NEOSHO BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Turkey Creek
Water Quality Impairment: Dissolved Oxygen

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Upper Neosho River **County:** Coffee and Woodson

HUC 8: 11070204

HUC 11 (HUC 14s)**:** **020** (010 and 020)

Drainage Area: 75.4 square miles

Main Stem Segment: WQLS: 18 (Turkey Creek) starting at confluence with the Neosho River and traveling upstream to headwaters in southwest Woodson County (**Figure 1**).

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

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 614 near Le Roy

Period of Record Used: 1992, 1996 and 2000 for Station 614; Some 2000 and all 2001 Kansas Biological Survey Data (**Figure 2**)

Flow Record: Pottawatomie Creek near Garnett (USGS Station 06914000) matched to Turkey Creek watershed area via estimated runoff from Big Creek watershed (USGS 07182710).

Long Term Flow Conditions: 10% Exceedence Flows = 90 cfs**,** 95% = 0.05 cfs

Turkey Creek Watershed
Dissolved Oxygen TMDL
HUC and Stream Segment Map

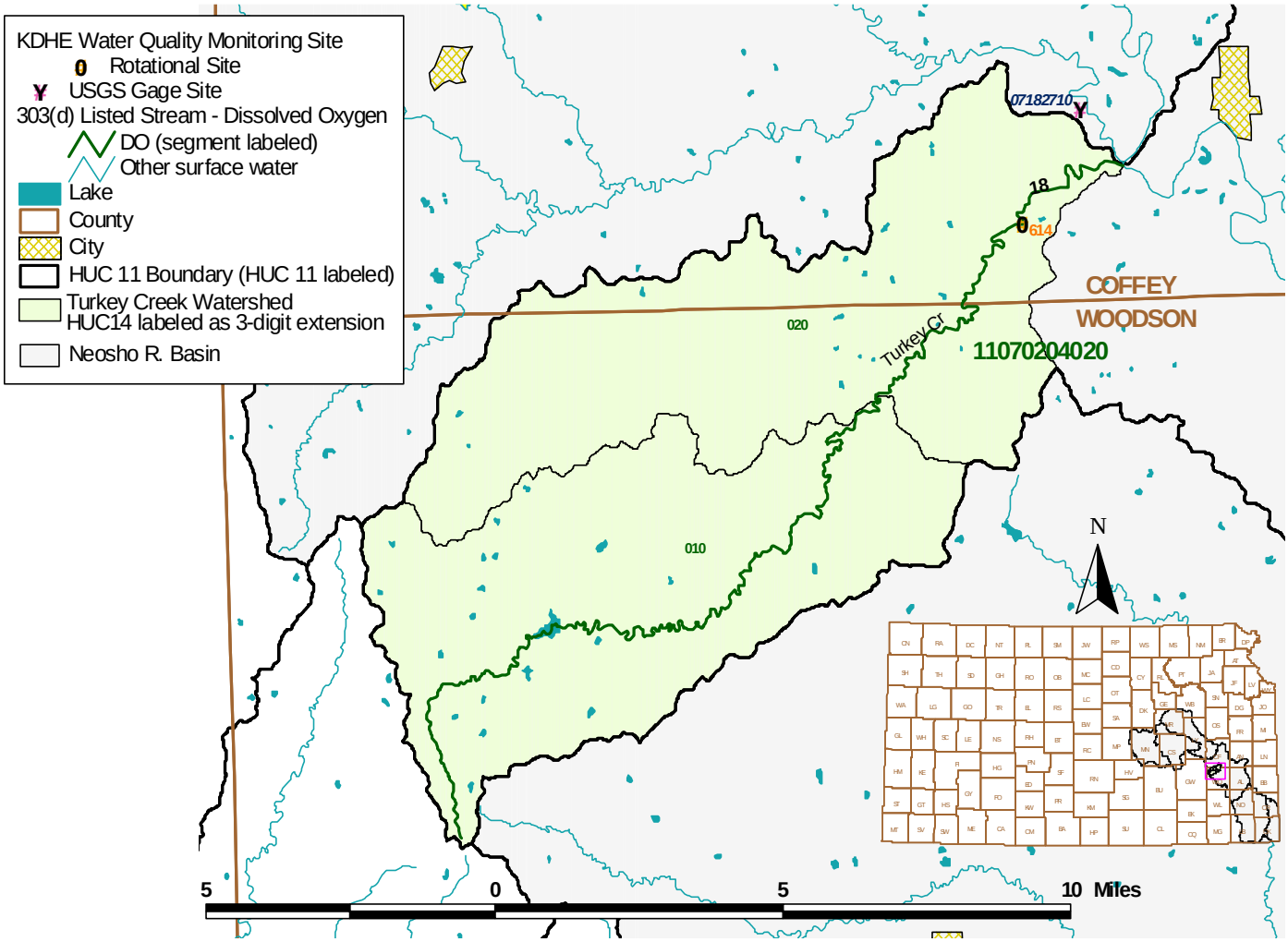


Figure 1

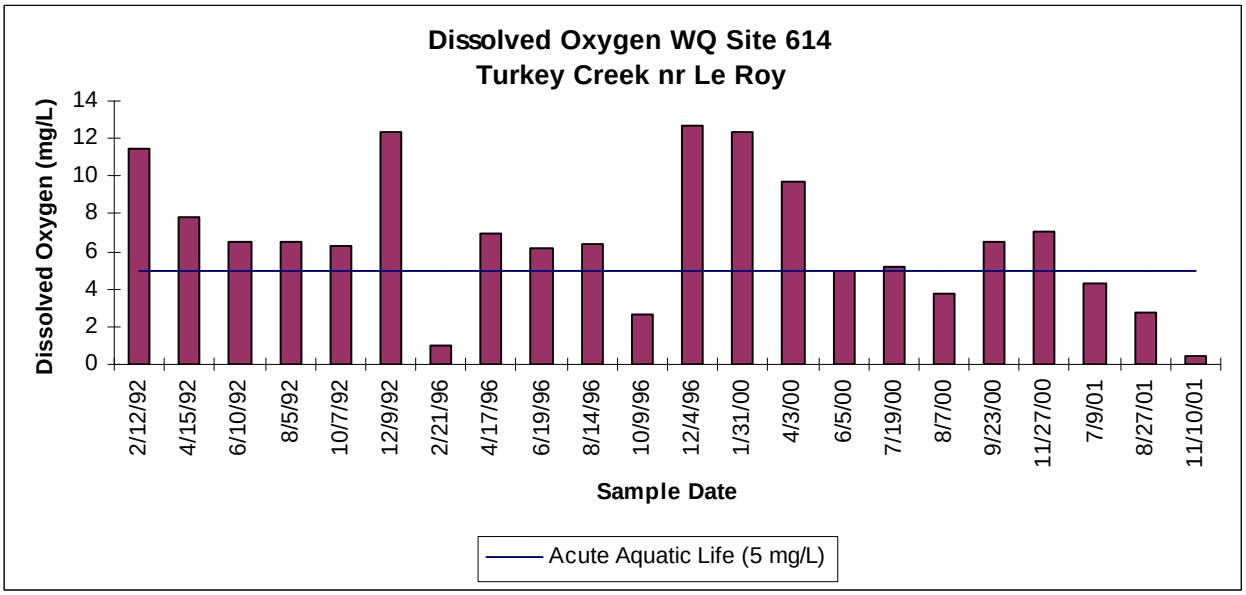


Figure 2

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 Turkey Creek near Le Roy 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**).

Excursions were seen in each of the three define seasons and are outlined in **Table 1**. Forty three percent of the Summer-Fall samples and 13% of Spring samples were below the aquatic life criterion. Twenty nine percent of the Winter samples were under the aquatic life criterion. Overall, 26% of the samples were under the criterion. This would represent a baseline condition of non-support of the impaired designated use.

