l (0.01 - 7.6 mg/l) / 5.16 mg/l (3.28 – 8.12 mg/l)
Phosphorus	1.31 mg/l (0.18 – 5.48 mg/l)
Nitrate	3.22 mg/l (0.33 – 19.07 mg/l)
Total Suspended Solids	43 mg/l (1 – 580 mg/l)

*TOC replaced BOD in 2001

Two initial biological metrics (MBI and %EPT) were analyzed to assess the nutrient/ oxygen demand impairment. The Macroinvertebrate Biotic Index rates the nutrient and oxygen demanding pollution tolerance of large taxonomic groups (order and family). Higher values indicate greater pollution tolerances. Along with the number of individuals within a rated group, a single index value is computed which characterizes the overall tolerance of the community. The higher the index value the more tolerant the community is of organic pollution exerting oxygen demands in the stream setting. Index values greater than 5.4 are indicative of non-support of the aquatic life use; values between 4.51 and 5.39 are indicative of partial support and values at or below 4.5 indicate full support of the aquatic life use.

The EPT index is the proportion of aquatic taxa present within a stream belonging to pollution intolerant orders; Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies). Higher percentages of total taxa comprising these three groups indicate less pollutant stress and better water quality.

On Mill Creek, the MBI values indicate that aquatic life was not fully supported in most years of sampling (two of seven years with values near 4.5, three years with values over 5.4; [Tables 1 and 2]). Sampling done by USGS and Johnson County in 2003 confirmed the MBI scores indicative of poor support for aquatic life with the upper reach scoring 4.71, middle reaches with a MBI of 5.46 and the MBI at the lowest station hitting 5.83. Table 2 shows the water quality conditions at Station 251 leading up to each biological sampling. Typically, samples immediately before and two dates prior to the sampling were averaged for a current condition. In the case of Total Suspended Solids (TSS), the concentration in the stream during the sampling immediately before the biological sampling was also listed. The overall averages are time weighted, hence, the overall averages for poor MBIs represent 15 samplings for the chemistry data, whereas those for the good MBIs represent 6 samplings. Table 2 indicates that the poorer MBI scores also have a lower proportion of EPT taxa, were collected during cooler periods on average, have slightly higher BOD and TSS, but lower phosphorus. Comparison of the average TDS values suggests similar flow conditions on average. The TSS values in the samples immediately before the biological sampling are about three times larger for the poor MBIs than the good scores. The nitrogen data show little difference between the two biotic conditions.

Data collected by USGS during 2003 near Station 251 show better EPT proportions, but higher TSS and lower TDS averages, hinting that flows might have been higher during that year than prior to sampling in 1993-1999. Nitrogen was lower and phosphorus was higher in 2003 on average. These data suggest that BOD and TSS dampen the vitality of the stream ecology, particularly if runoff events happened recently before biological sampling.

Table 2. Time weighted average values at Station 251 for periods before annual bio-sampling

Poor MBIs										
Date	MBI	%EPT	Temp	BOD	TSS	Last TSS	NH3	NO3	TP	TDS
6-3-93	5.72	8.6	11	4.1	55	83	0.05	3.37	0.75	470
6-14-95	6.13	12	10	3.1	24	45	0.13	4.01	0.96	494
4-18-96	5.26	16	1	2.4	8	10	0.25	5.13	2.05	1040
9-5-97	5.07	14	19	2.7	50	60	0.143	0.96	0.29	287
8-17-99	5.79	22	21	1.8	161	53	0.03	1.09	0.45	373
Average	5.59	14.5	13	2.8	61	50	0.12	2.91	0.90	533
Good MBIs										
Date	MBI	%EPT	Temp	BOD	TSS	Last TSS	NH3	NO3	TP	TDS
9-20-94	4.56	20	18	2.2	46	22	0.05	3.26	0.98	421
8-19-98	4.52	21	18	2.1	36	11	0.20	2.39	0.58	657
Average	4.54	20.5	18	2.1	41	17	0.12	2.83	0.78	540
2003 USGS	5.83	22	20	---	266	---	0.12	1.26	0.87	327

Table 3 splits the period of record before and after the existing Biology TMDL was established in 1999. Generally, water quality conditions improved in the past seven years since the TMDL was adopted, with lower concentrations of most pollutants. This might reflect a combination of treatment practices and less frequent runoff conditions. The earlier period coincided with the annual sampling of the stream biology. More recent data were collected in 2006 on Mill Creek and will continue to be collected to provide a measure of biological response to these alleged improved conditions. At no time since 1985, has monitoring on Mill Creek shown low dissolved oxygen below 5 mg/l, nor pH over 8.5.

Table 3. Mill Creek Water Quality Pre- & Post-TMDL (1999) [values in mg/l]

Location	NH3	NO3	TKN	TP	PO4	BOD	TOC	TSS	TDS
1985-1999 Avg	0.16	3.68	NA	1.63	0.47	2.88	NA	45	506
1985-1999 Max	2.55	19.07	NA	5.48	1.73	7.60	NA	580	1392
2000-2006 Avg	0.09	2.09	0.69	0.51	0.32	1.88*	5.16	36	535
2000-2006 Max	0.35	7.53	1.38	1.93	1.39	4.14*	8.12	458	1016

*2000-2001

USGS (Lee, et al, 2005) has collected water quality data on Mill Creek near Shawnee over 2002-2005 (Table 4). These data tend to support the KDHE sampling conclusions indicating fair water quality with occasional spikes in concentration, although the lower TDS and elevated TSS values suggest more runoff present since 2002.

