## KANSAS/LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

**Waterbody/Assessment Unit: Cedar Creek**
**Water Quality Impairment: Nitrate**

### 1. INTRODUCTION AND PROBLEM IDENTIFICATION

**Subbasin:** Lower Kansas River **County:** Johnson

**HUC 8:** 10270104

**HUC 11** (HUC 14)**: 060** (020) (**Figure 1**)

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

**Drainage Area:** 58.8 square miles

**Main Stem Segment:** WQLS: 38 (Cedar Creek) starting at the confluence with the Kansas River in northwest Johnson County and traveling upstream to the headwaters south-central Johnson County (**Figure 1**).

**Tributary Segments:** Camp Creek (74)
Little Cedar Creek (76)

**Designated Uses:** Expected Aquatic Life Support, Primary Contact Recreation 'C', Domestic Water Supply, Food Procurement, Groundwater Recharge, Industrial Water Supply, Irrigation Use and Livestock Watering for Main Stem Segment. Tributary Segments designated uses are the same except Contact Recreation for Little Cedar Creek is Primary 'B' and Contact Recreation for Camp Creek is Secondary 'b'.

**Impaired Use**: Expected Aquatic Life Support & Attainable Domestic Water Supply

**Water Quality Standard**: Nitrate (as N): 10 mg/L (KAR 28-16-28e(c)(3)(A)): Domestic water supply criteria are provided in table 1a of K.A.R. 28-16-28e(d).

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)(B)).

## 2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

**Level of Support for Designated Use under 2002 303(d):** Not Supporting Attainable Domestic Water Supply & Partially Supporting Expected Aquatic Life

**Monitoring Sites:** Station 252 near Cedar Junction

**Period of Record Used:** 1990 - 2006 for Station 252 (**Figure 2**)

**Flow Record:** Blue R. nr Stanley (USGS Station 06893080; 1974-2006) used to estimate flow duration of Cedar Creek and flows on Cedar Creek before October 2002. Estimates from Stanley were based on regression between Stanley and Cedar Creek USGS Station 06892495. Flows after October 2002 taken from Cedar Creek Station.

**Long Term Flow Conditions:** 10% Exceedance Flows = 69 cfs**,** 95% = 0.0 cfs **(Figure 3)**

**Current Conditions:** Since loading capacity varies as a function of the flow present in the stream, this TMDL represents a continuum of desired loads over all flow conditions, rather than fixed at a single value. Sample data for the sampling site were categorized for each of the three defined seasons: Spring (Apr-Jul), Summer-Fall (Aug-Oct) and Winter (Nov-Mar). High flows and runoff equate to lower flow durations; baseflow and point source influences generally occur in the 75-99% range. Load curves were established for the nitrate domestic water criterion by multiplying the estimated flow values for Cedar Creek along the curve by the applicable water quality criterion (10 mg/l) and converting the units to derive a load duration curve of pounds of nitrate per day. This load curve graphically displays the TMDL since any point along the curve represents water quality at the standard at that flow. Historic excursions from water quality standards (WQS) are seen as plotted points above the load curves. Water quality standards are met for those points plotting below the applicable load duration curves (**Figure 4**). In addition, a concentration duration curve was also created to visually aid in the identification of excursions from nitrate criterion (**Figure 5**). Excursions were seen two of the three defined seasons and are outlined in **Table 1**.

Nitrate excursions have only occurred during low flows in Cedar Creek watershed. This condition will be influenced by point source effluent, thus, the critical flow condition is defined by the design flow of the Olathe Cedar Creek wastewater plant (3.0 MGD = 4.6 cfs).
In **Figure 2** the nitrate data were broken into seasons and plotted through time. Regressions on time were applied to the overall and seasonal data to determine if

significant trends in concentration were noted at Site 252 on Cedar Creek. Although nitrate excursions were only noted in the Summer/Fall and Winter seasons, regressions suggest slight, but significantly valid ($p < 0.1$) increases in nitrate over time, driven by trends in the Spring and Summer-Fall data. No trends were apparent for the Winter data. Nevertheless, the average nitrate over 1998-2006 of 3.20 mg/l was not significantly different than the average nitrate over 1985-1997 (2.60 mg/l).