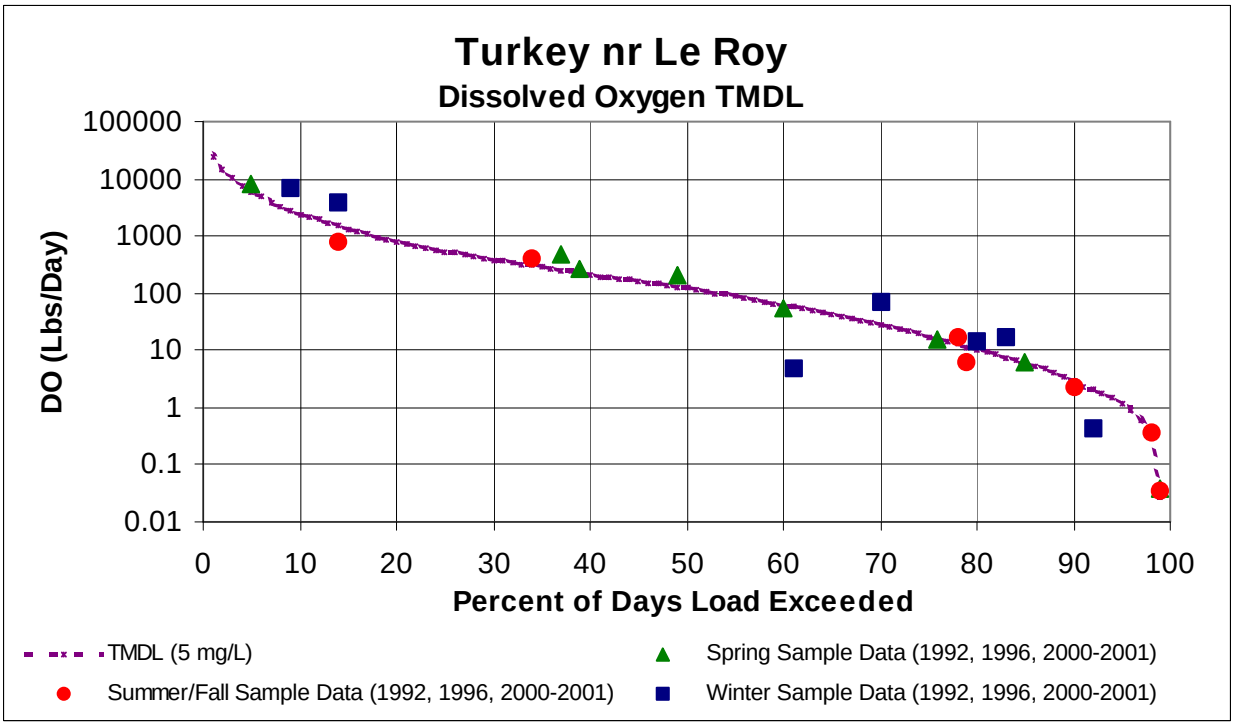


Figure 3

With the exception of one sample, no DO violations have been encountered at flows exceeding 2.3 cfs on Turkey Creek near Le Roy, therefore a critical low flow can be identified on Turkey Creek as those flows of 2.3 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.
Tureky Creek near Le Roy (614)	Spring	0	0	0	1	0	0	1/8 = 13%
	Summer	0	1	0	0	1	1	3/7 = 43%
	Winter	0	0	0	1	0	1	2/7 = 29%

A watershed comparison approach was taken in developing this TMDL. The Big Creek watershed (Water Quality Sampling Site 615 in the watershed was not impaired by low DO) has roughly similar land use (**see Table 2 in Appendix**), is of similar area and is located immediately to the north of the Turkey 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 comparisons. **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 a subset of Table 3 and summarizes those sample dates when DO was below the aquatic life criterion for sample site 614. At site 614 the average water temperature, turbidity, pH, ammonia, and TSS were all less than the averages for the comparison watershed, while nitrate and FCB were similar. BOD and phosphorus averages were higher than those of the comparison watershed.

Table 5 in the Appendix is also a subset of Table 3 that summarized those samples dates when flow was less than 2.3 cfs (the critical flow range) yet no DO excursions were seen at site 614. The average BOD in Table 5 was 3.9 mg/L , which is substantially less than the average BOD at site 614 in Table 4. The reference site's average BOD is also near 3.9 mg/L in Table 5 which reinforces this BOD target for the impaired watershed. 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 Turkey Creek watershed upstream of site 614 and, under certain conditions, is likely a factor influencing the DO violations.

Desired Endpoints of Water Quality at Site 614 over 2007 - 2011

The desired endpoint will be reduced biochemical oxygen demand from artificial sources such that average BOD concentrations remain below 3.9 mg/l in the stream under the critical flow conditions which results in no excursions below 5 mg/l of DO detected between 2007 - 2011 attributed to these sources.

This desired endpoint should improve DO concentrations in the creek at the critical lower flows (0 - 2.3 cfs). Seasonal variation is accounted for by this TMDL, since the TMDL endpoint is sensitive to the low flow usually occurring in the May-November 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 no NPDES permitted wastewater dischargers within the watershed

Livestock Waste Management Systems: A single operation is registered, certified or permitted within the watershed. The facility type is beef and is located at the upper end 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

would be indicative of flow durations well under 5 percent of the time. NPDES permits, also non-discharging, are issued for facilities with more than 1,000 animal units. The facilities in the watershed is not of this size Potential animal units for this facility is 75. The actual number of animal units on site is variable, but typically less than potential numbers.

