NEOSHO BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Cherry Creek
Water Quality Impairment: Dissolved Oxygen

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Middle Neosho River **County:** Cherokee, Labette, and Crawford

HUC 8: 11070205

HUC 11 (HUC 14s)**:** **060** (020 and 030)

Drainage Area: 113.6 square miles

Main Stem Segment: WQLS: 4 (Cherry Creek) starting at confluence with the Neosho River and traveling upstream to headwaters in south-central Crawford County (**Figure 1**).

Tributary Segments: WQLS: Denny Branch (31)
Little Cherry Creek (32)
Non-WQLS: Center Creek (25)

Designated Uses: Expected Aquatic Life Support, Secondary Contact Recreation and Food Procurement for Main Stem Segment.

Expected Aquatic Life Support and Secondary Contact Recreation on Denny Branch and Little Cherry Creek.

1998 303(d) Listing: Table 1 - Predominant Non-point Source and Point Source Impacts

Impaired Use: Expected Aquatic Life Support

Water Quality Standard: Dissolved Oxygen (DO): 5 mg/L (KAR 28-16-28e(c)(2)(A))

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

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

Monitoring Sites: Station 605 near Faulkner

Period of Record Used: 1991, 1995 and 1999 for Station 605; 2000 and 2001 Kansas Biological Survey Data (**Figure 2**)

Flow Record: Lightning Creek near McCune (USGS Station 07184000) matched to Cherry Creek watershed for Cherry Creek near Chetopa (USGS 07184240).