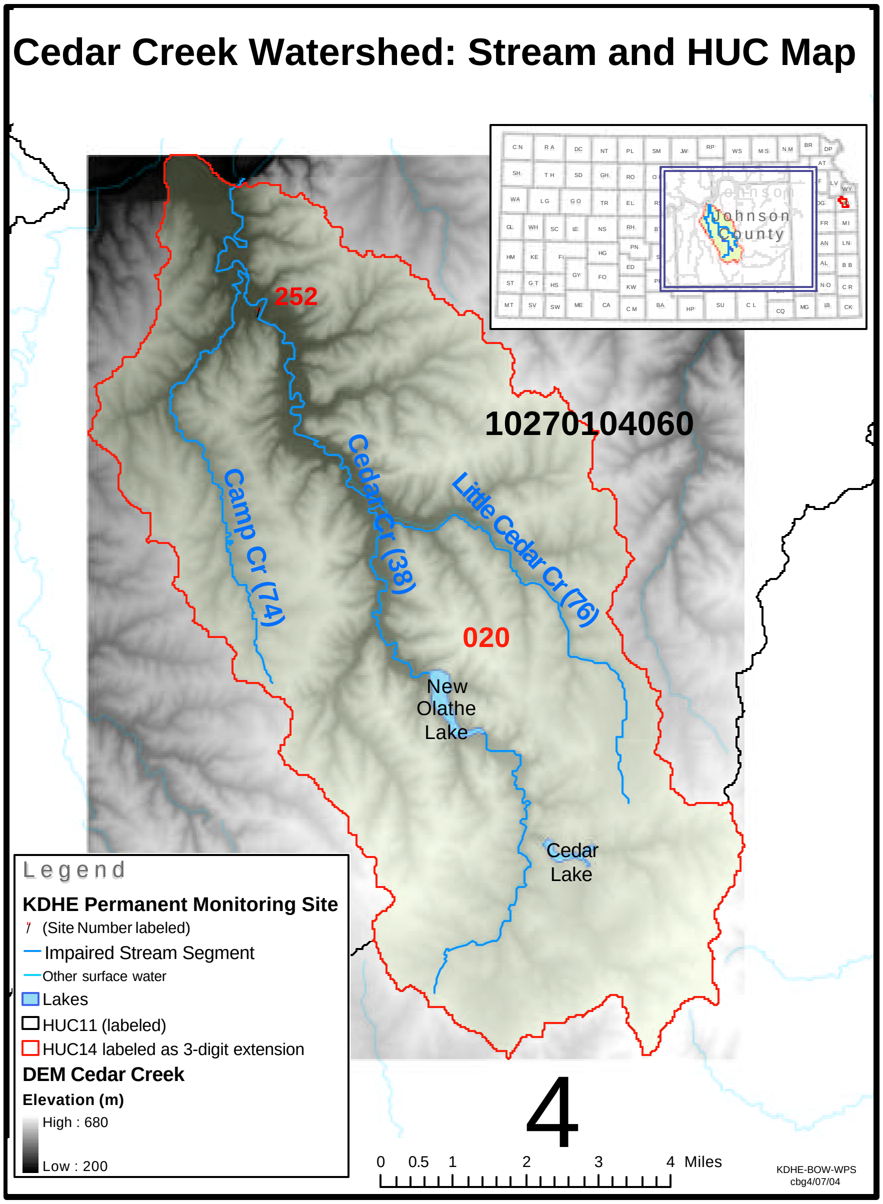


**Figure 1**

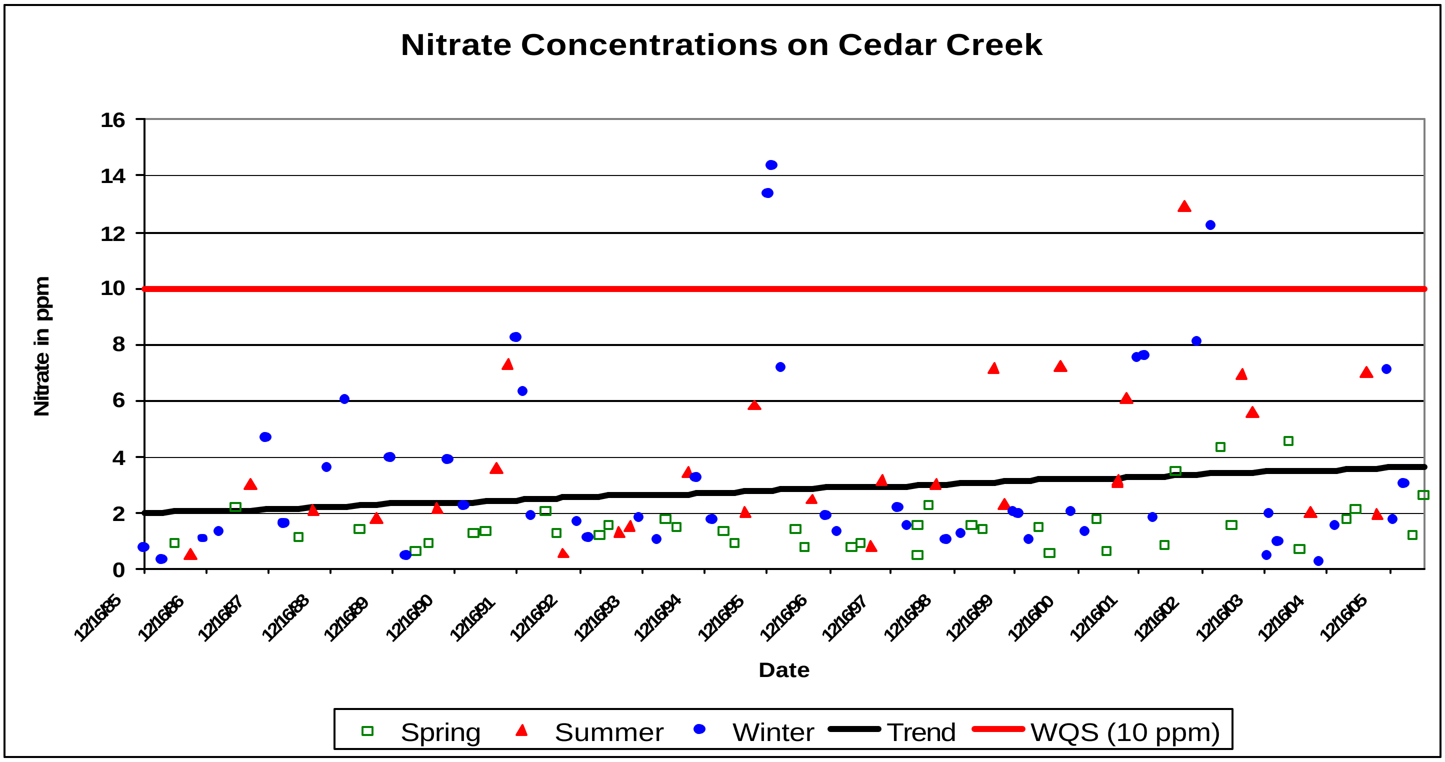


**Figure 2**

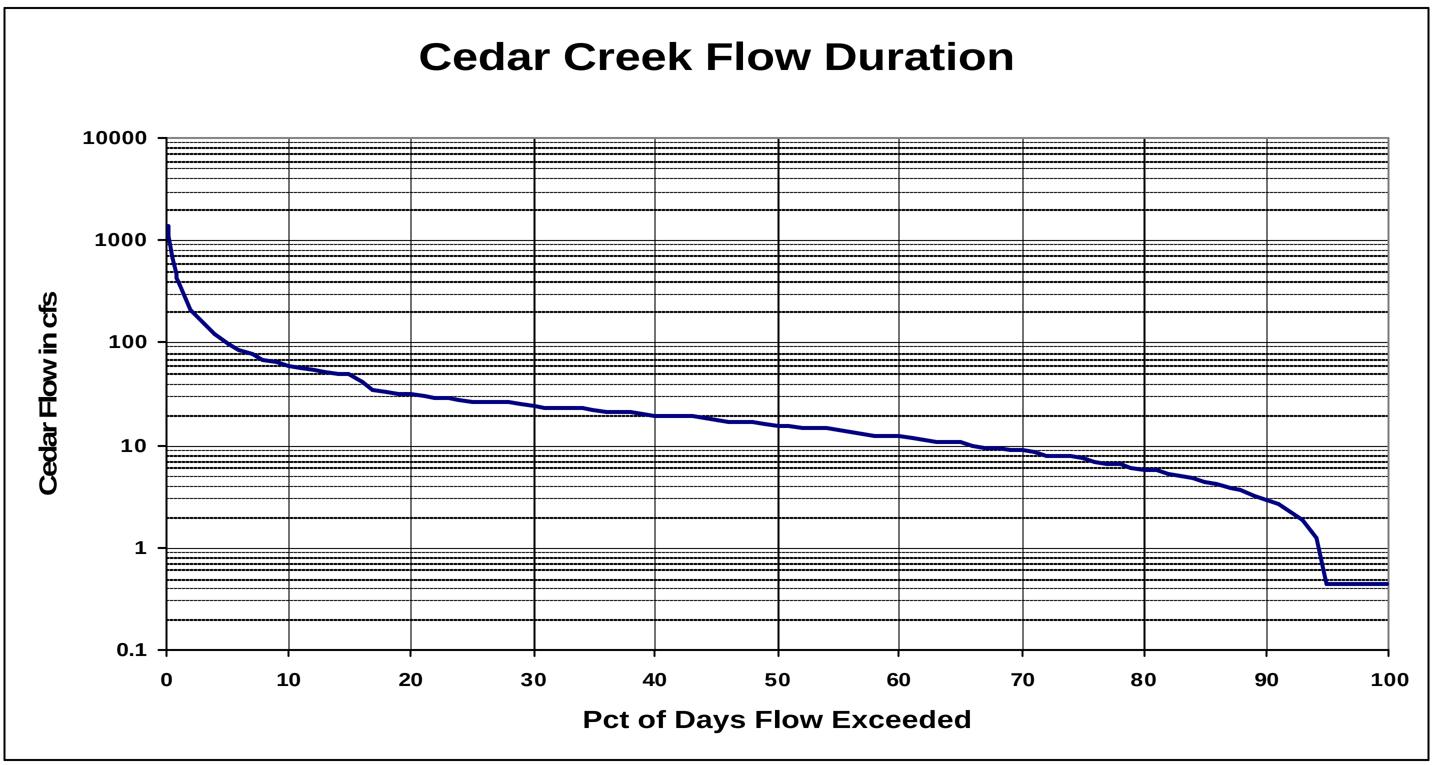


**Figure 3**

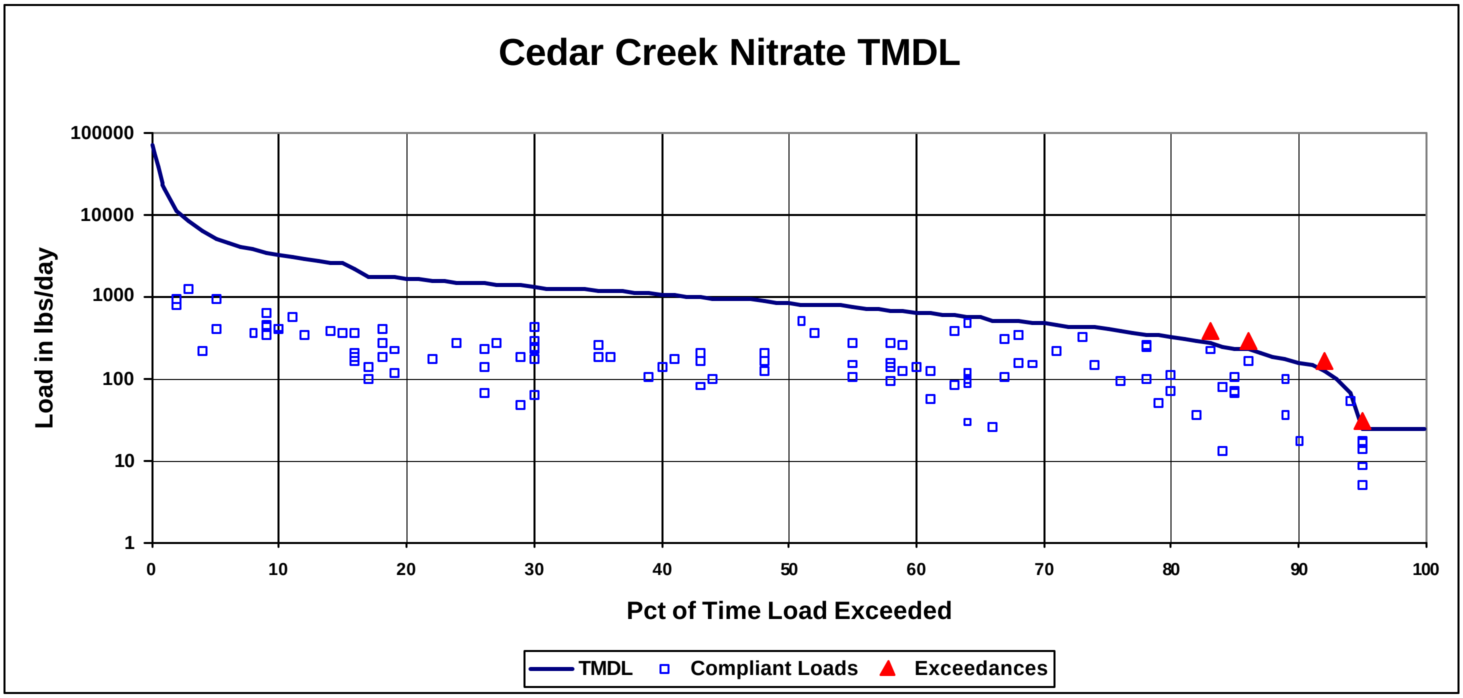


**Figure 4**

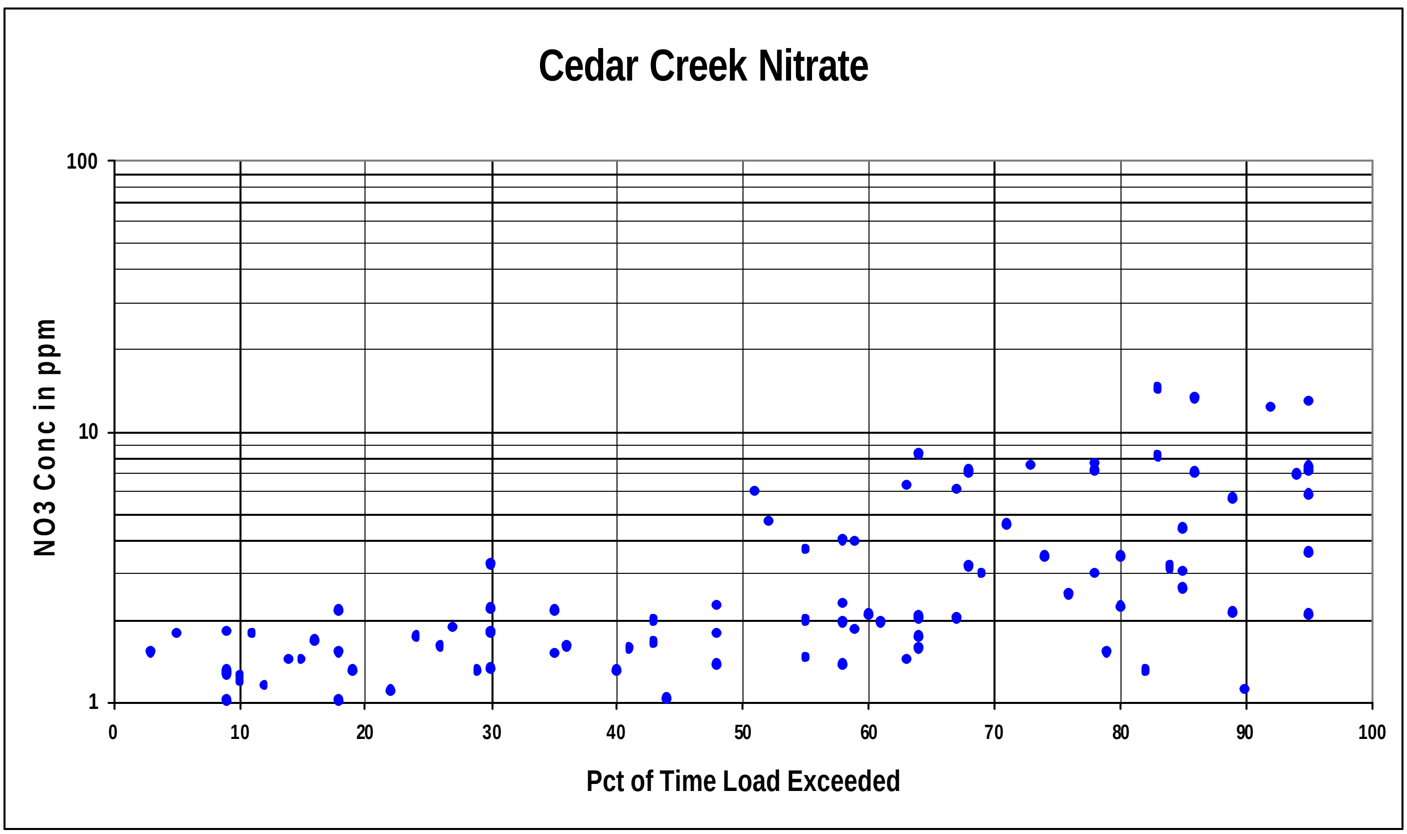


**Figure 5**

**Table 1**

| NUMBER OF SAMPLES ABOVE THE NITRATE STANDARD OF 10mg/L BY FLOW | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Station** | **Season** | **0 to 10%** | **10 to 25%** | **25 to 50%** | **50 to 75%** | **75 to 90%** | **90 to 100%** | **Cum. Freq.** |
| Cedar Cr (252) | Spring | 0 | 0 | 0 | 0 | 0 | 0 | 0/38 = 0% |
| | Summer/Fall | 0 | 0 | 0 | 0 | 0 | 1 | 1/28 = 4% |
| | Winter | 0 | 0 | 0 | 0 | 2 | 1 | 3/48 = 6% |

The data from Site 252 were divided into two groups for comparison purposes; those data associated with the nitrate excursions and those with nitrate compliant samples. Parameters related to nutrients (nitrate, ammonia, total Kjeldahl nitrogen, total phosphorus, ortho-phosphate), organic material (BOD, total organic carbon), high flow (fecal coliform, fecal strep, total suspended solids), base flow (chloride, fluoride, total dissolved solids, specific conductivity) and basic ambient condition (dissolved oxygen, temperature, pH, total hardness) were examined **(Table 2)**. Nitrates and phosphorus were significantly higher in the four exceedance samples, while ammonia and TKN were not significantly different.

The four samples with excessive nitrate occurred at low flow as indicated by the lower values for fecal coliform, fecal strep and total suspended solids. Conversely, the indicators of baseflow such as conductivity, TDS, chloride and fluoride were significantly higher for the four samples. The higher chloride and fluoride values might have