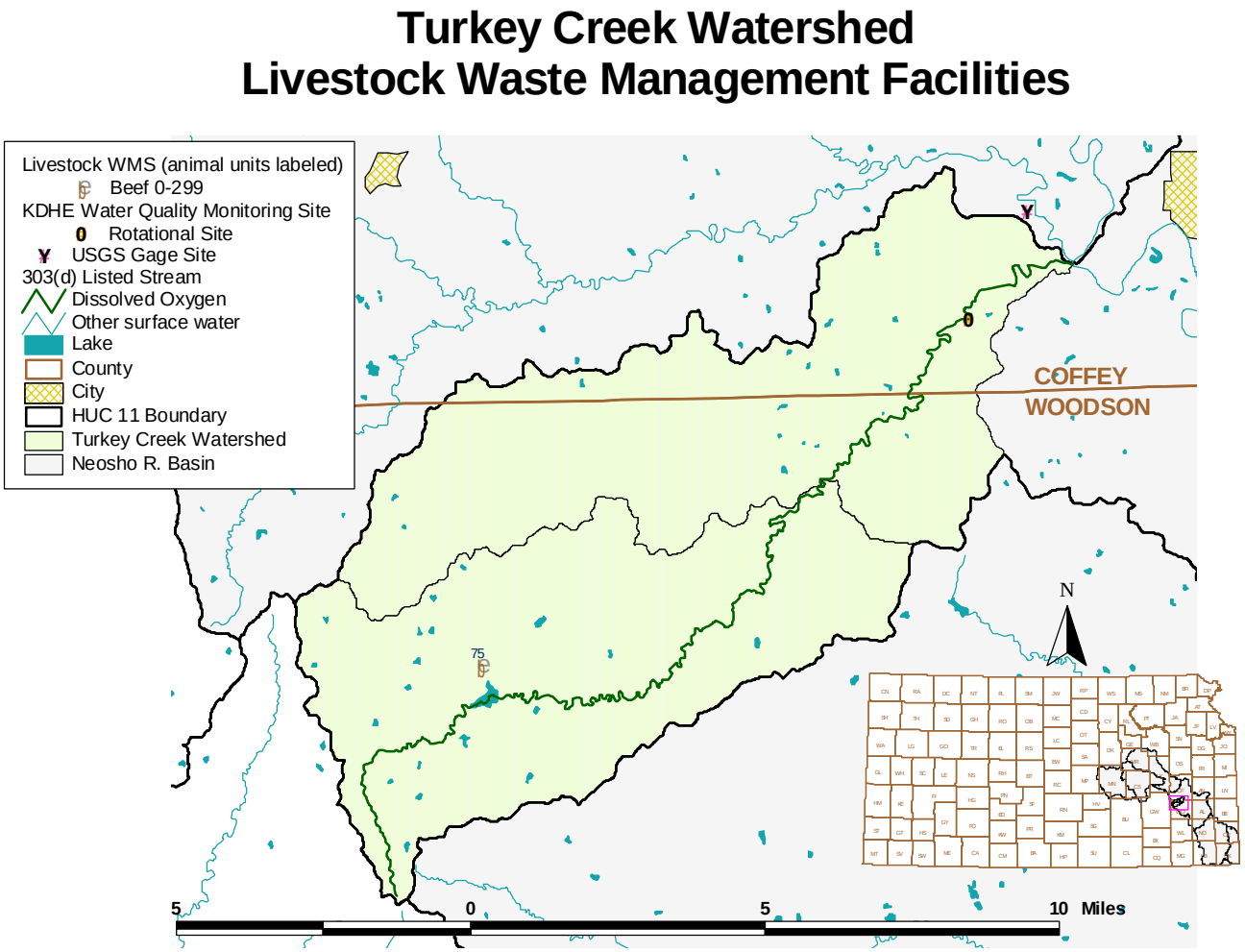
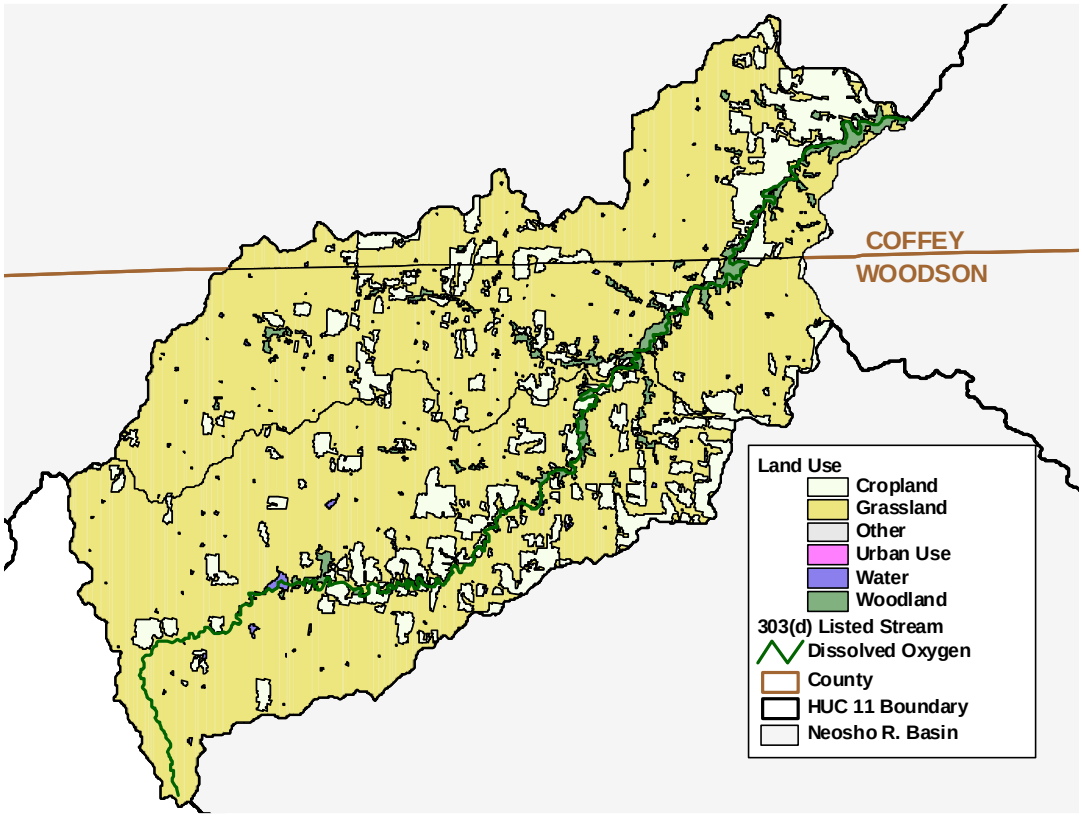