Table 4. USGS Water Quality Data from Mill Creek, 2002-2005. [values in mg/l]

Parameter	Average	Maximum	Minimum	Upper Decile
Diss. O2	9.67	16.7	6.1	14.1
pH	7.9	8.5	7.4	8.25
NH3	0.09	0.34	0.02	0.2
NO3	1.95	9.40	0.28	4.46
TKN	1.77	5.80	0.34	4.26
TP	0.87	2.38	0.28	1.94
PO4	0.30	1.46	0.12	0.73
Susp.Sed	862	3730	6	2570
TDS	327	696	199	535

Wastewater data from Olathe's Harold Street treatment plant indicate higher levels of nitrate and phosphorus than what is monitored downstream, indicating that some transformations and assimilation is occurring in transit between the plant's outfall and the downstream monitoring station. The exception is TSS which is typically low in wastewater, but increases 3-6 times at the downstream station. On occasions when wet weather causes extraneous flows to route around the wastewater plant, treatment suffers. Average BOD and TSS concentrations from Olathe under such events in 2003-2006 are 20 and 32 mg/l, respectively.

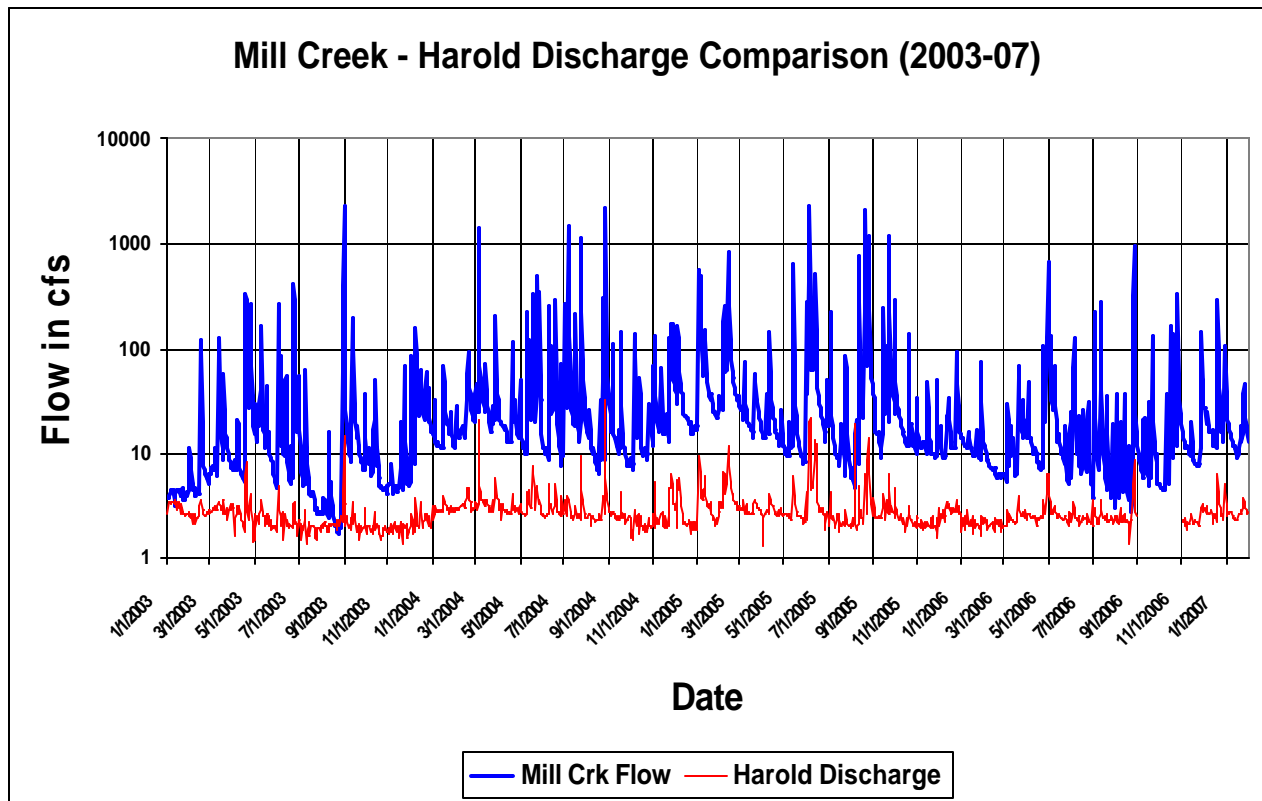
The wastewater discharge from the Harold Street Plant only makes up a portion of the flow seen typically in lower Mill Creek (Figure 2). Lee, et al (2005) found that the plant made up only about 20 percent of the baseflow seen at the downstream gage on Mill Creek during 2002-2003. This relationship means that Olathe effluent is being diluted by other flow contributions and likely being assimilated by stream biology en route downstream. Therefore, the impact of Olathe's wastewater treatment plant is likely to be moderated by the stream and its hydrology. While Olathe provides a significant source of nutrients, the impact of those nutrients on stream biology is uncertain, as both KDHE and USGS data indicate that nutrient concentrations decrease in a downstream direction. If sediment is the more likely impairing factor, the wastewater plant is not a contributor.

Desired Endpoint for Mill Creek for 2015

The use of biological indices allows assessment of the cumulative impacts of dynamic water quality on aquatic communities present within the stream. As such, these index values serve as a baseline of biological health of the stream. Sampling occurs during open water season (April to November) within the aquatic stage of the life cycle of the macroinvertebrates. Long term sampling over cool and warm conditions and baseflow and runoff adequately address any seasonal variation of the desired endpoint of this TMDL. The endpoint would be average MBI values of 4.5 or less over 2006-2015.

Achievement of this endpoint would be indicative of full support of the aquatic life use in the stream reach, therefore the narrative water quality standard pertaining to nutrients would be attained.