Long Term Flow Conditions: 10% Exceedance Flows = 135.6 cfs**,** 95% = 0 cfs

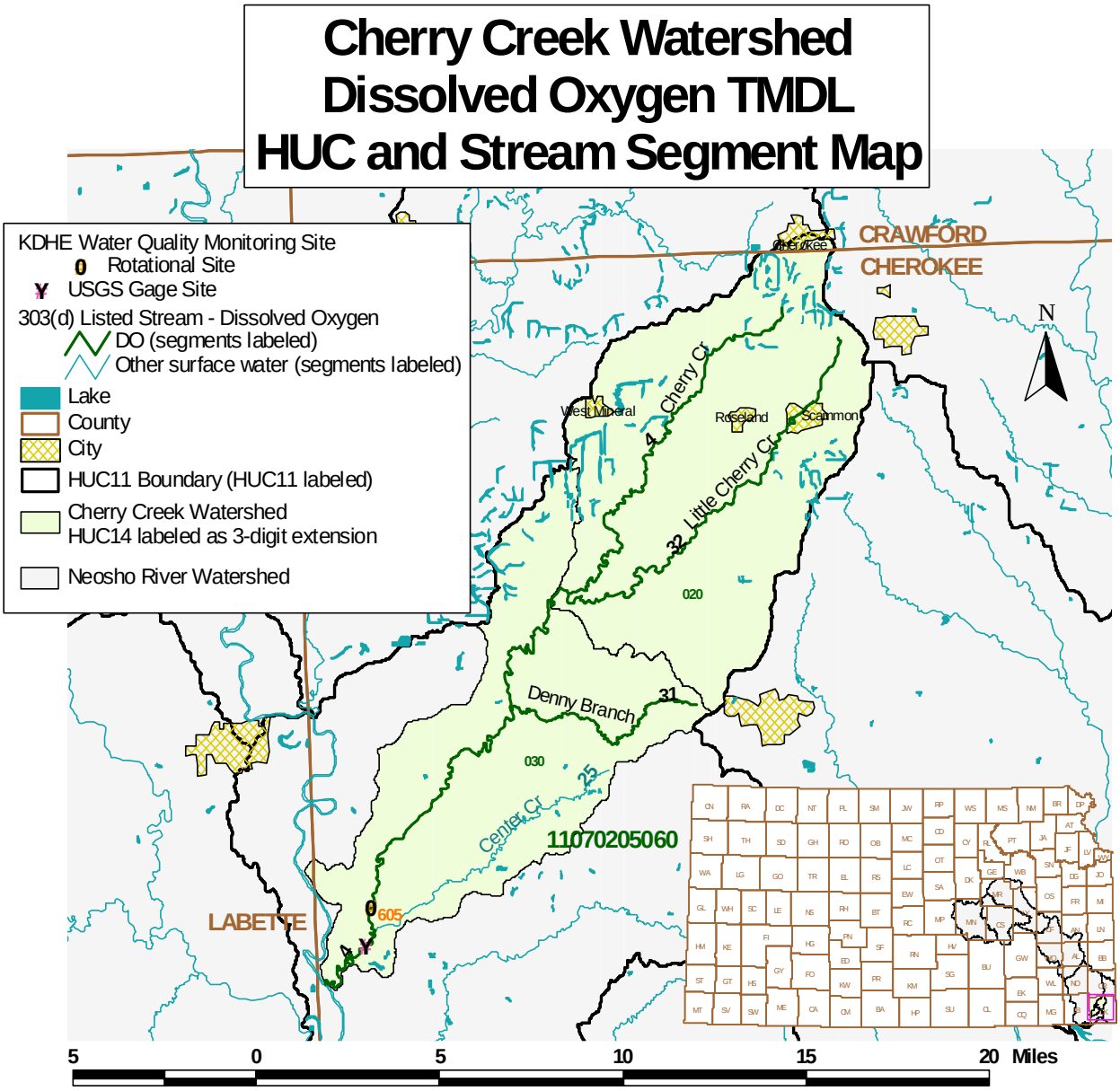


Figure 1

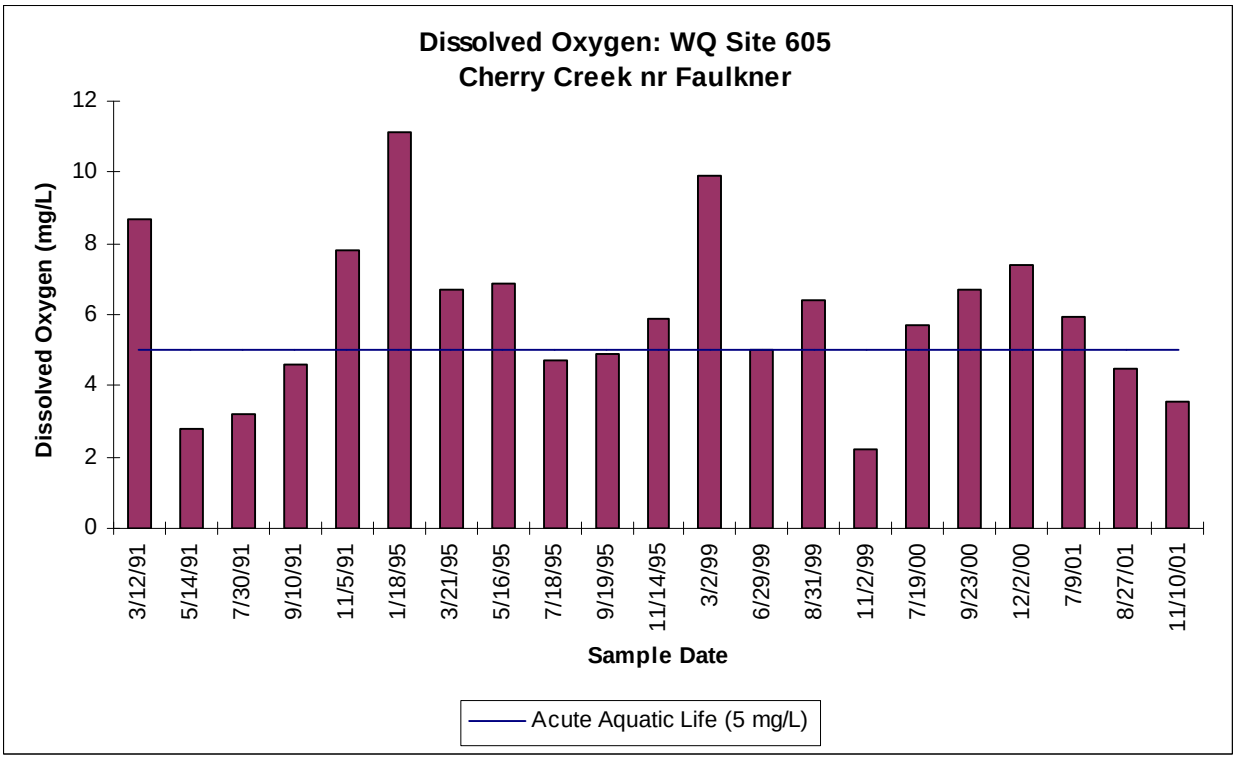


Figure 2

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 Aquatic Life criterion by multiplying the flow values for Cherry Creek near Chetopa along the curve by the applicable water quality criterion and converting the units to derive a load duration curve of pounds of DO 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 *below* the load curves. Water quality standards are met for those points plotting *above* the applicable load duration curves (**Figure 3**).

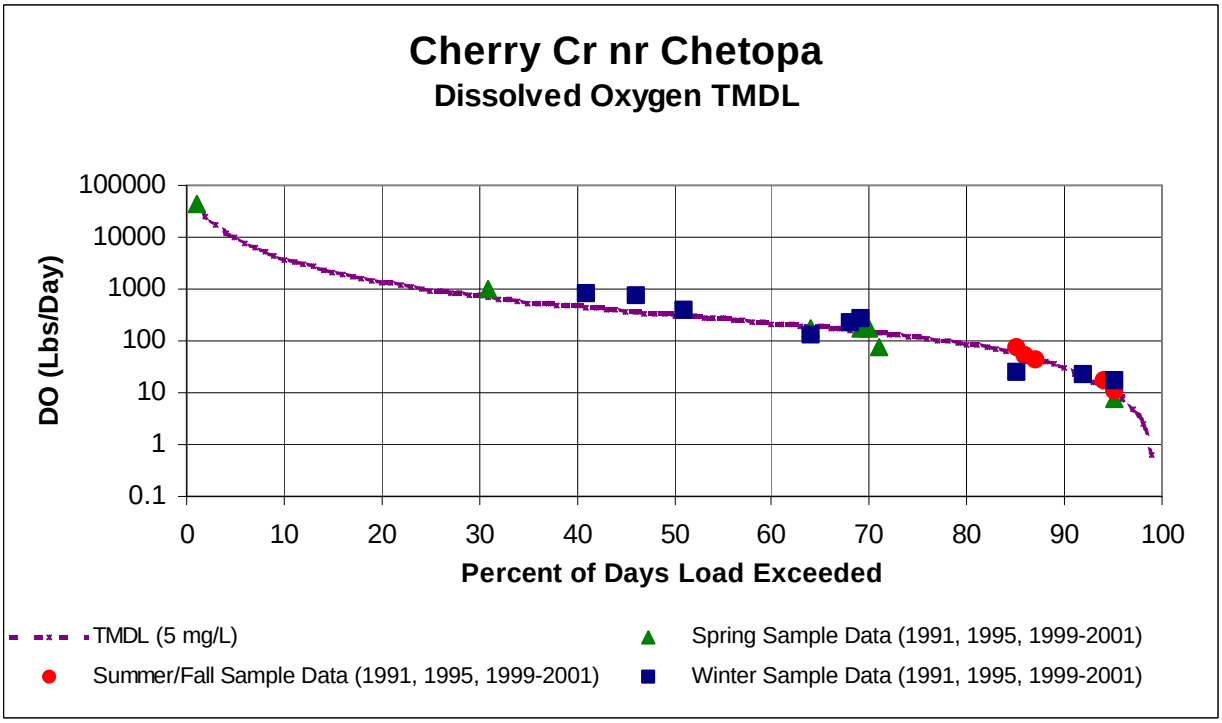


Figure 3

Excursions were seen in all seasons and are outlined in **Table 1**. Forty three percent of the Summer-Fall samples and 60% of Spring samples were below the aquatic life criterion. Twenty two percent of the Winter samples were under the aquatic life criterion. Overall, 38% of the samples were under the criterion. This would represent a baseline condition of non-support of the impaired designated use.

No DO violations have been encountered at flows exceeding 7.1 cfs on Cherry Creek near Chetopa, therefore a critical low flow can be identified on Cherry Creek as those flows of 7.1 cfs or less.

Table 1
NUMBER OF SAMPLES UNDER DISSOLVED OXYGEN STANDARD OF 5 mg/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.
Cherry Creek near Chetopa (605)	Spring	0	0	0	2	0	1	3/7 = 43%
	Summer	0	0	0	0	2	1	3/5 = 60%
	Winter	0	0	0	1	1	0	2/9 = 22%

A watershed comparison approach was taken in developing this TMDL. The Lightning Creek watershed (Water Quality Sampling Site 565 in the watershed was not impaired by low DO) has roughly similar land use characteristics (**see Table 2 in Appendix**) to the Cherry Creek watershed, and is located immediately north of the Cherry Creek watershed. The relationship of DO to ammonia, biochemical oxygen demand (BOD), fecal coliform bacteria (FCB), water temperature, turbidity, nitrate, phosphorus, pH and total suspended solids (TSS) were used in the comparison.