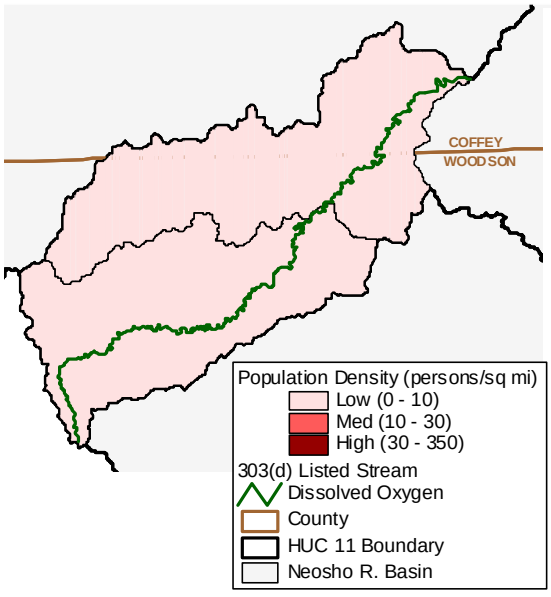
Figure 4

Land Use: Most of the watershed is cropland (16% of the area), grassland (81%), or woodland (3%). Most of the cropland is scatter across the middle of the watershed or located near the main stem at the end of the watershed. The grazing density estimate for the watershed is average when compared to densities across in the Neosho Basin (35-36 animal units/mi^2) (**Figure 5 and Table 2 in Appendix**).

On-Site Waste Systems: The watershed's population density is low when compared to densities elsewhere in the Neosho Basin (2-3 person/mi^2) (**Figure 5**). The rural population projections for Coffey and Woodson Counties through 2020 show modest growth (11-20% increase, respectively). 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.

Turkey Creek Watershed
Land Use, Population and Grazing Density





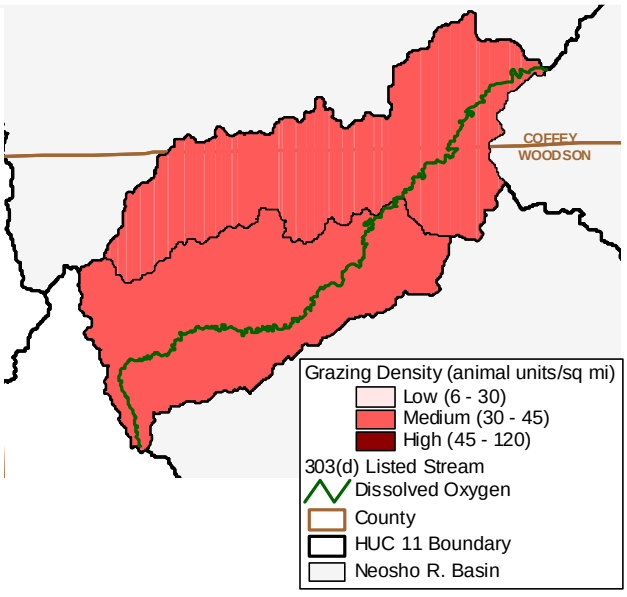


Figure 5

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.