Figure 2. Daily Flows on Mill Creek in 2003-2007 and corresponding discharges from Olathe

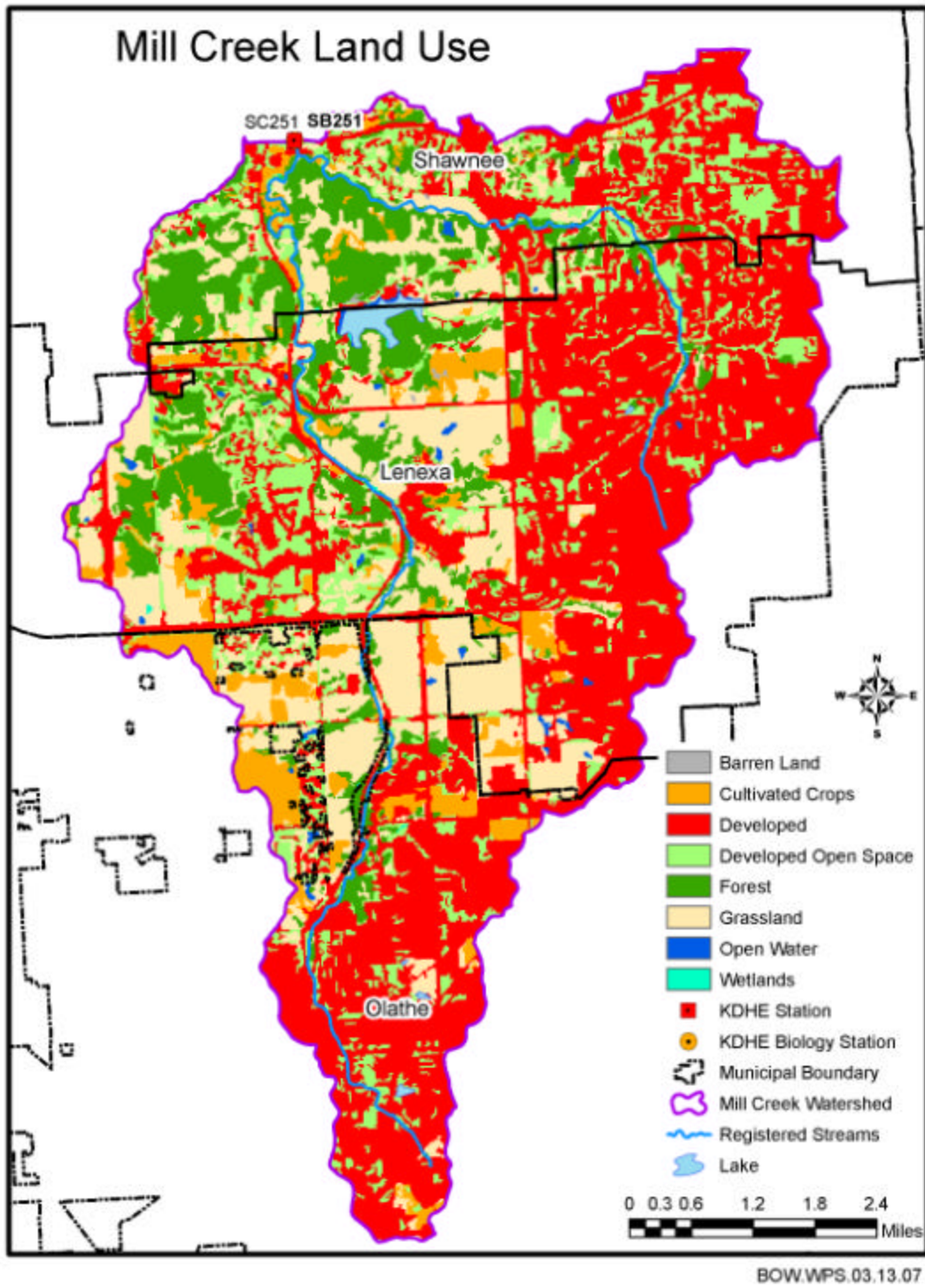


3. SOURCE INVENTORY AND ASSESSMENT

Land Use: According to Lee, et al (2005), the Mill Creek Watershed comprises about 27% residential land use and 38% of undeveloped land, including agricultural lands. There is a relatively high percentage of commercial land use (11%) for Johnson County watersheds and the percentage of impervious surface area is estimated to be 12%, a density that begins to impact streams negatively through reduction of baseflows and increases in peak discharges. Land use above Station 251 from the 2001 National Land Cover Database project is displayed in Figure 3.

Urban stormwater might be a major influence on the integrity of the stream, its habitat and the biological communities dwelling in Mill Creek. Table 5 lists estimated peak discharges for streams in Johnson County, including the main tributaries of Mill Creek (Perry, et al, 2004). Mill Creek has larger peaks than county streams to the west. There is a jump in peak flow along Mill Creek below the confluence with Little Mill Creek, and again below Clear Creek. Land use appears developed in residential and commercial areas along the south and east portions of the watershed. The western third of the watershed is more agricultural in use. The center of the watershed is dominated by green space and parkland. Peak discharges will disrupt the physical and biological characteristics of Mill Creek, through high shearing velocities and sediment delivery and transport.

Figure 3. Mill Creek Watershed Land Use above Station 251 (from 2001 NLCD)