other significance as indicators of domestic wastewater. Temperatures were higher for the compliant samples, indicating excessive nitrate likely occurs in the late fall or winter when biological processes to uptake and alter nitrate are diminished. Dissolved oxygen is notably higher during the periods of high nitrate which might be due to the lower temperatures; pH is not different, thus photosynthetic production of oxygen is ruled out.

Both the concentrations of phosphorus and orthophosphate appear to follow the pattern of nitrate concentrations through time, with the highest percentages occurring coincidentally in three of the four exceedance incidents (**Figure 6**). This seems to indicate that the source of nitrate, phosphorus and orthophosphate is likely the same. The dropoff in phosphorus in September 2002 might be attributed to some in-stream uptake, nonetheless the values were several fold greater than the average stream concentration. The probable source of these nutrients at low flow is the effluent from the Olathe Cedar Creek wastewater plant.

USGS studies in Johnson County also indicate the influence of the Olathe wastewater plant on Cedar Creek at low flows, with a stepwise decrease in nitrogen and phosphorus concentrations as flow moves downstream from the plant outfall along the creek (Lee, et al, 2005).

**Table 2**

| Parameter | NO3 | NH3 | TKN | TP | PO4 | BOD | TOC | TSS | FCB | FS | TDS | SC | Cl | F | DO | T | pH | TH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compliant | 2.51 | 0.093 | 0.74 | 0.751 | 0.457 | 2.5 | 5.6 | 32 | 1134 | 1771 | 442 | 753 | 64 | 0.29 | 9.7 | 15 | 8.0 | 243 |
| Exceedance | 13.22* | 0.58 | 0.76 | 2.98* | 1.89* | 2.4 | 6.8 | 9 | 10 | 105 | 871* | 1428* | 179* | 0.49* | 13.7* | 7* | 8.0 | 256 |