Table 3 in the Appendix outlines those water quality data for the samples taken on the same date for the two sites of interest. **Table 4 in the Appendix** is the subset of data from Table 3 for those sample dates when DO was below the aquatic life criterion for sample site 605. From Table 4 for site 605 the average ammonia, BOD (1.3 mg/L higher on average), and nitrate were higher than the reference site 565, pH was slightly lower than the reference site, most likely due to acid mine drainage. FCB, temperature, turbidity and phosphorus were comparable for both sites. This indicates that, in addition to the naturally driven factor of lower flow which can contribute to the occasional DO excursions, a probable oxygen demanding substance load is being added to the Cherry Creek watershed upstream of site 605 and, under certain conditions, is likely a factor influencing the DO violations.

Desired Endpoints of Water Quality at Site 605 over 2007 - 2011

The desired endpoint will be reduced biochemical oxygen demand from artificial sources such that average BOD concentrations remain below 2.65 mg/l in the stream under the critical flow conditions which results in no excursions below 5 mg/l of DO detected between 2006 - 2011 attributed to these sources.

This desired endpoint should improve DO concentrations in the creek at the critical lower flows (0 - 7.1 cfs). Seasonal variation is accounted for by this TMDL, since the TMDL endpoint is sensitive to the low flow usually occurring in the May-October months.

This endpoint will be reached as a result of expected, though unspecified, reductions in organic loading from the various sources in the watershed resulting from implementation of corrective actions and Best Management Practices, as directed by this TMDL (see Implementation - Section 5). Sediment control practices such as buffer strips and grassed waterways should help reduce the non-point source BOD load under higher flows which, in turn, should help reduce the oxygen demand exerted by the sediment transported to the stream that may occur during the critical flow period. Achievement of this endpoint will provide full support of the aquatic life function of the creek and attain the dissolved oxygen water quality standard.

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: There are two NPDES permitted wastewater dischargers located within the watershed that could contribute an oxygen demanding substance load to site 605(**Figure 4**). These systems are outlined below in **Table 5**.

Table 5

DISCHARGING FACILITY	STREAM REACH	SEGMENT	DESIGN FLOW	TYPE
Scammon MWTF	Little Cherry Cr.	32	0.084 mgd	Lagoon
West Mineral MWTP	Cherry Cr.	4	0.031 mgd	Lagoon

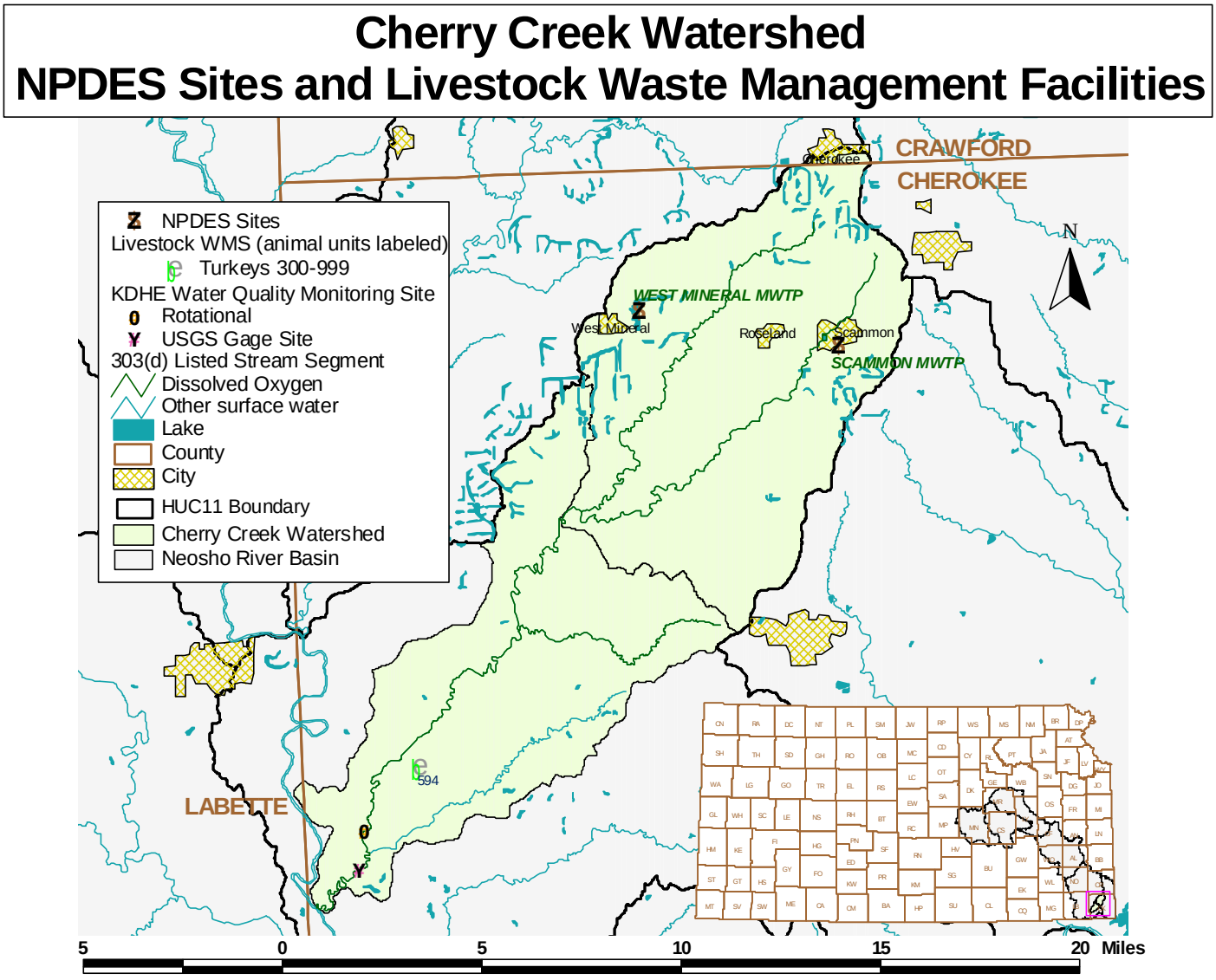


Figure 4

Both the cities of Scammon and West Mineral rely on four cell lagoon systems with at least 120 day detention time for treatment of their wastewater. Kansas Implementation Procedures - Waste Water Permitting - indicates both of these lagoon system meet standard design criteria.

The population projections for Scammon and West Mineral to the year 2020 indicate little change. Projections of future water use and resulting wastewater appear to be within the design flows for of the current system's treatment capacity. Examination of 1998, 1999, 2000 and 2001 effluent monitoring of the cities of Scammon and West Mineral indicate that BOD discharges are usually well within permit limits. In the case of each city, effluent monitoring indicates BOD discharges in excess of permit limits occurred only once during this time period.