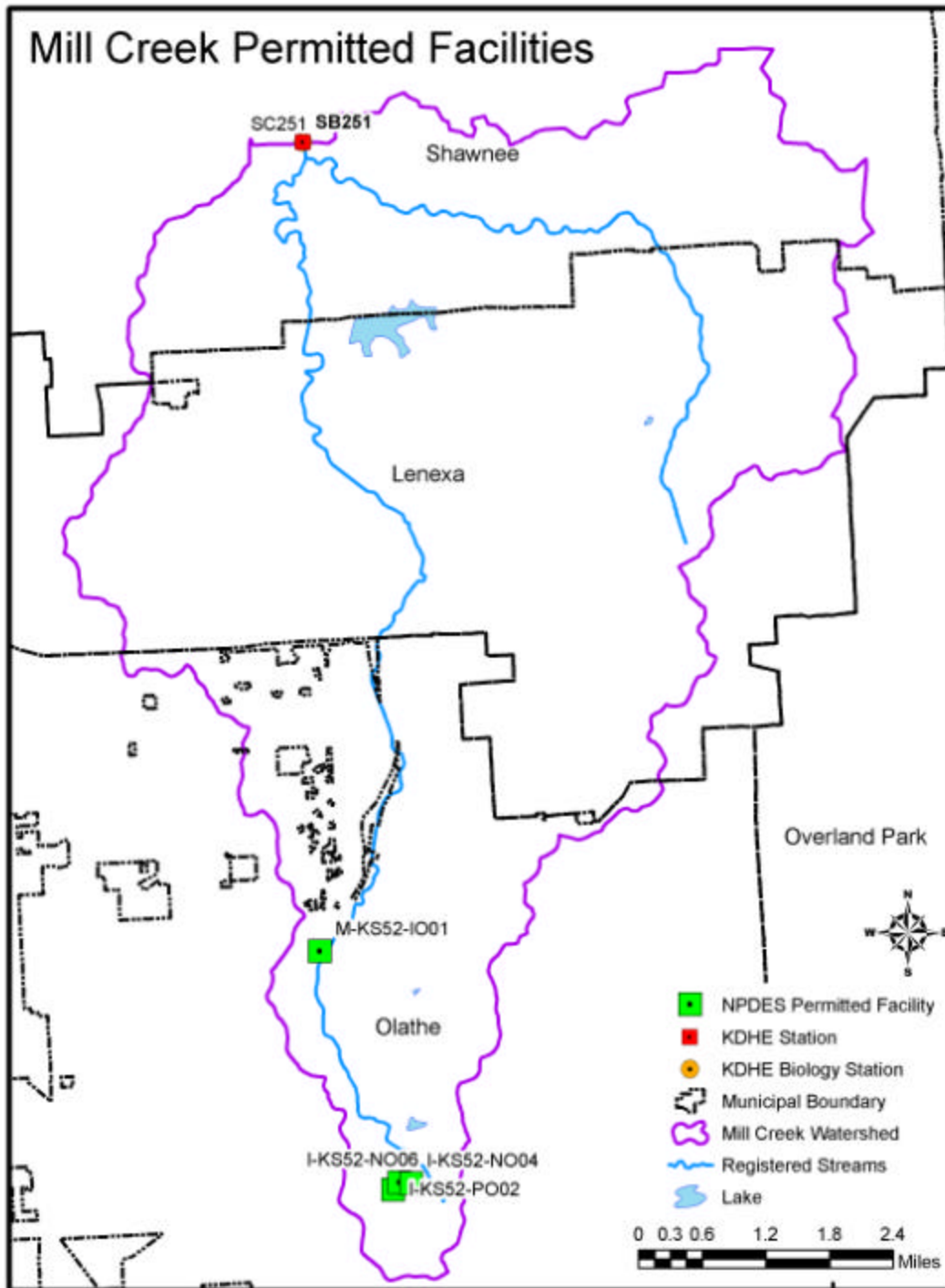
Contributing Runoff: The watershed has an average soil permeability of 0.8 inches/hour according to NRCS STATSGO data base. Runoff would be produced under storms ranging in duration from one to six hours, having a recurrence interval of five, ten or twenty five years. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. Generally, 29.8 percent of the watershed would generate runoff under dryer conditions or smaller storms. Moderate or wet conditions or larger storms would see runoff contributed from 65.0 to 93.4 percent of the watershed.

NPDES: There are currently four NPDES permitted wastewater dischargers located within the watershed (Figure 4). The major discharger, Olathe's Harold Street wastewater plant is located in the upper reaches of the watershed. It typically discharges below its design flow of 3.2 MGD (Table 6). Its current permit (NPDES # KS 0045802; Kansas # M-KS52-IO01), effective through August 31, 2011, has typical permit limits for BOD and TSS of 45 mg/l averaged weekly and 30 mg/l on a monthly average. Its extraneous flow basin discharges once peak flows through the main plant exceed 6.4 MGD and has 45 mg/l limits for BOD and TSS for its sporadic flows. The trickling filter plant nitrifies its effluent, resulting in low ammonia levels, but elevated nitrate. Total phosphorus is also elevated relative to ambient stream concentrations. Nitrogen and phosphorus concentrations decrease markedly between the wastewater plant outfall and monitoring station 251 (Figure 5). The current permit's Schedule of Compliance calls on Olathe to conduct a study by September 2008 to assess the feasibility of retro-fitting treatment processes to meet annual averages of 8 mg/l TN and 1.5 mg/l TP.

Table 5. High Flow Estimates for Streams in Johnson County, including Mill Creek Tributaries

Stream	Drainage Area	Resid, Commerc, & Indust Percent	Percent Imprv Surf	2-yr Peak	2-yr Runoff	10-yr Peak	10-yr Runoff
<i>Captain Crk</i>	<i>44 sq. mi</i>	<i>1.5%</i>	<i>1.1%</i>	<i>3900 cfs</i>	<i>88.6 cfsm</i>	<i>10,800 cfs</i>	<i>245 cfsm</i>
<i>Kill Crk</i>	<i>62 sq.mi.</i>	<i>10.5%</i>	<i>3.3%</i>	<i>6720 cfs</i>	<i>108.4 cfsm</i>	<i>16,700 cfs</i>	<i>269 cfsm</i>
<i>Cedar Crk</i>	<i>55 sq. mi.</i>	<i>21.1%</i>	<i>5.0%</i>	<i>6240 cfs</i>	<i>113.5 cfsm</i>	<i>15,600 cfs</i>	<i>284 cfsm</i>
Mill Crk	74 sq.mi.	40.6%	12.4%	8060 cfs	108.9 cfsm	19,000 cfs	257 cfsm
Hays Crk	6 sq. mi.	No estimate	No estimate	1070 cfs	178.3 cfsm	3060 cfs	510 cfsm
Clear Crk	18 sq. mi.	No estimate	No estimate	2030 cfs	112.8 cfsm	6050 cfs	336 cfsm
Mill Crk abv Clear Crk	47 sq. mi.	No estimate	No estimate	6710 cfs	142.8 cfsm	15,900 cfs	338 cfsm
Little Mill Crk	17 sq. mi.	No estimate	No estimate	2040 cfs	120 cfsm	5990 cfs	352 cfsm
Mill Crk abv Lit Mill Crk	30 sq. mi.	No estimate	No estimate	2830 cfs	94 cfsm	8430 cfs	281 cfsm