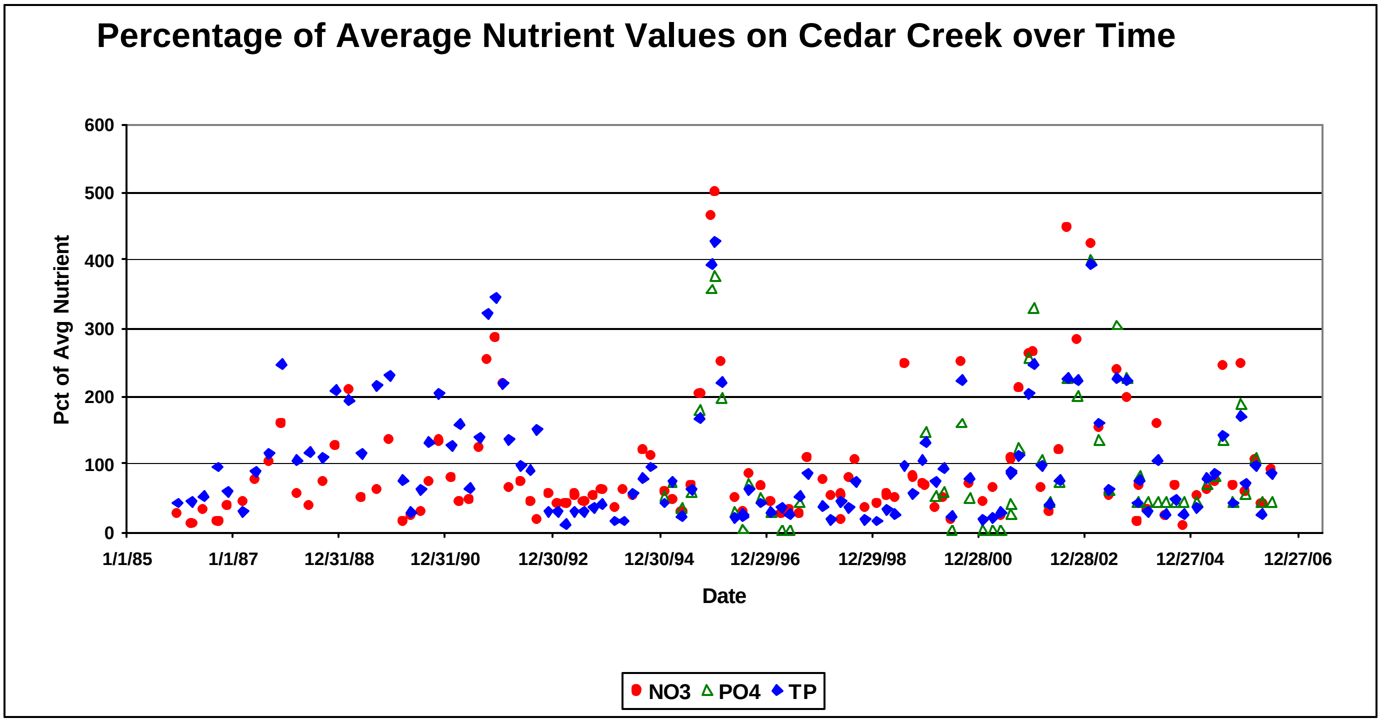


**Figure 6**

**Desired Endpoints of Water Quality (Implied Load Capacity) at Site 252 over 2011 – 2016**

The endpoint for this TMDL will be to achieve the Kansas Water Quality Standard of 10 mg/l to fully support any attainable Domestic Water Supply use on Cedar Creek. The long- term endpoint will be a reduction of total nitrogen concentrations below 8 mg/l, particularly at low flows, in accordance with the Kansas Surface Water Nutrient Reduction Plan. The long-term endpoint will result in a further reduction of downstream nitrate concentrations below the 10-mg/l criterion. Seasonal variation is accounted for by this TMDL, since the TMDL endpoint is sensitive to stream flow with the exceedances typically occurring at low flows during the Fall and Winter. To reach this endpoint this TMDL will concern itself with reducing nitrogen loads from wastewater sources in the watershed under critical low flow conditions of concern.

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

## 3. SOURCE INVENTORY AND ASSESSMENT

**NPDES**: There is one NPDES municipal wastewater discharger, Olathe, within the watershed (**Figure 8**) that contributes a nitrate load to the Cedar Creek watershed. This system is outlined in **Table 3** below. The Olathe – Lakestone Estates facility shown in **Figure 8** has a non-discharging two cell lagoon system that may contribute an nitrates to Cedar Creek under extreme precipitation events (stream flows associated with such events are typically exceeded only 1 - 5 % of the time).

All non-discharging lagoon systems are prohibited from discharging to the surface waters of the state. Under these standard conditions of these non-discharging facility permits, when the water level of the lagoon rises to within two feet of the top of the lagoon dikes, the permit holder must notify KDHE. Steps may be taken to lower the water level of the lagoon and diminish the probability of a bypass of sewage during inclement weather. Bypasses may be allowed if there are no other alternatives and 1) it would be necessary to prevent loss of life, personal injury or severe property damage; 2) excessive stormwater inflow or infiltration would damage the facility; or 3) the permittee has notified KDHE at least seven days before the anticipated bypass. Any bypass is immediately report to KDHE. The high flow conditions under which the Olathe-Lakestone Estates facility may discharge is vastly different than the low flow conditions under which nitrate excursions were noted in the watershed. Furthermore, any spill from Olathe-Lakestone Estates would occur above Lake Olathe and would be effectively captured and retained by the lake without moving down to the monitoring station near the mouth of Cedar Creek.

The Olathe – Cedar Creek facility relies on an activated sludge system to treat its wastewater. **Figure 7** indicates the relationship between nitrate (and nitrite) in the effluent from Olathe and the resulting downstream ambient nitrate concentrations. There is an almost universal trend of decreased nitrate at the downstream station, suggesting some in-stream biological uptake of the wastewater nitrate. Regression lines for winter and warm weather bear this out, as the warm weather line indicates considerable assimilation, particularly at high effluent levels. Winter, when biological activity is slowed considerably, shows a reduced rate of uptake of nitrate. Three of the four excursions occurred during winter, which is also the time that biological processes to transform nitrogen in the treatment plant are also slowed.

During the time of the stream's 9/4/2002 nitrate excursion, Olathe's Cedar Creek facility monthly effluent monitoring reports show nitrate levels of 18 mg/L in August, 15 mg/L in September and 18 mg/L in October of 2002. The in-stream phosphorus level on this sample date was 1.86 mg/L. The Olathe Cedar Creek facility monitoring report indicates phosphorus levels of 2.4 mg/L in August, 2.8 mg/L in September and 2.9 mg/L in October of 2002. Associated with the 2/6/2003 nitrate excursion, effluent monitoring records show nitrate levels of 13 mg/L in January, 11 mg/L in February and 15 mg/L in March 2003. On this same sample date the in-stream phosphorus level was 3.26 mg/L. Effluent monitoring records report phosphorus levels of 2.6 mg/L in January, 3.3 mg/L in February and 3.4 mg/L in March of 2003. It appears that the nitrate and phosphorus levels in the stream reflect the reported nitrate and phosphorus levels discharged from the Olathe – Cedar Creek facility. The estimated flow in Cedar Creek on these two excursion dates was very low. Most of the flow in the main stem at the sampling location was probably from the discharge of the Cedar Creek facility.

The plant seems to currently operate at or over design flow most of the time. The average effluent flow from January 2003 to October 2005 was 3.1 MGD and the average nitrate (+ nitrite) concentration during that time was 9.48 mg/l. Flow volumes were greatest in spring and lowest in summer, as were nitrate concentrations. Olathe has plans and designs currently in progress to upgrade the wastewater facility. The upgrades will increase the design flow to 9 MGD in 2010 and 13.5 MGD in 2022. The 2010 upgrade will also incorporate Biological Nutrient Removal to denitrify the effluent, lowering its total nitrogen as well as filtration and fermentation processes for phosphorus removal. Therefore, the expectation is that the facility's next NPDES permit will have final permit limits of 8 mg/l TN and 1.5 mg/l TP. The anticipated upgrade to the plant will ultimately increase the design flow to 13.5 MGD.

**Table 3**

| Discharging Facility | NPDES Permit # / Federal Permit # | Stream Reach | Segment | Design Flow | Type | Permit Expires |
|---|---|---|---|---|---|---|
| Olathe – Cedar Creek Facility | M-KS52-IO06 KS0081299 | Cedar Cr | 38 | 3.0 mgd | Activated Sludge | 8/31/2011 |