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 Turkey Creek system. These reductions have been based on the relationship between DO and BOD for the samples taken at Water Quality Monitoring site 614 for flows less than 2.3 cfs when DO was less than 5 mg/L versus when DO was greater than or equal to 5 mg/L. Allocations relate to the average BOD levels seen in the Turkey Creek system at site 614 for the critical lower flow conditions (0 - 2.3 cfs). Based on this relationship, BOD loads at site 614 needs to be reduced so that in stream average BOD is 3.9 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 Turkey Creek across all hydrologic conditions. This is represented graphically by the integrated area under the BOD load duration curve established by this TMDL. Any future development of wasteloads should be offset by reductions in the loads contributed by nonpoint sources. This offset along with appropriate BMPs 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: A current Wasteload Allocation of zero is established by this TMDL because of the lack of point sources in the watershed. Should future point sources be proposed in the watershed and discharge into the impaired segments, the current Wasteload Allocation will be revised by adjusting current load allocations to account for the presence and impact of these new point source dischargers(**Figure 6**).

Non-Point Sources: Based on the prior assessment of sources, the distribution of excursions from water quality standards at site 614 and the relationship of those excursions to runoff conditions and seasons, non-point sources are seen as a contributing factor to the occasional DO excursions in the watershed.

The samples from the Turkey Creek watershed show that DO violations primarily occurred at flows less than 2.3 cfs. The Load Allocation assigns responsibility for reducing the in stream BOD levels at site 614 to 3.9 mg/L across the 0.0 - 2.3 cfs range of the critical flow condition (60 - 99% exceedance) and maintaining the in stream BOD levels at site 614 to the historical levels of 6.0 mg/L for flows in excess of 2.3 cfs (which is 90th percentile of BOD samples for flows in Turkey Creek above 2.3 cfs near Le Roy)(**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.

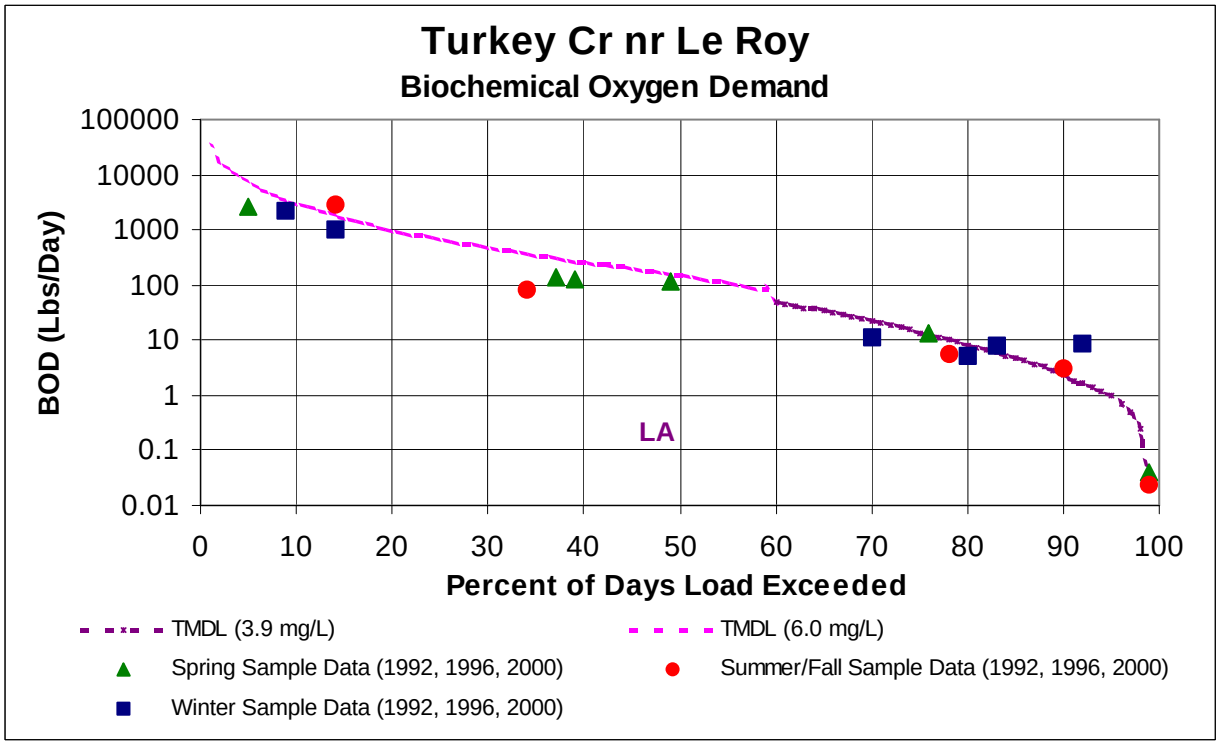


Figure 6

Defined Margin of Safety: The Margin of Safety will be implied based on conservative assumptions used to set the target BOD concentration, 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 Upper Neosho Basin (HUC 8: 11070204) with a priority ranking of 20 (High Priority for restoration work).