Figure 4. NPDES Facilities in the Mill Creek Watershed



BOW.WPS.03.13.07

Figure 5. Mill Creek and Olathe -Harold St Wastewater Concurrent Nutrient Levels – 2003-2005

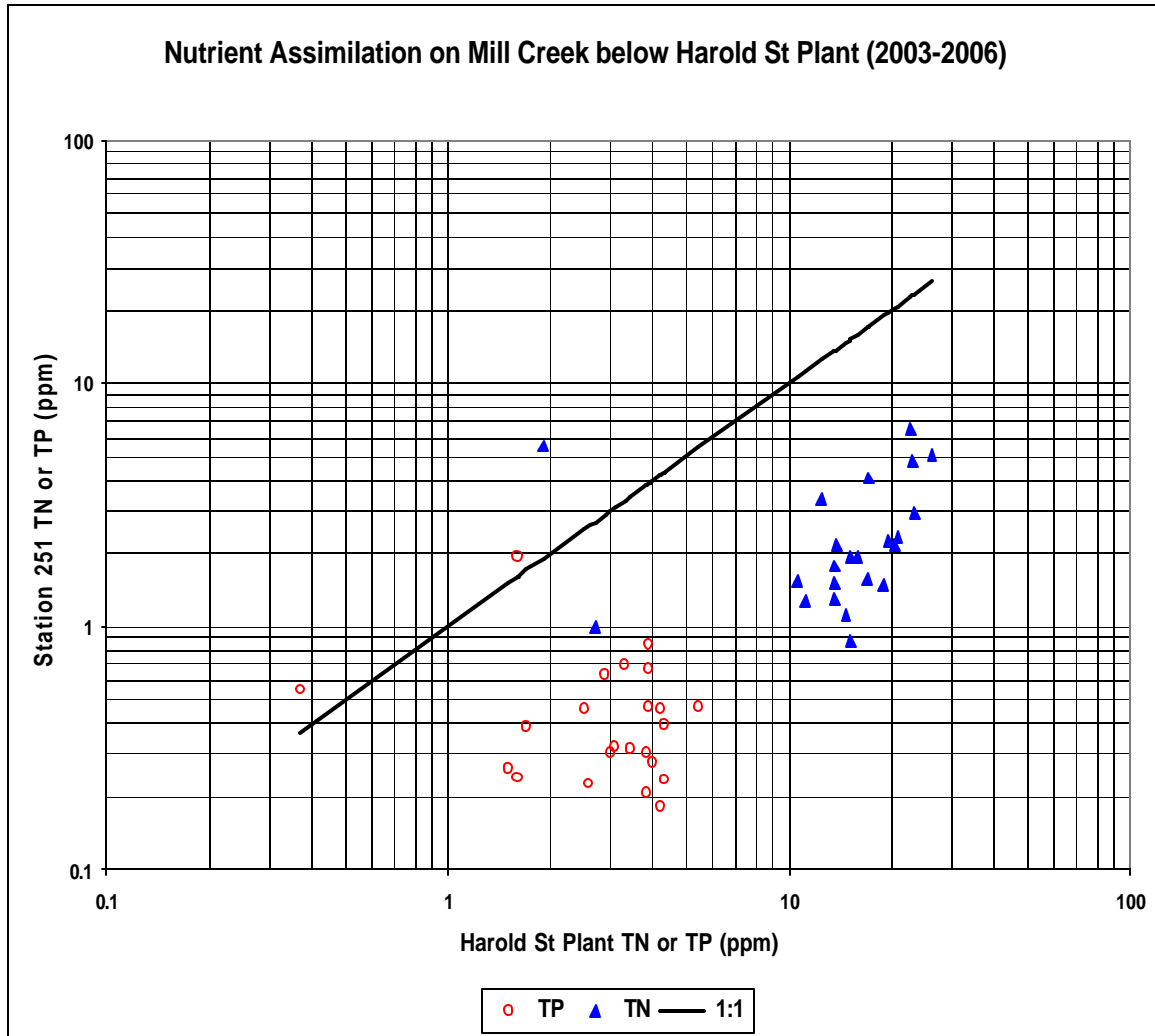


Table 6. Effluent Data from Olathe Harold Street Wastewater Treatment Plant (2003-2007)

Parameter	Average	Upper Decile	Maximum
Flow	1.79 MGD	2.29 MGD	12.3 MGD
BOD	10 mg/l	15 mg/l	30 mg/l
TSS	8.22 mg/l	13 mg/l	35 mg/l
Chloride	229 mg/l	328 mg/l	520 mg/l
NH3	0.4 mg/l	0.67 mg/l	8.15 mg/l
NO2	0.27 mg/l	0.51 mg/l	1.7 mg/l
NO3	14.28 mg/l	20 mg/l	22 mg/l
TP	3.54 mg/l	4.7 mg/l	6.4 mg/l

The plant is fairly landlocked, in terms of ability to expand, thus, the desired state strategy of upgrading major wastewater dischargers to install biological nutrient removal may be complicated by the lack of space to insert the necessary treatment trains to accomplish reductions at Harold Street. As previously seen, the proportion of Mill Creek flow attributed to discharge from the Harold Street Plant is approximately 20%. All other historic NPDES municipal dischargers to Mill Creek have been shut down and their waste streams handled by Johnson County's Mill Creek Regional Wastewater Treatment Plant, that discharges to the Kansas River.