Livestock Waste Management Systems: A single operation is registered, certified or permitted within the watershed. The facility type is turkey and is located toward the lower portion of the watershed near the main stem (**Figure 4**). All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed for the 25 year, 24 hour rainfall/runoff event, which typically coincide with stream flows exceeded less than 1 - 5 % of the time. NPDES permits, also non-discharging, are issued for facilities with more than 1,000 animal units. The single facility located in the Cherry Creek watershed is not of this size. Potential animal units for this facility is 594. The actual number of animal units on site is variable, but typically less than potential numbers.

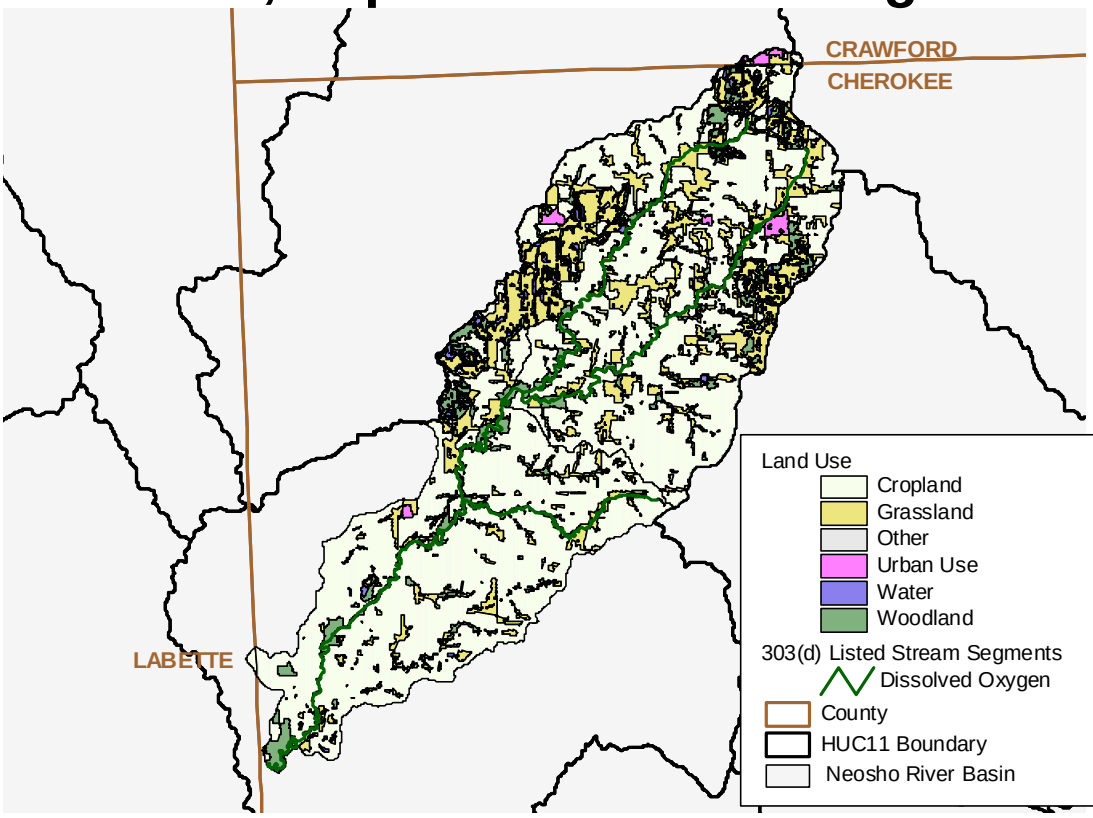
Land Use: Most of the watershed is cropland (68% of the area), grassland (20%), or woodland (9%). Most of the cropland is located in either the lower half of the watershed or toward the main stem or watershed boundary in the upper half of the watershed. The grazing density estimate is low in the lower half and average in the upper half of the watershed when compared to densities elsewhere in the Neosho Basin (16-31 animal units/mi^2) (**Figure 5 and Table 2 in Appendix**).

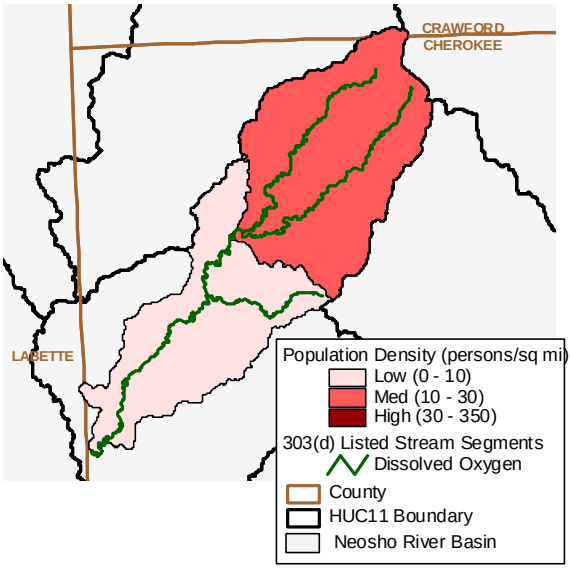
On-Site Waste Systems: The watershed's population density is low in the lower half and average in the upper half of the watershed when compared to densities elsewhere in the Neosho Basin (6-20 person/mi^2) (**Figure 5**). The rural population projection for Cherokee County through 2020 shows significant growth (27% increase). While failing on-site waste systems can contribute oxygen demanding substance loadings, their impact on the impaired segments is generally limited, given the small size of the rural population and magnitude of other sources in the watershed.

Contributing Runoff: The Cherry Creek watershed's average soil permeability is 0.6 inches/hour according to NRCS STATSGO data base. Practically allof the watershed produces runoff even under relatively low (1.71"/hr) potential runoff conditions (99.9%). Under very low (1.14"/hr) potential conditions, this potential contributing area is reduced about 73%. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.57"/hr of rain will still generate runoff from 67% of this watershed.

Background Levels: Some organic enrichment may be associated with environmental background levels, including contributions from wildlife and stream side vegetation, but it is likely that the density of animals such as deer is fairly dispersed across the watershed and that the loading of oxygen demanding material is constant along the stream. In the case of wildlife, this loading should result in minimal loading to the streams below the levels necessary to violate the water quality standards. In the case of stream side vegetation, the loading should be greater toward the middle third of the watershed with its larger proportion of woodland near the stream.