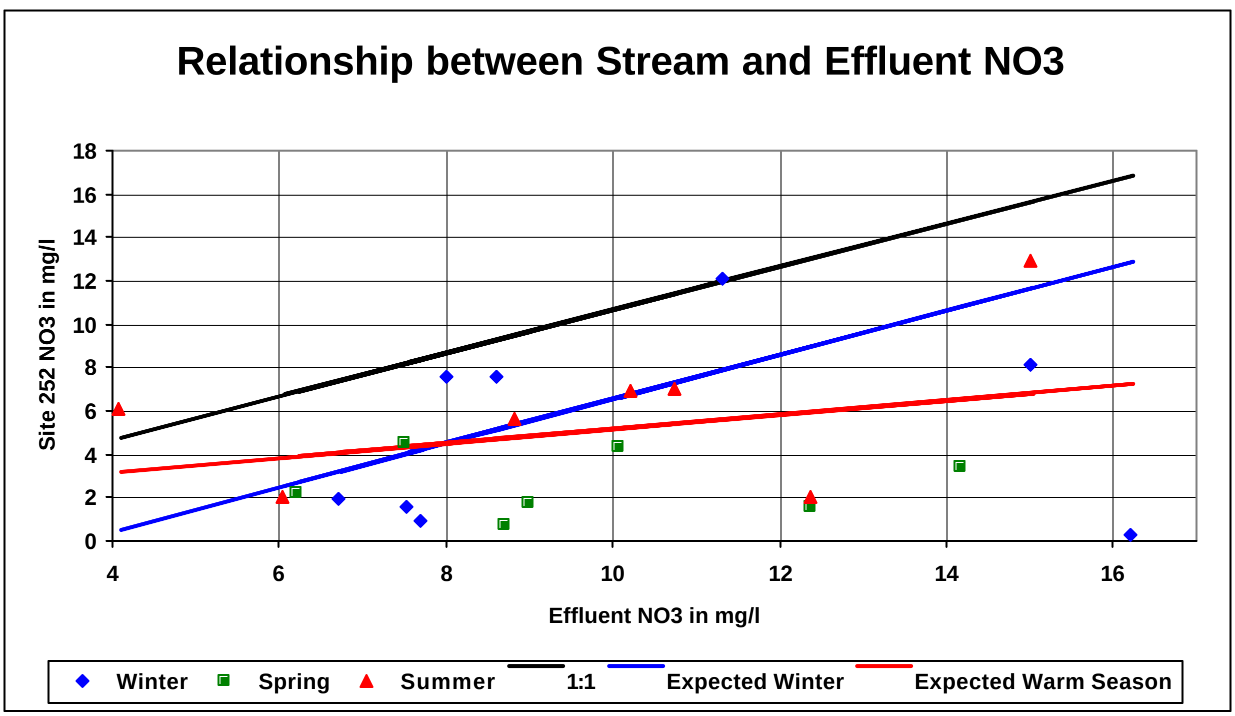


**Figure 7**

**Livestock Waste Management Systems**: Four operations are certified within the watershed (Appendix A). These facilities (small dairy, beef, horse or swine operations) are primarily located along the west side of the watershed (**Figure 8**) and the swine and dairy operation actually would discharge to the Kill Creek watershed. None of these facilities are of sufficient size to warrant NPDES permitting, and have been certified to not pose a significant potential to pollute surface waters. High rainfall events may trigger some discharge from these small facilities, typically coinciding with high stream flows that are exceeded less than 1 - 5 percent of the time. Therefore, events of this type are not associated with the nitrate problem in the Cedar Creek watershed. The actual number of animal units on site is variable, but typically less than potential numbers.

**Land Use**: Much of the watershed remains undeveloped, typically dominated by agricultural uses (65%), urban uses, such residential, commercial and industrial uses, comprise 24% of the watershed. Another five percent is occupied by parkland or surface water. The remaining five percent is unknown land use, including government property and public roads (Lee, et al, 2005). An estimated four percent of the watershed is overlain with impervious surface. Most of the cropland is located along the main stem in the lower third of the watershed (**Figure 9**). According to the NRCS Riparian Inventory, there are about 4,175 acres of riparian area in the watershed, most of which is categorized as forest land (40%), crop/tree mix (10%), pasture/tree mix (9%), cropland (18%), pasture land (7%) and urban/urban tree mix (7%) (**Figure 10**).

**On-Site Waste Systems**: The watershed's population density is high (375 persons/sq mi) when compared to densities elsewhere in the Kansas/Lower Republican Basin. The rural population projection for Johnson County through 2020 shows a marked decline of about 30% as incorporated areas expand across the watershed reducing the rural population in the county. Yet septic systems for domestic wastewater are numerous, estimated at 16.6 systems per square mile of drainage area (Lee, et al, 2005). Based on 1990 census data about 6% of households in Johnson County are on septic systems. Failing on-site waste systems can contribute nitrogen/nutrient loadings and their contribution may be important, given the very low flows associated with the excursions in the watershed. There seems to be a high density of septic systems at the lower portions of the watershed (Lee, et al, 2005).

**Background Levels:** Some nitrate/nutrient loading may be associated with environmental background levels, including contributions from soils and wildlife and stream-side vegetation. It is likely that the density of animals such as deer is fairly dispersed across the watershed and that any nutrient loading is constant along the stream. The environmental background loading should result in minimal loading to the streams below the levels necessary to exceed water quality standards.

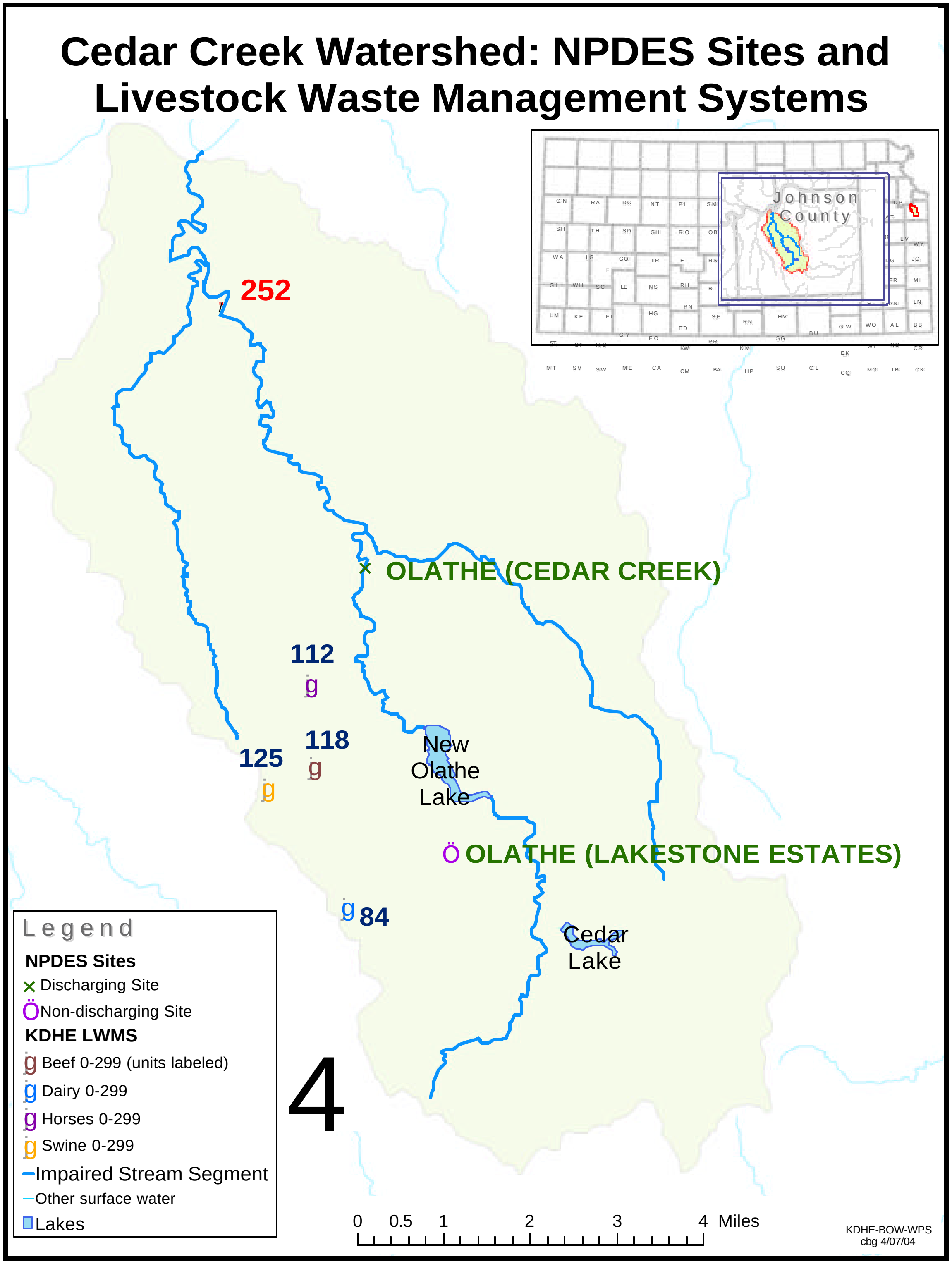
Cedar Creek Watershed: NPDES Sites and Livestock Waste Management Systems
Johnson County
252
OLATHE (CEDAR CREEK)
112
118
125
New Olathe Lake
OLATHE (LAKESTONE ESTATES)
84
Cedar Lake
4
Legend
NPDES Sites
Discharging Site
Non-discharging Site
KDHE LWMS
Beef 0-299 (units labeled)
Dairy 0-299
Horses 0-299
Swine 0-299
Impaired Stream Segment
Other surface water
Lakes
0 0.5 1 2 3 4 Miles
KDHE-BOW-WPS
cbg 4/07/04