The other three NPDES facilities are located at the headwaters of Mill Creek: Geiger Ready-Mix Co (NPDES # KSG460011, I-KS52-PR01), LaFarge Construction (NPDES # KSG4600004, I-KS52-NO04) and Exxon-Mobil (NPDES #KS0082988, I-KS52-PO02). The Geiger facility replaces another operation that originally discharged to Mill Creek, as shown in Figure 4. The current operation and the LaFarge facility discharge to drainage ditches that lead to Frisco Lake. The range in expected discharges from these two facilities is 0 – 0.003 MGD. The Exxon-Mobil facility manufactures greases and discharges 0.019-0.026 MGD to Mill Creek. Oil and grease are the main pollutants of concern and discharges typically contain less than 5 mg/l. These facilities are not considered causes of the biological impairments registered at the lower reaches of Mill Creek. Geiger and LaFarge permits are to expire in September 2007 and Exxon-Mobil's permit expires is effective over 2007-2011.

There are four MS4 Stormwater NPDES permits overlying the Mill Creek watershed, held by Lenexa (KSR041016, M-KS34-SU01), Olathe (KSR041025, M-KS52-SU01), Shawnee (KSR041033, M-KS68-SU01) and Johnson County (KSR041007, M-KS52-SU02). All four permits have provisions to install Best Management Practices to deal with pollutants cited by TMDLs on Mill Creek and are in effect until September 30, 2009.

Background Levels: About nine percent of the watershed is parkland, right of ways or open water. Contributions of suspended solids from these areas would appear to be limited.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

Cause and effect relationships between typical pollutants and the measures of biological integrity on Mill Creek are not well defined, although there is some suggestion that elevated BOD and TSS levels is associated with the lower biological indicators. With the uncertainty in causal factors, the primary emphasis of this TMDL will be to decrease suspended solid or sediment loading, particularly that delivered through urban stormwater.

The tendency of biological data to integrate the impacts of the entire watershed on the aquatic community defies allocation of specific loads between point and non-point sources. The relative presence of point and non-point activities has to be used to assess the relative contributions and responsibilities for nutrient load reduction in the watershed. Therefore, allocations are made for this TMDL in a general sense to direct appropriate action, assuming that Best Management Practices for urban stormwater will yield improved MBI values.

Point Sources: The existing TMDL, developed in 1999, erroneously referred to historic conditions where up to nine municipal facilities operating lagoon systems discharged to Mill Creek. Those facilities have been shut down and their wastewater treated by the Mill Creek Regional Wastewater Treatment Plant and discharged to the Kansas River. The only discharger to Mill Creek is Olathe's Harold Street Plant. Table 6 indicates the quality of its effluent over 2003-2007. The existing treatment process does a good job in maintaining low BOD and TSS.

The existing TMDL indicated the Wasteload Allocation would be based on reductions of monthly BOD concentrations to below 18 mg/l, based on a Streeter-Phelps analysis. However, that analysis may have underestimated the flow of the receiving stream, the dissolved oxygen content of the wastewater or the stream's reaeration coefficient because there have been no recorded deficient dissolved oxygen conditions on Mill Creek, even when the Harold Street Plant discharged higher concentrations. The typical condition at Harold Street Plant has been to discharge at flows below design flow and at BOD concentrations at or below 15 mg/l. Therefore, the currently permitted Wasteload Allocation for BOD of 800 pounds per day is sufficient to maintain achievement of aquatic life support in Mill Creek, as affected by the wastewater discharged to the creek. Similarly, TSS levels are lower than those typically seen in the stream, except on the occasions that extraneous flow is discharged from the facility during wet weather. The Wasteload Allocation for TSS is 800 pounds per day based on current permit limits. Given the small proportion of Mill Creek flow composed of Olathe wastewater, the impacts from the Harold Street Plant appear minimal. While phosphorus levels may be linked to some of the degraded condition in the aquatic community, the Wasteload Allocation will be established in anticipation of the effective output anticipated by nutrient control treatment introduced at the Harold Street Plant (1.5 mg/l as an annual average). The phosphorus Wasteload Allocation will be 40 pounds per day.

Urban stormwater, on the other hand, appears to be a significant factor in the conditions seen in Mill Creek. Johnson County, Olathe, Shawnee and Lenexa have MS4 general permits governing the discharge of stormwater from their respective storm sewer systems. These permits, effective from October 1, 2004 to September 30, 2009, direct the implementation of Best Management Practices addressing TMDLs within their jurisdictions. All four permits incorporate Mill Creek for its bacteria TMDL. The permits will need to be revised to incorporate Total Suspended Solids for Mill Creek and its tributaries and direct implementation of Best Management Practices to abate the loading of TSS to the stream by stormwater. The Wasteload Allocation for urban stormwater is taken as the desired runoff loads, proportioned by the percentage of the watershed expected to be developed for urban uses. Table 7 displays the segregation of the desired Load Allocations between the MS4 permits and non-point sources.

Non-Point Sources: Given the runoff characteristics of the watershed, overland runoff can easily carry sediment and organic matter from the watershed into Mill Creek. The fluctuating nature of the MBI values suggests that recent sediment loading prior to biologic sampling might have a direct impact on the index values used to assess biological integrity. Although additional fieldwork is necessary to further define the relationship between sediment and other pollutants and the biological communities found in Mill Creek, the Load Allocation for TSS should be based on the average concentration seen during the two years that the MBI values indicated good

biological support on Mill Creek. That concentration of 40 mg/l is an approximate reduction of 35% of average TSS concentrations during poorly supported biological conditions. Since phosphorus typically is loaded by the same mechanism as sediment, some reduction should be expected as well. The average phosphorus concentration during the good years of 1994 and 1998 was 0.78 mg/l, 14% less than the average seen during the five poorer years. Therefore, the Load Allocation for phosphorus will be based on the average concentration of 0.78 mg/l.

In both situations, the runoff driven loads that are desired will be segregated between MS4 Wasteload Allocations and non-point Load Allocations based on proportion of the watershed occupied by urban and other types of land uses (Table 7).