Cherry Creek Watershed
Land Use, Population and Grazing Density





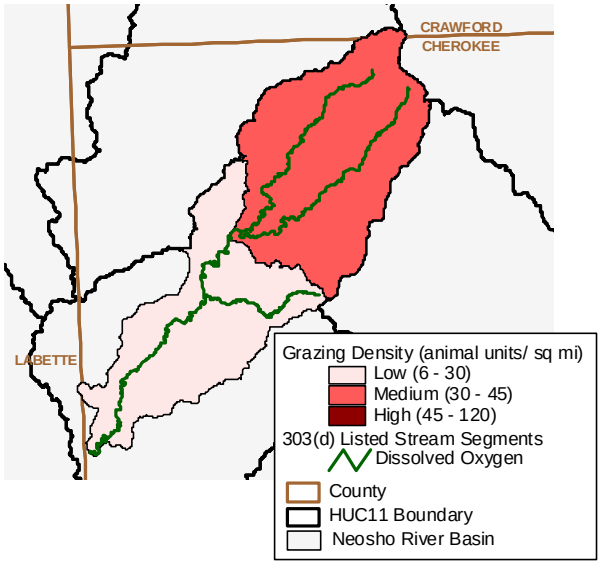


Figure 5

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

BOD is a measure of the amount of oxygen required to stabilize organic matter in a stream. As such, BOD is used as a benchmark measure to anticipate DO levels while it measures the total concentration of DO that will be demanded as organic matter degrades in a stream. It is presumed that reductions in BOD loads will reduce DO excursions under certain critical flow conditions. Therefore, any allocation of wasteloads and loads will be made in terms of BOD reductions. Yet, because DO is a manifestation of multiple factors, the initial pollution load reduction responsibility will be to decrease the BOD over the critical range of flows encountered on the Cherry Creek system. These reductions have been based on the relationship between DO and BOD for the samples taken at Water Quality Monitoring site 605 as compared to the reference Lightning Creek watershed and its water quality monitoring site 565. Allocations relate to the BOD levels seen in the Cherry Creek system at site 605 relative to site 565 for the critical lower flow conditions (0-7.1 cfs). Based on this relationship, BOD loads at site 605 needs to be reduced by 33% (so that in stream average BOD is 2.65 mg/L or less). Additional monitoring over time will be needed to further ascertain the relationship between BOD reductions of non-point sources, flow conditions, and DO levels along the stream.

For this phase of the TMDL the average condition is considered across the seasons to establish goals of the endpoint and desired reductions. Therefore, the target average BOD level was multiplied by the average daily flow for Cherry Creek across all hydrologic conditions. This is represented graphically by the integrated area under the BOD load duration curve established by this TMDL. The area is segregated into allocated areas assigned to point sources (WLA) and nonpoint sources (LA). Future growth in wasteloads should be offset by reductions in the loads contributed by nonpoint sources. This offset along with appropriate limitations is expected to eliminate the impairment. This TMDL represents the "Best Professional Judgment" as to the expected relationship between physical factors, organic matter and DO.

Point Sources: Point sources are responsible for maintaining their systems in proper working condition and appropriate capacity to handle anticipated wasteloads of their respective populations. The State and NPDES permits will continue to be issued on 5 year intervals, with inspection and monitoring requirements and conditional limits on the quality of effluent released from these facilities. Ongoing inspections and monitoring of the systems will be made to ensure that minimal contributions have been made by this source.

Based upon the preceding assessment, only those point sources (Scammon and West Mineral) contributing a BOD load in the Cherry Creek Watershed upstream of site 605 will be considered in this Wasteload Allocation.

Streeter-Phelps analyses for both point sources indicate the present BOD permit limit (30 mg/L) for these point sources causes DO levels to drop below 5 mg/L in the stream when there is no flow upstream of the discharge point. A BOD permit limit of 23-25 mg/L for both point sources maintains DO levels above 5 mg/L (see attached Streeter-Phelps analysis). Pending further definition of the DO/BOD relationship, compliance with a 25 mg/L BOD limit should maintain an average BOD of less than 2.65 mg/L at the sampling site across this flow condition and achieves the Kansas Water Quality Standard for DO of 5 mg/L for the months with the warmest

water temperatures in the year (May - October).

Streeter-Phelps analyses using stream temperatures below 17.8º C indicate the current BOD limit (30mg/L) for each point source maintains DO levels above 5 mg/L in the stream even when there is no flow upstream of either discharge point.

KDHE will review options to initiate a research project and/or series of pilot studies to determine cost effective options to improve the effluent quality from wastewater treatment lagoons. Several approaches will be considered, including solar-powered mixers at several locations in the state, including Scammon and West Mineral to reduce the BOD levels of wastewater discharged to the Cherry Creek stream system during warm weather months (May-October). This technology should ensure that the reduced BOD limits imposed by this TMDL will be achieved.

The sum of the design flows of the point sources (0.18 cfs) redefines the lowest flow seen at site 605 (97-99% exceedance), and the WLA equals the TMDL curve across this flow condition (**Figure 6**).

For periods of zero flow in receiving streams during May through October, the WLA will be 17.5 lbs/day BOD for Scammon and 6.5 lbs/day BOD for West Mineral. Otherwise, during periods when receiving flow is present or anytime during the November through April time period the WLA for the city of Scammon is 21.1 lbs/day BOD and 7.8 lbs/day BOD for West Mineral which translates to an in stream WLA of 1.86 lbs/day BOD and 0.69 lbs/day at Site 605, respectively (**Figure 6**).

Non-Point Sources: Based on the prior assessment of sources, the distribution of excursions from water quality standards at site 605 and the relationship of those excursions to runoff conditions and seasons, non-point sources are also seen as a contributing factor to the occasional DO excursions in the watershed.

The samples from the Cherry Creek watershed show there were no DO violations at flows in excess of 7.1 cfs. The Load Allocation assigns responsibility for reducing the in stream BOD levels at site 605 to 2.65 mg/L across the 0.18 - 7.1 cfs range of the critical flow condition (96 - 64% exceedance) and maintaining the in stream BOD levels at site 605 to the historical levels of 2.85 mg/L for flows in excess of 7.1 cfs (which is 90th percentile of BOD samples for flows in Cherry Creek above 7.1 cfs near Chetopa). The LA equals zero for flows from 0 - 0.18 cfs (97 - 99% exceedance), since the flow at this condition is entirely effluent created, and then increases to the TMDL curve with increasing flow beyond 0.18 cfs (**Figure 6**). Sediment control practices such as buffer strips and grassed waterways should help reduce the non-point source BOD load under higher flows as well as reduce the oxygen demand exerted by the sediment transported to the stream that may occur during the critical flow period.