**Figure 8**

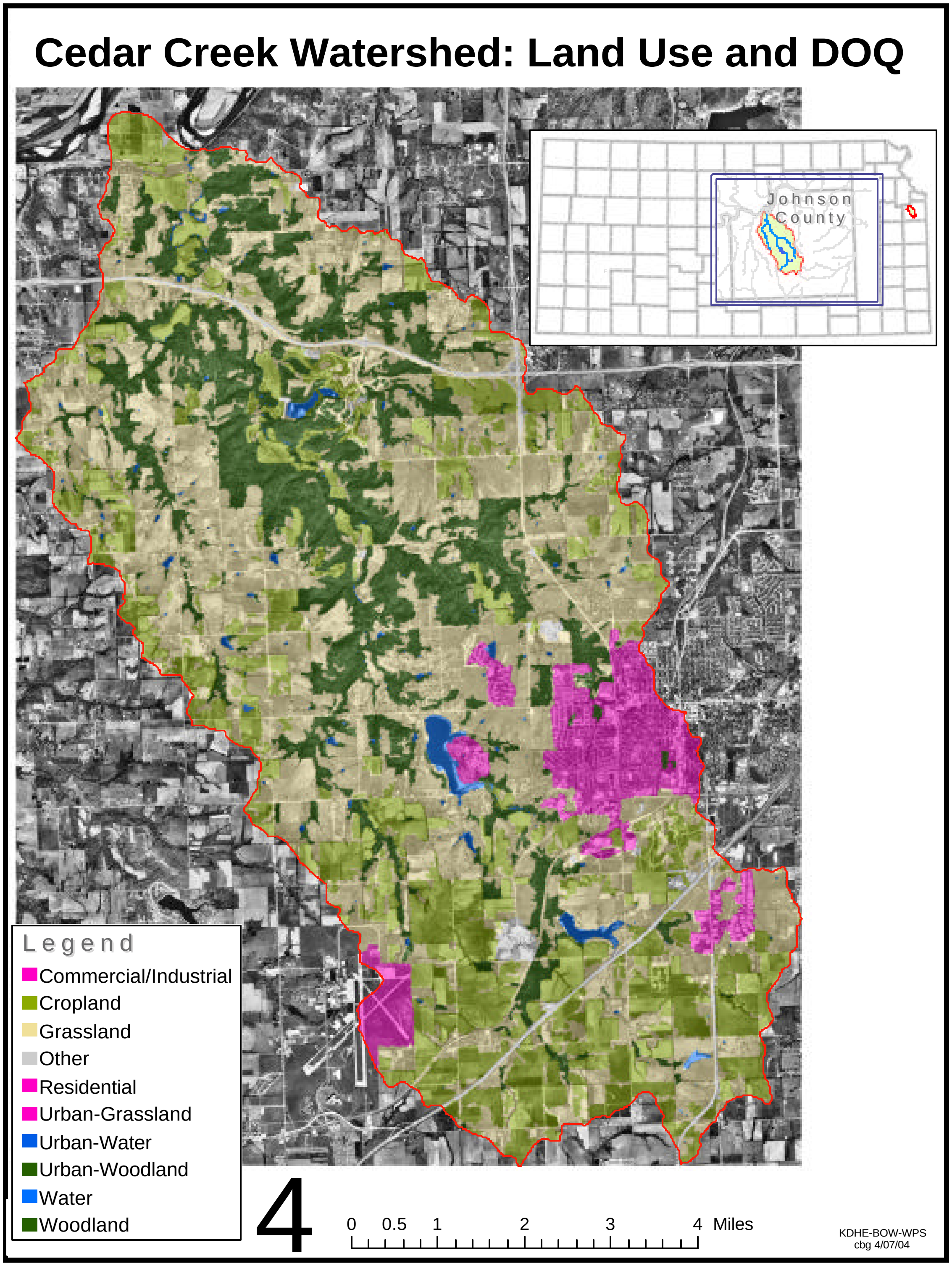
Cedar Creek Watershed: Land Use and DOQ
Johnson County
Legend
Commercial/Industrial
Cropland
Grassland
Other
Residential
Urban-Grassland
Urban-Water
Urban-Woodland
Water
Woodland
0 0.5 1 2 3 4 Miles
KDHE-BOW-WPS
cbg 4/07/04

**Figure 9**

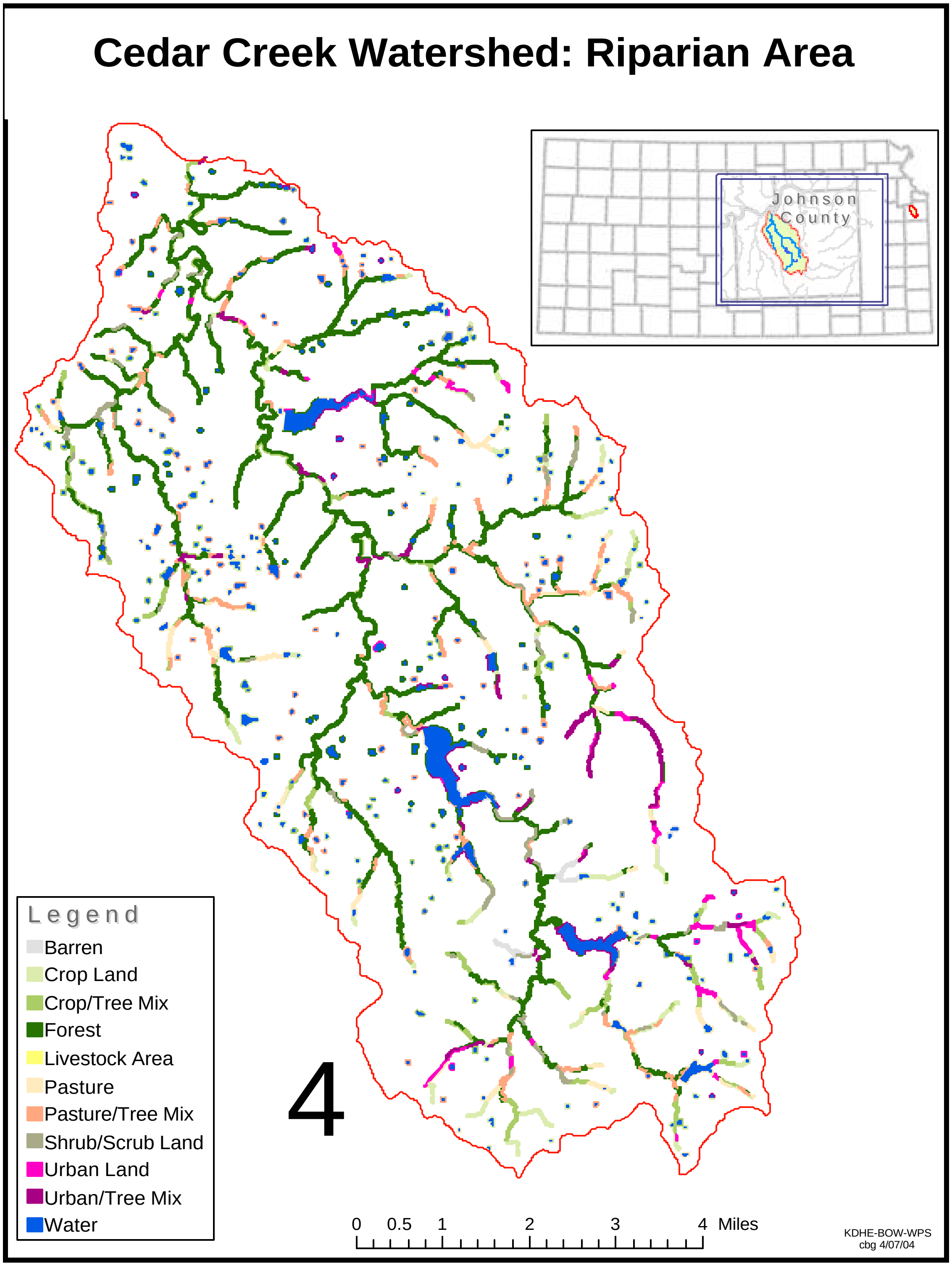
Cedar Creek Watershed: Riparian Area
Johnson
County
Legend
Barren
Crop Land
Crop/Tree Mix
Forest
Livestock Area
Pasture
Pasture/Tree Mix
Shrub/Scrub Land
Urban Land
Urban/Tree Mix
Water
4
0 0.5 1 2 3 4 Miles
KDHE-BOW-WPS
cbg 4/07/04

**Figure 10**

## 4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

Nitrate excursions have only been noted under low flow conditions. Therefore, reductions in nitrate loadings within the watershed will only apply under the critical low flow condition influenced by the design flow of the Olathe-Cedar Creek Wastewater Plant. The estimated flow condition that exhibits influence from the Olathe plant is the 85% exceedance flow. Since no nitrate excursions have been observed outside this critical low flow condition, nitrate load reductions from improved wastewater treatment will indirectly benefit nitrogen levels in Cedar Creek at flows beyond this critical condition.

The TMDL as a load duration curve is displayed in Figure 11, based on a maximum load level as defined by the 10mg/l criterion. Actual conditions should remain well below those levels through implementation of nutrient reduction at the Olathe wastewater plant. The CAFOs and the Lakestone Estates facility will have a Wasteload Allocation of zero because of their lack of discharge to Cedar Creek.