The existing TMDL for Mill Creek had based the Load Allocation on a reduction to in-stream concentrations below 100 ppb of phosphorus and 200 ppb of nitrate. There was no linkage made between those desired goals and the biological response on Mill Creek. Additional study by KDHE, USGS and Johnson County should indicate desired nutrient levels to be maintained on Mill Creek in the future. In the meantime, relatively short-term reduction in point source loadings of nitrogen and phosphorus through Biological Nutrient Removal technology should have some, as of yet, unknown beneficial impact to the aquatic community and will be re-addressed in future revisions of this TMDL. In the meanwhile, the emphasis of this TMDL will be abatement of TSS.

Table 7. Wasteload Allocations, Load Allocations and Load Capacity of TSS & TP on Mill Creek

Total Suspended Solids						
Flow Condition	Design Q	Runoff	WLA	WLA MS4	LA	TMDL
VERY LOW 90%	5 cfs	1.9 cfs	800 #/d	165 #/d	245 #/d	1210 #/d
DRY 75%	5 cfs	5.5 cfs	800 #/d	475 #/d	710 #/d	1990 #/d
NORMAL 50%	5 cfs	11.7 cfs	800 #/d	1010 #/d	1515#/d	3330 #/d
WET 25%	5 cfs	26.2 cfs	800 #/d	2265 #/d	3395 #/d	6460 #/d
VERY HIGH 10%	5 cfs	65.2 cfs	800 #/d	5635 #/d	8450 #/d	14885 #/d
Total Phosphorus						
VERY LOW 90%	5 cfs	1.9 cfs	40 #/d	3.2 #/d	4.8 #/d	48 #/d
DRY 75%	5 cfs	5.5 cfs	40 #/d	9 #/d	14 #/d	63 #/d
NORMAL 50%	5 cfs	11.7 cfs	40 #/d	20 #/d	30 #/d	90 #/d
WET 25%	5 cfs	26.2 cfs	40 #/d	44 #/d	66 #/d	150 #/d
VERY HIGH 10%	5 cfs	65.2 cfs	40 #/d	110 #/d	165 #/d	315 #/d

Defined Margin of Safety: Given the uncertain nature of load reduction for TSS and other factors that might influence the condition of the biologic community in Mill Creek, the Margin of Safety will be the number of EPT taxa found in Mill Creek to be over 13 while MBI values are suggesting full aquatic life support (MBI = 4.5 or lower). This Margin of Safety assures that the macroinvertebrate community comprises a diverse number of pollution intolerant taxa (EPT), indicative of a high quality biologic community.

The existing TMDL suggested using over 55 percent of EPT individuals within the aquatic community as the measure of the Margin of Safety. However, the number of EPT taxa is a better

indicator of the diversity in the aquatic community since the individual measure might be dominated by only one or two EPT taxa and not be indicative of a wholly supportive environment for diverse populations. Therefore, the number of taxa will replace the percent of individuals as the Margin of Safety and at least 13 EPT taxa are indicative of fully supporting aquatic life.

State Water Plan Implementation Priority: Because this TMDL addresses urban stormwater impacts on the aquatic community at a time as stormwater management planning is starting in Johnson County with implementation developing over the next five years, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Lower Kansas Subbasin (HUC 8: 10270104) with a priority ranking of 1 (Highest Priority for restoration work).

Priority HUC 11s and Stream Segments: Since the emphasis of this TMDL is on stormwater management and the most effective means of management is along the smaller tributary streams with small drainages, the priority segments will be these smaller feeder streams with the expectation that improvements in TSS loading from these areas will accrue to reduce the overall TSS levels seen in the main stem of Mill Creek. Since the southern and eastern drainages of Little Mill Creek and Mill Creek are dominated by urban development, restoration and mitigation efforts might be applied to those sub-watersheds while preventive measures are employed in the center and the western portions of the watershed.

5. IMPLEMENTATION

Desired Implementation Activities

1. Implement Best Management Practices for urban stormwater in order to reduce peak discharges and sediment and coincidental nutrient loading to Mill Creek.
2. Implement and maintain conservation farming, including conservation tillage, contour strips and no till farming in remaining portions of agricultural lands within the Mill Creek watershed.
3. Install grass buffer strips along small feeder streams draining to Mill Creek
4. Maintain and expand riparian areas around streams in the watershed
5. Minimize road and bridge construction impacts on streams
6. Monitor wastewater discharges for excessive Total Suspended Solid and nutrient loadings

Implementation Programs Guidance

NPDES - KDHE

- a. Ensure proper monitoring, permitting, and operations to limit TSS loading from the Harold Street wastewater plant.
- b. Revise MS4 stormwater general permits for Johnson County, Shawnee, Lenexa and Olathe to incorporate requirements to begin implementation of Best Management Practices for TSS loading into Mill Creek.
- c. Work with Olathe to assess alternative treatment technology to reduce nutrient loading from landlocked wastewater treatment facilities such as the Harold Street

plant.

Non-Point Source Pollution Technical Assistance - KDHE

- a. Support Section 319 demonstration projects for reduction of siltation and runoff from agricultural, residential, commercial or road construction activities
- b. Provide technical assistance on practices geared to establishment of vegetative buffer strips and enhancing the integrity of urban riparian areas and streambanks.
- c. Support development of a Watershed Restoration and Protection Program (WRAPS) with Johnson County to supplement stormwater management efforts with a comprehensive watershed management strategy for Mill Creek.
- d. Provide technical assistance on road construction activities in vicinity of streams.
- e. Through the WRAPS, support aspects of the Johnson County, Lenexa, Shawnee and Olathe Stormwater Programs, outside the requirements of the Phase II NPDES permit, that promote stream buffers, installation of new and retrofitted stormwater management practices, including Low Impact Development and Best Management Practices, and runoff treatment practices, to mitigate the impact of impervious areas in the watershed.

Water Resource Cost Share Program - SCC

Support conservation farming practices, including terraces and waterways to any remaining cropland within Mill Creek watershed.