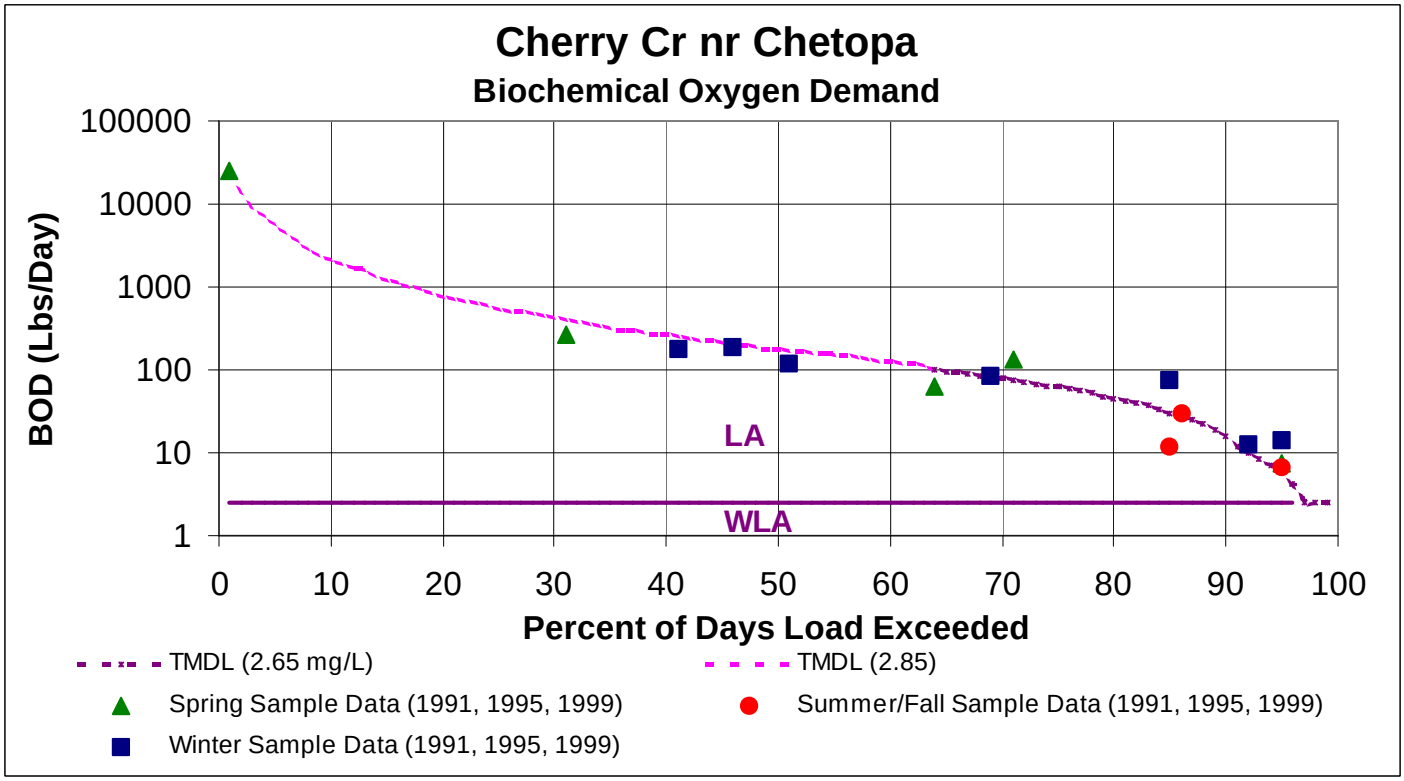


Figure 6

Defined Margin of Safety: The Margin of Safety will be implied based on conservative assumptions used in the permitting of the point source discharges including coincidence of low flow with maximum discharge from the treatment plant, associated CBOD content, temperature of the effluent, higher than expected stream velocity and the better than permitted performance of the treatment plant in producing effluent with BOD well below permit limits under critical seasonal conditions. Additionally, the target BOD concentration has been set at a conservative value since sampling data indicates exceeding this value has seldom led to a dissolved oxygen violation.

State Water Plan Implementation Priority: Because this watershed has indicated some problem with dissolved oxygen which has short term and immediate consequences for aquatic life, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Middle Neosho Basin (HUC 8: 11070205) with a priority ranking of 24 (Medium Priority for restoration work).

Priority HUC 11s and Stream Segments: Priority should be directed toward baseflow gaining stream segments along the main stem of Cherry Creek (4) including Denny Branch (31) and Little Cherry Creek (32), particularly for the stream reaches below the outfalls of Scammon and West Mineral.

5. IMPLEMENTATION

Desired Implementation Activities

1. Where needed, restore riparian vegetation along target stream segments.
2. Install grass buffer strips where needed along streams.
3. Renew state and federal permits and inspect permitted facilities for permit compliance
4. Install proper manure and livestock waste storage.
5. Insure proper on-site waste system operations in proximity to targeted streams.
6. Insure that labeled application rates of chemical fertilizers are being followed.

Implementation Programs Guidance

NPDES and State Permits - KDHE

a. Municipal permits for facilities in the watershed will be renewed after 2006 with DO and BOD monitoring and permit limits preventing excursions in these criteria, including lower effluent BOD levels (25 mg/l) during periods of zero flow in the warm weather months between May and October.

b. Develop a pilot study on the use of aerators in lagoon systems to lower BOD levels of wastewater discharged from the lagoon treatment facilities during warm weather months.

c. Livestock permitted facilities will be inspected for integrity of applied pollution prevention technologies.

d. Registered livestock facilities with less than 300 animal units will apply pollution prevention technologies.

e. Manure management plans will be implemented to prevent introduction of organic material to the stream.

Non-Point Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for pollution reduction from livestock operations in watershed.

b. Provide technical assistance on practices geared to small livestock operations which minimize impact to stream resources.

c. Guide federal programs such as the Environmental Quality Improvement Program, which are dedicated to priority subbasins through the Unified Watershed Assessment, to priority stream segments identified by this TMDL.

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

a. Provide alternative water supplies to small livestock operations

b. Develop improved grazing management plans

c. Reduce grazing density on overstocked pasturelands

d. Install livestock waste management systems for manure storage

e. Implement manure management plans

f. Install replacement on-site waste systems

g. Coordinate with USDA/NRCS Environmental Quality Improvement Program

in providing educational, technical and financial assistance to agricultural producers.

Riparian Protection Program - SCC

a. Develop riparian restoration projects along targeted stream segments, especially those areas with baseflow.
b. Design winter feeding areas away from streams.

Buffer Initiative Program - SCC

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

Extension Outreach and Technical Assistance - Kansas State University

a. Educate livestock producers on riparian and waste management techniques.
b. Provide technical assistance on livestock waste management design.
c. Continue Section 319 demonstration projects on livestock management.

Agricultural Outreach - KDA

a. Provide information on livestock management to commodity advocacy groups.
b. Support Kansas State outreach efforts.

Local Environmental Protection Program - KDHE

a. Inspect and repair on-site waste systems within 500 feet of priority stream segments.

Timeframe for Implementation: Pollution reduction practices should be installed along Cherry Creek and base flow gaining tributaries 2003-2007, with follow up implementation thereafter.