**Point Sources**: Based on the assessment of sources, the distribution of excursions from water quality standards at site 252 by flow and season and the relationship of those effluent levels to in-stream flow conditions, the Olathe plant is seen as the primary contributing factor to the nitrate excursions in the watershed.

The load duration curve was constructed by applying the 10 mg/l nitrate concentration to the historic flow condition. Olathe wastewater was presumed to constitute all flow between the 85-99 percentiles. Since Olathe's average nitrate content of its wastewater was slightly below 10 mg/l, the historic load curve used 10 mg/l. Current operations and design presume a 3 MGD discharge. Hence, the load duration curve for the 3 MGD level was established assuming that future flows in the 85-99 percentile range would increase to 4.6 cfs (3 MGD). Historic flows greater than the 80$^{th}$ percentile flow (5.9 cfs), were assumed to be composed of 2 MGD of wastewater with the balance of flow coming from non-point and urban stormwater sources. The proportion of Olathe wastewater design flow comprising the historic flow in Cedar Creek transitioned between 100% at 4.6 cfs to and 2 MGD at 5.9 cfs. The historic load duration curve was then elevated by the addition of the incremental increase in anticipated Olathe wastewater.

In anticipation of the two stages of increased discharge from the Olathe plant in the future, two additional load duration curves were established, assuming 9 and 13.5 MGD discharges from the wastewater treatment plant. The respective curves were established in the same manner as the 3 MGD curve with increased wastewater contributions elevating the historic load curve.

Wasteload Allocations at the three stages were established with the assumption of Biological Nutrient Removal installed and producing an effluent with total nitrogen of 8 mg/d. The Wasteload Allocations conservatively assume that all the nitrogen will be in the form of nitrate. The Wasteload Allocations increase over time as a result of increased discharge volume, but the concentrations remain constant. Appendix B indicates the respective Wasteload Allocations at the three wastewater design flow conditions.

Urban stormwater is not seen as a significant factor in the nitrate levels seen in Cedar Creek since nitrate concentrations average less than 2 mg/l at higher flows. Nonetheless, Johnson County and Olathe 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. Both permits incorporate Cedar Creek for its bacteria TMDL. Should nitrate or total nitrogen concentrations become problematic in Cedar Creek in the future, the stormwater permits will need to be revised to incorporate nutrients, particularly nitrogen, for Cedar Creek and its tributaries and direct implementation of Best Management Practices to abate the loading of nutrients to the stream by stormwater. The Wasteload Allocations for stormwater is established by 30% of the Load Allocation over the constant wasteloads from the Olathe plant (Appendix B). The percentage was derived by the proportion of developed land within the watershed.

**Non-Point Sources:** The samples from the Cedar Creek watershed indicate nitrate excursions only occurred under low flow conditions. Such conditions are not indicative of non-point source influences, although some seepage from faulty septic systems might enter Cedar Creek. The volume of that seepage would likely be small compared to the typical discharge from Olathe. The Load Allocation assigns responsibility for maintaining nitrate loads at site 252 below 10 mg/l on average under runoff conditions exceeded less than 80% of the time (**Figure 11**). The Load Allocation is represented within Figure 11 as the 70% of the area lying between the Wasteload Allocation for the wastewater discharges of 3, 9 or 13.5 MGD, their Margin of Safety and their associated TMDL curve. Appendix B lists the Load Allocations from non-point sources at various flow conditions on Cedar Creek.

**Defined Margin of Safety**: The Margin of Safety is explicit under the critical low flow conditions exceeded 85% of the time or more. Under those conditions, there is no Load Allocation since all of the flow in Cedar Creek is wastewater effluent. The TMDL is established at the 10 mg/l concentration, but the actual nitrate concentrations will be a factor of the Wasteload Allocation, which is based on the expected 8 mg/l of total nitrogen to be produced by the wastewater plant after installation of Biological Nutrient Removal. The TMDL assumes the total nitrogen is all nitrate, but in fact, typical wastewater contains about 2 mg/l of total Kjeldahl nitrogen (organic N plus ammonia). Therefore, nitrate levels should be substantially below the standard. Once runoff conditions appear, the Margin of Safety derived from the Wasteload Allocation analysis is withheld from the Load Allocation to non-point sources and the Wasteload Allocation assigned to urban stormwater. Furthermore, the impact of the highest nitrate source, the Olathe wastewater, is diminished under runoff conditions, that have historically averaged under 2 mg/l of nitrate.

**State Water Plan Implementation Priority:** Because this watershed has indicated some problem with nitrate and nutrients in general, which has short and long term consequences for its designated uses, because of the significant influence of the Olathe plant on downstream water quality and because of the opportunity to implement the Kansas Surface Water Nutrient Reduction Plan with the planned city upgrades to the wastewater plant, this TMDL will be a High Priority for implementation.

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

**Priority HUC 11s and Stream Segments**: Priority focus of implementation will primarily concentrate on reducing the nitrate loads along Segment 38. Non-point sources along Little Cedar Creek (74) or Camp Creek (76) should be examined for nutrient contributions during moderate flows.

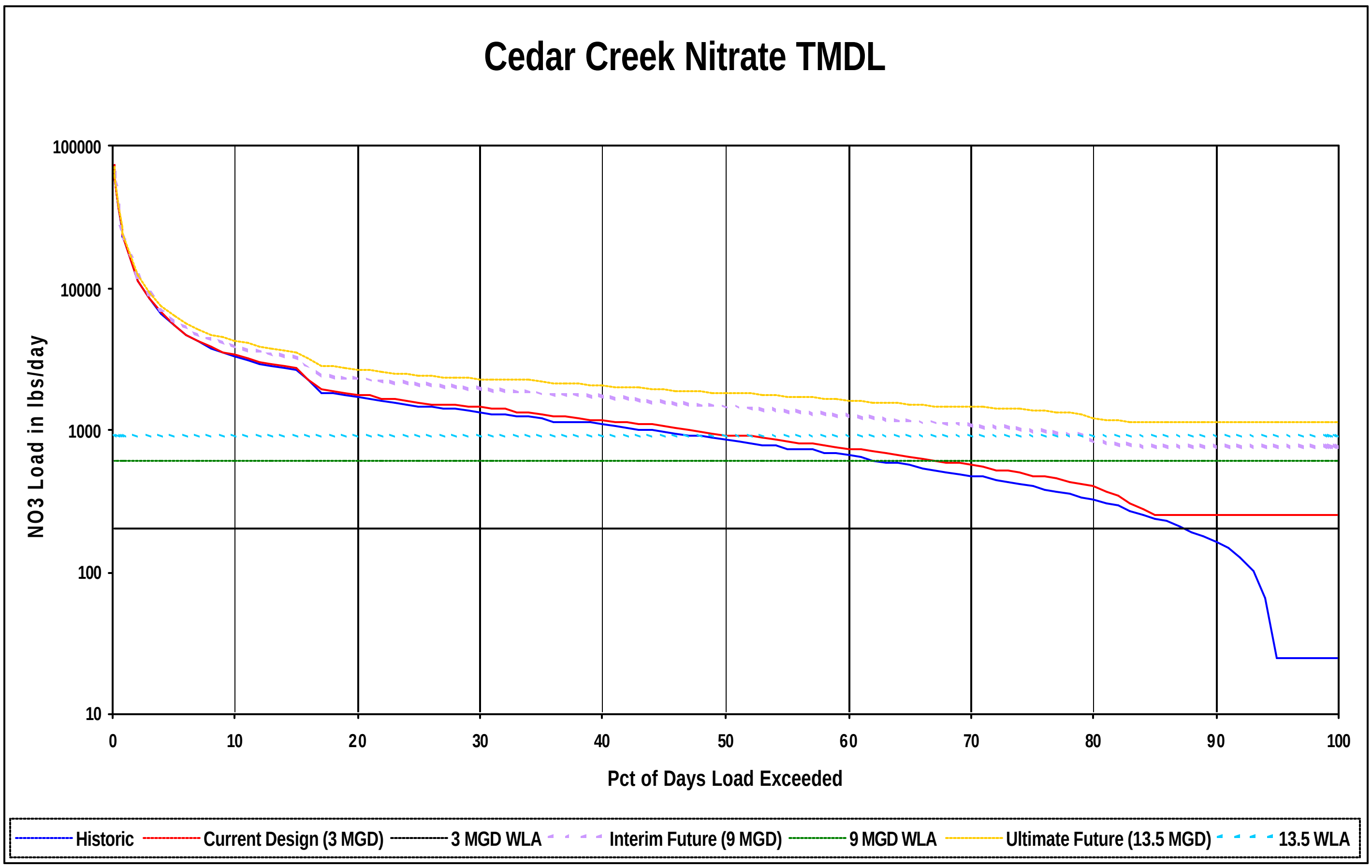


**Figure 11**

## 5. IMPLEMENTATION

### Desired Implementation Activities

1. Upgrade the Olathe wastewater facility to reduce nutrient loads in its effluent discharging to Cedar Creek.
2. Repair or replace or remove faulty septic systems in the vicinity of Cedar Creek
3. Improve riparian conditions along Cedar Creek.
4. Abate any agricultural non-point source or urban stormwater contributions of nutrients to Cedar Creek

### Implementation Programs Guidance

#### NPDES - Municipal Program Sections - KDHE

a. Issue renewed NPDES permits with schedules of compliance planning and directing treatment plant upgrades, including biological nutrient removal, that are necessary to reduce long term, average nitrogen loading in order to meet water quality standards.
b. Evaluate influence of nutrient levels in Olathe wastewater on downstream nutrient levels monitored at Station 252.
c. Once, treatment upgrades are in place and operating, establish an average annual limit of 8.0 mg/l for total nitrogen for the Cedar Creek Plant.
d. Review and approve necessary plans and specifications for treatment plant upgrades in order to achieve nutrient reduction.
e. Revise MS4 stormwater general permits for Johnson County and Olathe to incorporate implementation of Best Management Practices for nutrient loading into Cedar Creek, if high flow nutrient problems arise.