Priority HUC 11s and Stream Segments: Priority should be directed toward baseflow gaining

stream segments along the main stem of Turkey Creek.

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. Any new municipal permits for facilities in the watershed with will require DO and BOD monitoring and permit limits preventing excursions in these criteria.
b. Livestock permitted facilities will be inspected for integrity of applied pollution prevention technologies.
c. Registered livestock facilities with less than 300 animal units will apply pollution prevention technologies.
d. Manure management plans will be implemented to prevent the 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. Provide technical assistance in urban and agricultural setting on practices geared to minimize chemical fertilizer impact to stream resources.
d. Guide federal programs such as the Environmental Quality Improvement Program, which are dedicated to priority subbasins through the Unified Watershed Assessment, to priority watersheds and stream segments within those subbasins 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 close to streams.
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 Turkey Creek and base flow gaining tributaries in 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 Turkey Creek and contributing tributaries.
2. Facilities with in adequate 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 614 should indicate evidence of improved dissolved oxygen levels at the critical flow conditions below 2.3 cfs relative to the conditions seen over 1992, 1996 and 2000.

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.

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.

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 1992, 1996 and 2000, 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 2004 at rotational Station 614 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 will need to be conducted under specified lower flow conditions over the period 2007-2011. Use of the real time flow data available at the Pottawatomie Creek near Scipio stream gaging station can help direct these sampling efforts.

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 Turkey 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 (Turkey Creek DO TMDL)

Table 2

Turkey Cr Wtrshd (614)			Big Cr Wtrshd (615)		
Land Use	Acres	% of Total	Land Use	Acres	% of Total
Cropland	7663	15.9	Cropland	20970	25.0
Grassland	38849	80.5	Grassland	60449	72.1
Urban Use	12	0.0	Urban Use	165	0.2
Water	228	0.5	Water	452	0.5
Woodland	1525	3.2	Woodland	1749	2.1
Total	48277	100	Total	83785	100

Table 3

COL_DATE	DISOXY		AMMONIA		BOD		FECCOLI		NITRATE		TEMP_CENT		PHFIELD		PHOSPHU		TSS		TURBIDITY		FLOW
614	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614
2/12/92	11.5	11.7	0.000	0.000	5.00	5.00	400	2000	0.15	0.08	3	2	7.7	7.9	0.180	0.180	454	227	720.0	544.0	0.28
4/15/92	7.8	9.7	0.050	0.050	4.40	5.10	140	100	0.02	0.02	18	18	8.0	8.4	0.050	0.080	31	39	16.7	17.3	4.80
6/10/92	6.5	5.8	0.050	0.050	2.20	6.60	1000	28000	0.46	1.23	19	18	6.7	6.7	0.090	0.730	47	963	30.0	72.9	225.00
8/5/92	6.5	6.0	0.050	0.050	1.40	2.30	300	300	0.14	0.42	21	21	7.5	7.7	0.070	0.170	26	40	26.0	36.0	11.25
10/7/92	6.3	6.4	0.050	0.050	2.10	2.10	30	60	0.02	0.02	15	15	7.7	7.8	0.050	0.070	13	43	7.3	19.0	0.48
12/9/92	12.4	12.2	0.050	0.050	3.40	1.50	6000	70	0.20	0.90	0	0	----	----	0.180	0.090	256	31	104.0	24.0	55.20
2/21/96	**1.0**	7.9	0.100	0.200	20.70	6.60	2	5	0.01	0.01	0	6	7.1	7.6	1.370	0.330	84	50	25.0	15.4	0.08
4/17/96	6.9	8.6	0.470	0.280	7.10	5.30	1	2	0.04	0.04	14	12	7.8	8.1	0.830	0.290	28	120	5.0	33.0	0.00
6/19/96	6.2	5.4	0.110	0.100	2.80	3.40	2300	1200	0.29	0.32	22	22	7.4	7.6	0.190	0.270	180	176	145.0	110.0	8.10
8/14/96	6.4	8.7	0.040	0.050	4.40	4.10	130	30	0.08	0.01	22	24	7.8	8.2	0.114	0.153	16	48	8.0	15.0	0.00
10/9/96	**2.6**	6.7	0.210	0.290	9.80	7.70	80	30	0.01	0.06	12	14	7.1	7.5	0.290	0.210	13	428	18.0	74.0	55.20
12/4/96	12.7	12.6	0.020	0.020	3.80	3.80	1500	2300	0.36	0.58	3	3	7.6	7.8	0.120	0.180	30	55	58.0	56.0	103.50
1/31/00	12.3	14.5	0.022	0.020	1.98	3.00	20	10	0.01	0.01	1	1	7.4	7.7	0.037	0.051	10	9	3.2	3.5	1.05
4/3/00	9.7	9.7	0.020	0.020	2.67	3.81	160	60	0.07	0.13	12	12	8.1	8.1	0.070	0.120	32	45	18.0	22.0	9.30
6/5/00	5.0	5.5	0.020	0.020	4.17	5.79	70	130	0.10	0.08	20	23	7.9	8.1	0.100	0.140	31	39	6.6	7.5	0.59
8/7/00	**3.8**	6.4	0.040	0.020	4.83	4.38	40	90	0.10	0.07	25	27	7.2	7.4	0.080	0.150	18	53	10.9	32.0	0.11
11/27/00	7.1	6.8	0.027	0.048	2.52	1.65	110	20	0.01	0.31	4	3	7.2	7.3	0.140	0.140	7	12	15.0	17.0	0.38
Avg	7.3	8.5	0.078	0.078	4.90	4.24	722.53	2023.9	0.12	0.25	12.4	13.0	7.51	7.74	0.233	0.197	75.1	140	71.6	64.6	28.0