Targeted Participants: Primary participants for implementation will be the identified point sources and landowners immediately adjacent to the priority stream segments. Implemented activities should be targeted to those stream segments with greatest potential contribution to baseflow. Nominally, this would be most likely be:

1. Areas of denuded riparian vegetation along Cherry Creek, Denny Branch, Little Cherry Creek and their contributing tributaries.
2. Facilities with inadequate water quality controls
3. Unbuffered cropland adjacent to stream
4. Sites where drainage runs through or adjacent livestock areas
5. Sites where livestock have full access to stream and stream is primary water supply
6. Poor riparian sites
7. Failing on-site waste systems

Some inventory of local needs should be conducted in 2003 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 2007: The year 2007 marks the mid-point of the ten year implementation window for the watershed. At that point in time, milestones should be reached which will have at least two-thirds of the landowners responsible for riparian restoration or buffer strips, cited in the local assessment, participating in the implementation programs provided by the state. Additionally, sampled data from site 605 should indicate evidence of improved dissolved oxygen levels at the critical flow conditions below 7.1 cfs relative to the conditions seen over 1991, 1995 and 1999. Information on the ability of aerators to improve lagoon effluent quality should be available in 2007.

Delivery Agents: The primary delivery agents for program participation will be the 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 County staff managing. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for primarily Cherokee county. KDHE Bureau of Water is responsible for working with the cities of Scammon and West Mineral to limit the water quality impact of their effluent, including initiating a study using aerator technology to reduce BOD levels of wastewater discharged from lagoons during warm weather months.

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

4. 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.

5. 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.

6. 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.

7. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan.*
8. The *Kansas Water Plan* and the Neosho 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 TMDL is a High Priority consideration.

Effectiveness: Buffer strips are touted as a means to filter sediment before it reaches a stream and riparian restoration projects have been acclaimed as a significant means of stream bank stabilization. The key to effectiveness is participation within a finite subwatershed to direct resources to the activities influencing water quality. The milestones established under this TMDL are intended to gauge the level of participation in those programs implementing this TMDL.

Lagoons are largely effective in discharging wastewater with low BOD concentrations, except during winter periods. Occasional periods of zero flow can necessitate lower BOD levels in lagoon discharges in order to maintain adequate DO levels in the receiving stream. Aerator technology will be tested to evaluate its effectiveness in lowering BOD levels in wastewater discharged from lagoons under such conditions.

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 1991, 1995 and 1999, the state may employ more stringent conditions on agricultural producers and urban runoff in the watershed in order to meet the desired endpoints expressed in this TMDL. The state has the authority to impose conditions on activities with a significant potential to pollute the waters of the state under K.S.A. 65-171. If overall water quality conditions in the watershed deteriorate, a Critical Water Quality Management Area may be proposed for the watershed, in response.

6. MONITORING

KDHE will continue to collect bimonthly samples in 2003, 2007 and 2011 at rotational Station 605 including dissolved oxygen samples, in order to assess progress and success in implementing this TMDL toward reaching its endpoint. Should impaired status remain, the desired endpoints

under this TMDL may be refined and more intensive sampling may need to be conducted under specified low flow conditions over the period 2007-2011. Use of the real time flow data available at the Lightning Creek near McCune stream gaging station can help direct these sampling efforts.

Monitoring of BOD levels in effluent will continue to be a condition of NPDES and state permits for facilities, particularly in association with studies on technology impacts on reduced BOD levels in lagoon wastewater. This monitoring will continually assess the functionality of the systems in reducing organic levels in the effluent released to the streams.

Local program management needs to identify its targeted participants of state assistance programs for implementing this TMDL. This information should be collected in 2003 in order to support appropriate implementation projects.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Neosho Basin were held January 9, 2002 in Burlington and March 4, 2002 in Council Grove. An active Internet Web site was established at http://www.kdhe.state.ks.us/tmdl/ to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Neosho Basin.

Public Hearing: Public Hearings on the TMDLs of the Neosho Basin were held in Burlington and Parsons on June 3, 2002.

Basin Advisory Committee: The Neosho Basin Advisory Committee met to discuss the TMDLs in the basin on October 2, 2001, January 9 and March 4, 2002.

Milestone Evaluation: In 2007, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of Cherry 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 creek will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2007-2011. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable water quality criteria during the ten year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2003 which will emphasize implementation of TMDLs. 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 2003-2007.

Appendix (Cherry Creek DO TMDL)

Table 2

Cherry Cr Watershed (605)			Lightning Creek Wtrshd (565)		
Land Use	Acres	% of Total	Land Use	Acres	% of Total
Cropland	49517	68.1	Cropland	83779	56.1
Grassland	14528	20.0	Grassland	49647	33.2
Urban Use	722	1.0	Urban Use	1626	1.1
Water	1431	2.0	Water	3174	2.1
Woodland	6498	8.9	Woodland	11168	7.5
Total	72696	100	Total	149393	100

Table 3

COL_DATE	DISOXY		AMMONIA		BOD		FECCOLI		NITRATE		PHFIELD		TEMP_CENT		PHOSPHU		TSS		TURBIDITY		FLOW
	605	565	605	565	605	565	605	565	605	565	605	565	605	565	605	565	605	565	605	565	605
3/12/91	8.7	9.5	0.020	0.000	2.70	2.40	280	20	0.00	0.02	7.5	8.2	10	12	0.050	0.060	22	16	11.8	7.4	4
5/14/91	**2.8**	8.4	0.530	0.000	4.70	3.20	200	160	0.89	0.05	7.3	8.2	22	29	0.080	0.080	36	33	19.4	19.8	3.1
1/18/95	11.1	14.2	0.010	0.010	2.60	2.50	60	----	0.24	0.01	7.5	----	2	----	0.010	0.020	10	7	2.7	2.0	19
3/21/95	6.7	9.1	0.010	0.010	2.00	2.60	70	10	0.11	0.01	7.4	8.2	12	15	0.050	0.060	42	18	13.0	5.0	15
5/16/95	6.9	8.7	0.100	0.050	1.90	2.30	380	200	0.36	0.44	7.2	7.8	18	20	0.030	0.080	32	20	4.0	4.0	43
7/18/95	**4.7**	6.0	0.090	0.010	1.70	2.20	200	100	0.17	0.04	7.3	7.8	23	26	0.080	0.180	78	56	10.0	7.0	6
9/19/95	**4.9**	9.6	0.283	0.298	2.80	2.00	100	200	0.12	0.04	7.1	8.3	19	19	0.036	0.143	37	13	4.0	5.0	0.41
11/14/95	5.9	11.0	0.047	0.032	3.30	5.30	10	10	0.06	0.06	7.2	8.1	3	7	0.039	0.291	7	856	4.0	27.0	0
3/2/99	9.9	11.5	0.050	0.030	1.98	3.15	130	10	0.19	0.05	7.6	7.9	12	11	0.060	0.070	28	20	12.0	7.9	26
6/29/99	5.0	5.2	0.020	0.020	3.00	4.23	2200	9000	0.37	0.95	6.8	7.1	25	24	0.260	0.550	204	428	148.0	100.0	3340
8/31/99	6.4	10.8	0.040	0.020	1.00	1.00	20	10	0.10	0.10	7.3	8.3	27	29	0.030	0.070	7	29	4.2	11.0	0.5
11/2/99	**2.2**	11.1	0.020	0.020	6.48	3.18	190	10	0.01	0.03	7.0	8.2	13	15	0.130	0.100	35	11	11.0	7.9	0.54
Avg	5.9	9.7	0.033	0.023	3.12	2.89	635	2258	0.17	0.28	7.2	7.9	19	20	0.120	0.198	69	122	43.80	31.70	841.8