#### Watershed Management Program - KDHE

a. Support ongoing implementation projects conducted under a Watershed Restoration and Protection Strategy for Johnson County, including demonstration projects and outreach efforts dealing with nutrient management, stormwater management and practices, pollution prevention, public outreach and studies of water quality impacts of new development.
b. Support septic system inspection, upgrade and repair through the Johnson County Local Environmental Protection Program.
c. Provide technical assistance on nutrient management and vegetative buffer development in vicinity of streams.
d. Support aspects of the Johnson County and Olathe Stormwater Programs, outside the requirements of their 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 impacts of impervious area in the watershed.

**Water Resource Cost Share & Nonpoint Source Pollution Control Programs - SCC**

a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands in cropland of unincorporated areas of Johnson County lying within the watershed.
b. Provide sediment control practices to minimize erosion and sediment and nutrient transport from cropland and grassland in the watershed.
c. Repair faulty septic systems located adjacent to Cedar Creek and its main tributaries.

**Riparian Protection Program - SCC**

a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation along Cedar Creek and its tributaries.
b. Develop riparian restoration projects.
c. Promote wetland construction to assimilate nutrient loadings.
d. Coordinate riparian management within Olathe and in unincorporated Johnson County.

**Buffer Initiative Program - SCC**

a. Install vegetative buffer strips along Cedar Creek and its tributaries.

**Timeframe for Implementation:** The year 2007 marks the beginning of the new NPDES permit at the Cedar Creek facility. At that point in time, a schedule of compliance will note the Facilities Master Plan for necessary plant upgrades to install biological nutrient removal. Construction will commence in 2009 and will be completed sometime in time for the 2011 permit cycle, such that the final total nitrogen limits are met during 2011 – 2016.

**Targeted Participants:** Primary participants for implementation will be public works personnel of Olathe and Environmental Program personnel for Johnson County.

**Milestone for 2010**: The year 2010 is the next period of TMDL review in the Kansas-Lower Republican Basin. At that point in time, any necessary plant upgrades should be near completion.

**Delivery Agents:** KDHE staff in the Municipal Program Sections will develop the appropriate permits, schedules of compliance and review of plans. Review of technical information and studies will be made by KDHE staff of the Technical Services Section and the Bureau of Environmental Field Services.

**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. 65-3335 empowers the Secretary of KDHE to provide financial assistance for wastewater treatment through the State Revolving Loan Fund.

**Funding**: The State Revolving Loan Fund is operated through the Municipal Program at KDHE and provides low interest loans for wastewater treatment improvement. Since its inception, $128 million in loans have been made to municipal dischargers in the state. The Non-Point Source Pollution Control Fund of the State Conservation Commission distributes $2.8 million annually to the 105 Conservation Districts to implement non-point source abatement practices, including repair and replacement of faulty septic systems and riparian area improvements. The upgrades to the Olathe Cedar Creek Facility are estimated to cost $23.8 million.

**Effectiveness:** Denitrification techniques within mechanical treatment plants, for example at the Great Bend Plant, have been very effective in reducing nitrate concentrations in wastewater effluent. Biological nutrient removal has been effective at reducing nitrogen and phosphorus concentrations in effluent at the Garden City and applicable Wichita treatment facilities.

## 6. MONITORING

KDHE will continue to collect bimonthly samples at Station 252 including all forms of nitrogen, in order to assess progress and success in implementing this TMDL toward reaching its endpoint. Once plant upgrades are complete, stream and biological sampling will be done to assess low flow conditions and status of aquatic life after 2011. Use of the real time flow data available at the recent Cedar Creek near Desoto (USGS Station 06892495) stream gaging station can help evaluate the impact of quality improvement at the upgraded Olathe plant.

Routine sampling of effluent quality will be a condition of the issued permits with testing frequency consistent with Kansas Surface Water Implementation Procedures.

## 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.

**Discussion with City of Olathe**: A meeting to discuss TMDLs of interest to the City of Olathe and Johnson County occurred on December 21, 2005.

**Milestone Evaluation**: In 2010, evaluation will be made as to the progress in upgrading the Olathe-Cedar Creek wastewater treatment plant with biological nutrient removal. Additionally, any implementation activities that have occurred within the watershed and developed areas of Olathe and the levels of nitrogen seen in lower Cedar Creek will be assessed. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

**Consideration for 303(d) Delisting**: Because the stream is influenced so heavily by the wastewater discharges from the Olathe plant, any improvement in effluent quality will result in improved quality in Cedar Creek. Because biological nutrient removal will be in place by 2011, data after 2011 should indicate no problems with nitrate. Therefore the first opportunity to evaluate delisting Cedar Creek under Section 303(d), will come about in the preparation of the 2014 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 2007-2011.

## 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.

Revised March 8, 2007

**Appendix A – Inventory of Livestock Waste Management Systems in Cedar Creek Watershed**

| Permit ID | Type | Animal Units | Certificate? | Active? |
|---|---|---|---|---|
| A-KSJO-EA01 | Horses | 112 | Yes | Yes |
| A-KSJO-BA04 | Beef | 118 | Yes | Yes |
| A-KSJO-MA05 | Dairy | 84 | Yes* | Yes |
| A-KSJO-S001 | Swine | 125 | Yes* | Yes |

- ***Any potential discharge would go to Kill Creek Watershed**

**Appendix B – Load Capacities, Wasteload Allocations, Load Allocations and Margin of Safety**

| Flow Condition | Design Q | Load Capacity | WLA | WLA-MS4 | LA-NPS | MOS |
|---|---|---|---|---|---|---|
| **90% Exceedance** | 3 MGD | 250 #/d NO3 | 200 #/d | 0.0 #/d | 0.0 #/d | 50#/d |
| | 9 MGD | 750 #/d NO3 | 600 #/d | 0.0 #/d | 0.0 #/d | 150 #/d |
| | 13.5 MGD | 1125 #/d NO3 | 900 #/d | 0.0 #/d | 0.0 #/d | 225 #/d |
| **75% Exceedance** | 3 MGD | 487 #/d NO3 | 200 #/d | 70 #/d | 167 #/d | 50#/d |
| | 9 MGD | 983 #/d NO3 | 600 #/d | 70 #/d | 163 #/d | 150 #/d |
| | 13.5 MGD | 1359 #/d NO3 | 900 #/d | 70 #/d | 164 #/d | 225 #/d |
| **50% Exceedance** | 3 MGD | 933 #/d NO3 | 200 #/d | 205 #/d | 478 #/d | 50#/d |
| | 9 MGD | 1435 #/d NO3 | 600 #/d | 205 #/d | 480 #/d | 150 #/d |
| | 13.5 MGD | 1810 #/d NO3 | 900 #/d | 205 #/d | 480 #/d | 225 #/d |
| **25% Exceedance** | 3 MGD | 1566 #/d NO3 | 200 #/d | 395 #/d | 921 #/d | 50#/d |
| | 9 MGD | 2067 #/d NO3 | 600 #/d | 395 #/d | 922 #/d | 150 #/d |
| | 13.5 MGD | 2443 #/d NO3 | 900 #/d | 395 #/d | 923 #/d | 225 #/d |
| **10% Exceedance** | 3 MGD | 3360 #/d NO3 | 200 #/d | 933 #/d | 2177 #/d | 50#/d |
| | 9 MGD | 3861 #/d NO3 | 600 #/d | 933 #/d | 2178 #/d | 150 #/d |
| | 13.5 MGD | 4237 #/d NO3 | 900 #/d | 933 #/d | 2179 #/d | 225 #/d |