Table 4

COL_DATE	DISOXY		AMMONIA		BOD		FECCOLI		NITRATE		TEMP_CENT		PHFIELD		PHOSPHU		TSS		TURBIDITY		FLOW
614	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614
2/21/96	**1.0**	7.9	0.100	0.200	20.70	6.60	2	5	0.01	0.01	0	6	7.1	7.6	1.370	0.330	84	50	25.0	15.4	0.08
10/9/96	**2.6**	6.7	0.210	0.290	9.80	7.70	80	30	0.01	0.06	12	14	7.1	7.5	0.290	0.210	13	428	18.0	74.0	55.20
8/7/00	**3.8**	6.4	0.040	0.020	4.83	4.38	40	90	0.10	0.07	25	27	7.2	7.4	0.080	0.150	18	53	10.9	32.0	0.11
Avg	2.5	7.0	0.117	0.170	11.78	6.23	40.67	41.67	0.04	0.05	12.3	15.7	7.13	7.50	0.580	0.230	38.3	177	18.0	40.5	18.5

Table 5

COL_DATE	DISOXY		AMMONIA		BOD		FECCOLI		NITRATE		TEMP_CENT		PHFIELD		PHOSPHU		TSS		TURBIDITY		FLOW
614	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614	615	614
2/12/92	11.5	11.7	0.000	0.000	5.00	5.00	400	2000	0.15	0.08	3	2	7.7	7.9	0.180	0.180	454	227	720.0	544.0	0.28
10/7/92	6.3	6.4	0.050	0.050	2.10	2.10	30	60	0.02	0.02	15	15	7.7	7.8	0.050	0.070	13	43	7.3	19.0	0.48
4/17/96	6.9	8.6	0.470	0.280	7.10	5.30	1	2	0.04	0.04	14	12	7.8	8.1	0.830	0.290	28	120	5.0	33.0	0.00
8/14/96	6.4	8.7	0.040	0.050	4.40	4.10	130	30	0.08	0.01	22	24	7.8	8.2	0.114	0.153	16	48	8.0	15.0	0.00
1/31/00	12.3	14.5	0.022	0.020	1.98	3.00	20	10	0.01	0.01	1	1	7.4	7.7	0.037	0.051	10	9	3.2	3.5	1.05
6/5/00	5.0	5.5	0.020	0.020	4.17	5.79	70	130	0.10	0.08	20	23	7.9	8.1	0.100	0.140	31	39	6.6	7.5	0.59
11/27/00	7.1	6.8	0.027	0.048	2.52	1.65	110	20	0.01	0.31	4	3	7.2	7.3	0.140	0.140	7	12	15.0	17.0	0.38
Avg	7.9	8.9	0.090	0.067	3.90	3.85	108.71	321.71	0.06	0.08	11.3	11.4	7.64	7.87	0.207	0.146	79.9	71.1	109.3	91.3	0.4