Table 4

COL_DATE	DISOXY		AMMONIA		BOD		FECCOLI		NITRATE		PHFIELD		TEMP_CENT		PHOSPHU		TSS		TURBIDITY		FLOW
	605	565	605	565	605	565	605	565	605	565	605	565	605	565	605	565	605	565	605	565	605
5/14/91	**2.8**	8.4	0.530	0.000	4.70	3.20	200	160	0.89	0.05	7.3	8.2	22	29	0.080	0.080	36	33	19.4	19.8	3.1
7/18/95	**4.7**	6.0	0.090	0.010	1.70	2.20	200	100	0.17	0.04	7.3	7.8	23	26	0.080	0.180	78	56	10.0	7.0	6
9/19/95	**4.9**	9.6	0.283	0.298	2.80	2.00	100	200	0.12	0.04	7.1	8.3	19	19	0.036	0.143	37	13	4.0	5.0	0.41
11/2/99	**2.2**	11.1	0.020	0.020	6.48	3.18	190	10	0.01	0.03	7.0	8.2	13	15	0.130	0.100	35	11	11.0	7.9	0.54
Avg	3.7	8.8	0.231	0.082	3.92	2.65	173	118	0.30	0.04	7.2	8.1	19	22	0.082	0.126	47	28	11.10	9.93	2.5

Streeter-Phelps DO Sag Model - Stream - CherryCrDO_Scammon_Wmineral
Single Reach - Single Load

1 cfs = .0283 m^3/s
0.25 mph =0 .11176 m/s

		Elev (ft)	Dist to 605	Min DO	Crit Dist DO
0.0036847	Design Flow (Scammon)	890	43.90	5.32	10.36
0.0013598	Design Flow (West Mineral)	870	40.70	5.17	10.84

Elevation Correction (DO)

Elevation	**832**	ft
Correctn Factor (DO_{sat})	0.973376	mg/L

Distance (km)
Flow (m3/s)
Concentration (mg/L)
Temp (C)
Vel (m/s)

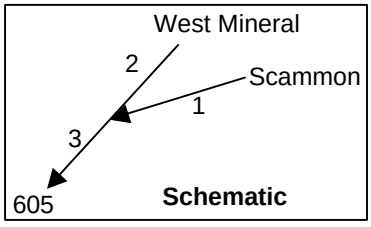
Unless modified by upstream pt. source, upstream BOD set as target for basin

Upstream DO (where appropriate) elevation corrected and set at 90% sat.

Velocity	0.11176		
BOD coef	0.23	Theta	1.056
O2 coef	*see below*	Theta	1.024

		Flow	BOD	DO	T	Dist	Slope (ft.mi)	Calc K_r	
1	**Scammon**	0.0036847	23	6.69	22.5	17.9	5.21	1.39	
	Upstream	0	0	0	0	-----			
	Result at Dist	0.0036847	14.11	5.56	22.5				
2	**West Mineral**	0.0013598	23	6.65	22.5	12.4	4.93	1.32	
	Upsteam	0	0	0	0	-----			
	Result at Dist	0.0013598	16.37	5.19	22.5				
3	**Scammon Result**	0.0036847	14.11	5.56	22.5	25	3.03	0.86	Elev= 832
	Upstream (W. Mineral Result)	0.0013598	16.37	5.19	22.5	-----			
	Result at Dist (605)	0.0050445	7.44	5.69	22.5				Elev= 785

Kr Values (Foree 1977) using 0.42 (0.63 + 0.4S^1.15)
for q < 0.05 where q = cfs/mi^2 and S (ft/mile)



Streeter-Phelps DO Sag Model - Stream - CherryCrDO_Scammon_Wmineral
Single Reach - Single Load

1 cfs = .0283 m^3/s
0.25 mph =0 .11176 m/s

		Elev (ft)	Dist to 605	Min DO	Crit Dist DO
0.0036847	Design Flow (Scammon)	890	43.90	5.54	10.76
0.0013598	Design Flow (West Mineral)	870	40.70	5.39	11.3

Elevation Correction (DO)

Elevation	**832**	ft
Correctn Factor (DO_{sat})	0.973376	mg/L

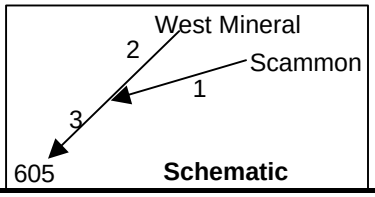
Distance (km)
Flow (m3/s)
Concentration (mg/L)
Temp (C)
Vel (m/s)

Unless modified by upstream pt. source, upstream BOD set as target for basin
Upstream DO (where appropriate) elevation corrected and set at 90% sat.

Velocity	0.11176		
BOD coef	0.23	Theta	1.056
O2 coef	*see below*	Theta	1.024

		Flow	BOD	DO	T	Dist	Slope (ft.mi)	Calc K_r	
1	**Scammon**	0.0036847	30	6.69	17.8	17.9	5.21	1.39	
	Upstream	0	0	0	0	-----			
	Result at Dist	0.0036847	20.55	5.73	17.8				
2	**West Mineral**	0.0013598	30	6.65	17.8	12.4	4.93	1.32	
	Upsteam	0	0	0	0	-----			
	Result at Dist	0.0013598	23.09	5.4	17.8				
3	**Scammon Result**	0.0036847	20.55	5.73	17.8	25	3.03	0.86	Elev= 832
	Upstream (W. Mineral Result)	0.0013598	23.09	5.4	17.8	-----			
	Result at Dist (605)	0.0050445	12.52	5.5	17.8				Elev= 785

Kr Values (Foree 1977) using 0.42 (0.63 + 0.4S^1.15)
for q < 0.05 where q = cfs/mi^2 and S (ft/mile)



Schematic