Non-Point Source Pollution Control Program - SCC

- a. Support sediment control practices to minimize erosion and sediment transport
- b. Investigate opportunities to implement sediment control practices in urbanized areas

Riparian Protection Program - SCC

Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation along small tributaries to Mill Creek.

Buffer Initiative Program - SCC

Install grass buffer strips along small streams draining to Mill Creek

Extension Outreach and Technical Assistance - Kansas State University

- a. Educate agricultural producers on sediment and pasture management
- b. Educate urban landowners on techniques to reduce sediment loading to streams from residential properties.
- c. Provide technical assistance on buffer strip design and lowering ag runoff

Timeframe for Implementation: Initial Best Management Practices necessary to implement this TMDL should be incorporated through revision of existing MS4 General Permits before 2009, with actual implementation commencing within a year after the revisions. Additional implementation should be developed over 2007-2015. Additional source assessment and evaluation of biological data collected over 2006-2015 should occur in 2010 and 2015.

Targeted Participants: Primary participants for implementation will be the cities and Johnson County managing urban stormwater within the drainages of the priority subwatersheds. Initial work over 2007-2010 should include an inventory of activities in those areas with greatest potential to impact the stream, including, within a mile of the stream network:

1. Impervious surface areas
2. High density residential and commercial development
3. Total rowcrop acreage in remaining croplands
4. Stormwater drainage systems
5. Riparian condition
6. Presence of livestock in any concentrated area
7. Highway and road systems
8. Construction projects

Some inventory of local needs should be conducted in 2007 to identify such activities. Such an inventory would be done by local program managers with appropriate assistance by commodity representatives and state program staff in order to direct state assistance programs to the principal activities influencing the quality of the streams in the watershed during the implementation period of this TMDL.

Milestone for 2010: The year 2010 marks the next cycle of TMDL development and revision for the Kansas-Lower Republican Basin, including the Mill Creek watershed. At that point in time, adequate source assessment should be complete which allows an allocation of resources to responsible activities contributing to the sediment problem. Additionally, stormwater programs should have plans for placement of Best Management Practices within the Mill Creek watershed by 2010. Furthermore, Olathe should have completed a study to assess upgrading the Harold Street Plant to accommodate nutrient reduction in its wastewater.

Delivery Agents: The primary delivery agents for program participation will be the Stormwater Management and Public Works Departments of Johnson County, Olathe, Lenexa and Shawnee. Johnson County Conservation District can direct the application of programs of the State Conservation Commission and the Natural Resources Conservation Service.

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. 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.
4. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control non-point source pollution.
5. 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.
6. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.
7. The *Kansas Water Plan* and the Kansas-Lower Republican 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.

Effectiveness: Sediment control has been proven effective through construction erosion control practices and use of wet weather detention basins in urban areas. In agricultural settings, conservation tillage, contour farming and use of grass waterways and buffer strips as well as runoff control around animal feeding operations have been shown to be effective.

Should participation significantly lag below expectations over the next five years or monitoring indicates lack of progress in improving water quality conditions from those seen over 1993-1999, the state may employ more stringent conditions through the MS4 general permits for stormwater in order to meet the desired endpoints expressed in this TMDL. County ordinances maybe used to address impacts of agricultural producers in the watershed.

6. MONITORING

Johnson County is working with USGS to establish a baseline of biological and chemical quality in the streams within the county, including Mill Creek. An initial report on biological indicators (up to 10 metrics) in the streams of Johnson County should be produced by mid-2007. The results of that study should be used in 2010 for this TMDL to modify the applicable metrics for assessing the degree of support for aquatic life in urbanized Mill Creek. KDHE will continue to collect

seasonal biological samples from Mill Creek after 2010 to evaluate achievement of the desired endpoint in coordination with the metrics most applicable for assessment.

Periodic monitoring of total suspended solids and nutrients in wastewater discharged from the Olathe Harold Street wastewater treatment plant will be expected under reissued NPDES and state permits.

KDHE will maintain its schedule of bimonthly monitoring at Station 251 throughout the time the TMDL remains in force.

7. FEEDBACK

Public Notice: Public notification of the second round of TMDLs in the Kansas-Lower Republican Basin was made in the Kansas Register in January 5, 2006. An active Internet Web site was established at <http://www.kdheks.gov/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Kansas-Lower Republican Basin.

Public Hearing: Public Hearings on the second round of TMDLs for the Kansas-Lower Republican Basin were held in Olathe on January 19, and in Topeka on January 30, 2006. Comments were received from Johnson County Wastewater and Stormwater Programs.

Basin Advisory Committee: The Kansas-Lower Republican Basin Advisory Committee met to discuss the second round of TMDLs in the basin on April 7, 2005 in Lawrence, July 26, 2005 in Concordia, October 20, 2005 in Lawrence and January 24, 2006 in Topeka.

Milestone Evaluation: In 2010, evaluation will be made as to the progress in implementing Best Management Practices in Johnson County. Additionally, the biologic baseline data collected by USGS on behalf of Johnson County will be used to assess the condition of the aquatic community in Mill Creek. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303(d) Delisting: The stream will be evaluated for delisting under Section 303(d), based on the biological monitoring data collected between 2010 and 2015. Therefore, the decision for delisting will come about in the preparation of the 2016 303(d) list. Should modifications be made to the applicable water quality criteria during the 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 will come in 2007 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in Kansas Water Plan implementation decisions under the State Water Planning Process for Fiscal Years 2008-2015.

Bibliography

Lee, Casey J., D.P Mau and T.J. Rasmussen; Effects of Nonpoint and Selected Point Contaminant Sources on Stream-Water Quality and Relation to Land Use in Johnson County, Northeastern Kansas, October 2002 through June 2004; USGS Scientific Investigations Report 2005-5144; 2005; 104 p.

Perry, C.A., D.M. Wolock and J.C. Artman; Estimates of Flow Duration, Mean Flow and Peak-Discharge Frequency Values for Kansas Stream Locations; USGS Scientific Investigations Report 2004-5033; 651 p.

Revised April 18, 2007