MARAIS DES CYGNES RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody/Assessment Unit (AU): Ottawa Creek Watershed
Water Quality Impairment: Lead

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Upper Marais des Cygnes **Counties:** Douglas and Franklin

HUC 8: 10290101 **HUC 10 (12):** 07 (01, 02, 03)

Ecoregion: Central Irregular Plains, Osage Cuestas (40b)

Drainage Area: 133 square miles

Water Quality Limited Segments:

Main Stem	***Tributaries***	
Ottawa Cr (9011)	Walnut Cr (90)	
	Tauy Cr (11)	W. Fk. Tauy Cr (9911)
		E. Fk. Tauy Cr. (85)

Designated Uses:

Table 1. Designated uses for water quality limited segments in the Ottawa Creek watershed.

Stream	Segment #	Expected Aquatic Life	Contact Rec.	Drinking Supply	Food Procurement	Ground Water Recharge	Industrial Water Use	Irrigation Use	Livestock Watering Use
Ottawa Cr	9011	E	C	X	X	X	X	X	X
Walnut Cr	90	E	b	X	X	X	X	X	X
Tauy Cr	11	E	C	X	X	X	X	X	X
W. Fk. Tauy Cr	9911	S	b	X	X	X	X	X	X
E. Fk. Tauy Cr	85	E	b	X	X	X	X	X	X

303(d) Listings: 2002, 2004, 2010 & 2012 Marais Des Cygnes River Basin Streams.

Impaired Use: Expected Aquatic Life is impaired due to elevated lead (chronic) concentrations.

Water Quality Criteria: Hardness dependent criteria from Table 1b of the Kansas Surface Water Quality Standards (K.A.R. 28-16-28e(c)(2)(D)(ii)) where Water Effects Ratio (WER) = 1.0 and hardness is in mg/L.

Chronic AL Total Lead (μg/L) = WER[EXP[1.273(LN(hardness))-4.705]]*

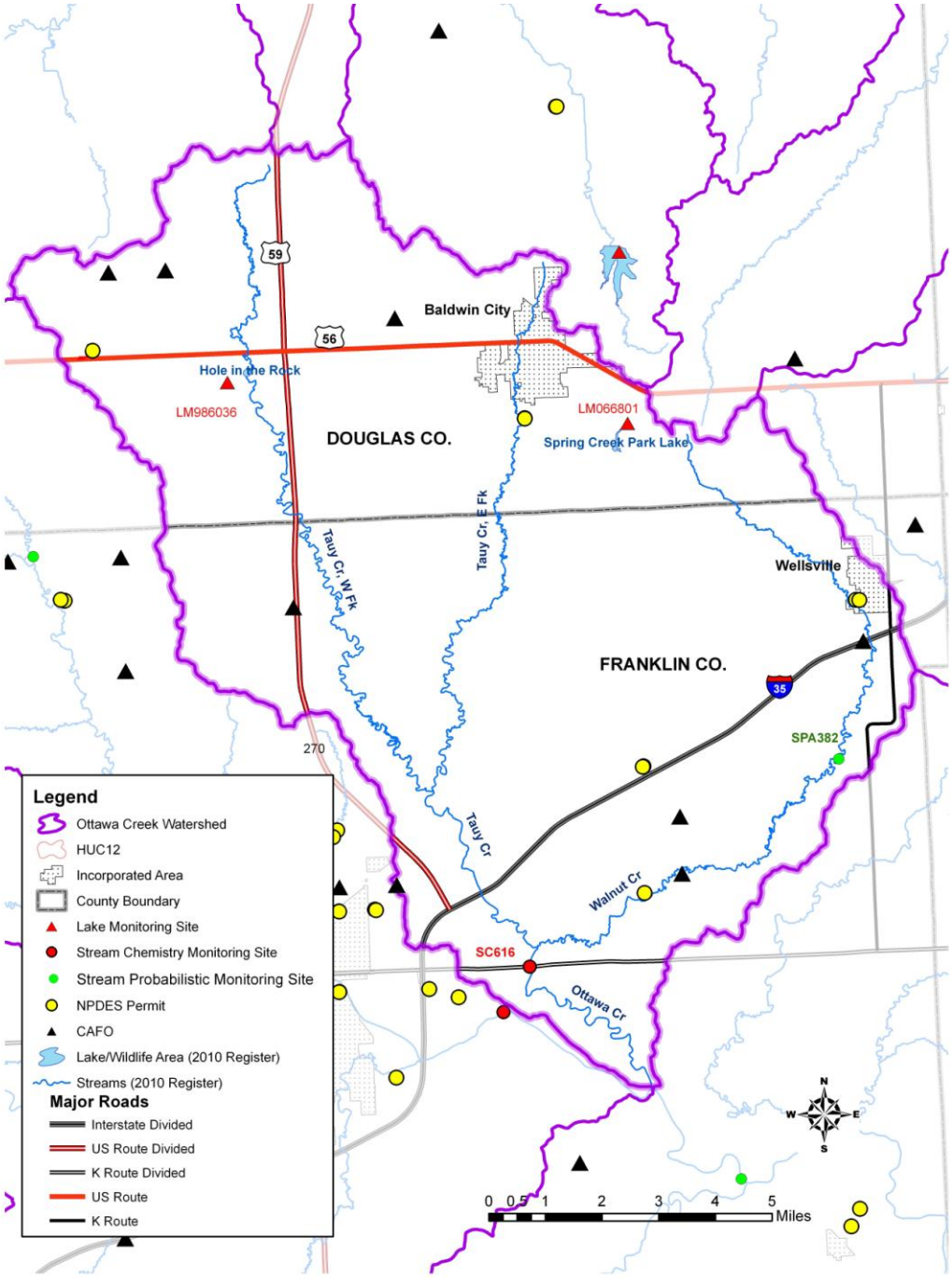
2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 2012 303(d): Not supporting Aquatic Life.

Stream Monitoring Site: Active KDHE Rotational Stream Chemistry sampling station SC616, Ottawa Creek near Ottawa, located on highway K-68 3 ¾ miles east of Ottawa and SPA382 located on Walnut Creek (Figure 1).

Period of Record Used: SC616: Seven surveys conducted by KDHE in calendar years: 1993, 1999, 2000, 2001, 2005, 2007 and 2011. SPA382: Three surveys conducted in February, April, August and October of 2009.

Figure 1. Ottawa Creek watershed.



Flow Record: USGS Gage 06911900 on Dragoon Creek near Burlingame (1/1/1990 – 1/31/2012) was used to establish flow conditions in the watershed. The ratio (1.17) of the watershed size at SC616 (133 mi^2) to the watershed size at USGS gage 06911900 (114 mi^2) was used to adjust the flow seen at SC616 (Table 2).

Table 2. Actual long term flow conditions at USGS gage 06911900 (1/1/1990 – 1/31/2012). Flow at KDHE stream chemistry station SC616 was calculated using the ratio of the drainage area at SC616 to drainage area at USGS 06911900. Flow duration values are in cubic feet per second (cfs) for the percentage of time flow equaled or exceeded.

Stream Name	Drainage Area (mi^2)	Mean Flow (cfs)	90%	75%	50%	25%	10%
USGS 06911900 Dragoon Cr near Burlingame	114	68.4	0.04	1.70	8.50	32.0	96.0
SC616 Ottawa Cr near Ottawa	133	79.7	0.05	1.98	9.92	37.3	112

Figure 2. Flow duration curve for Ottawa Creek at KDHE sampling station SC616.

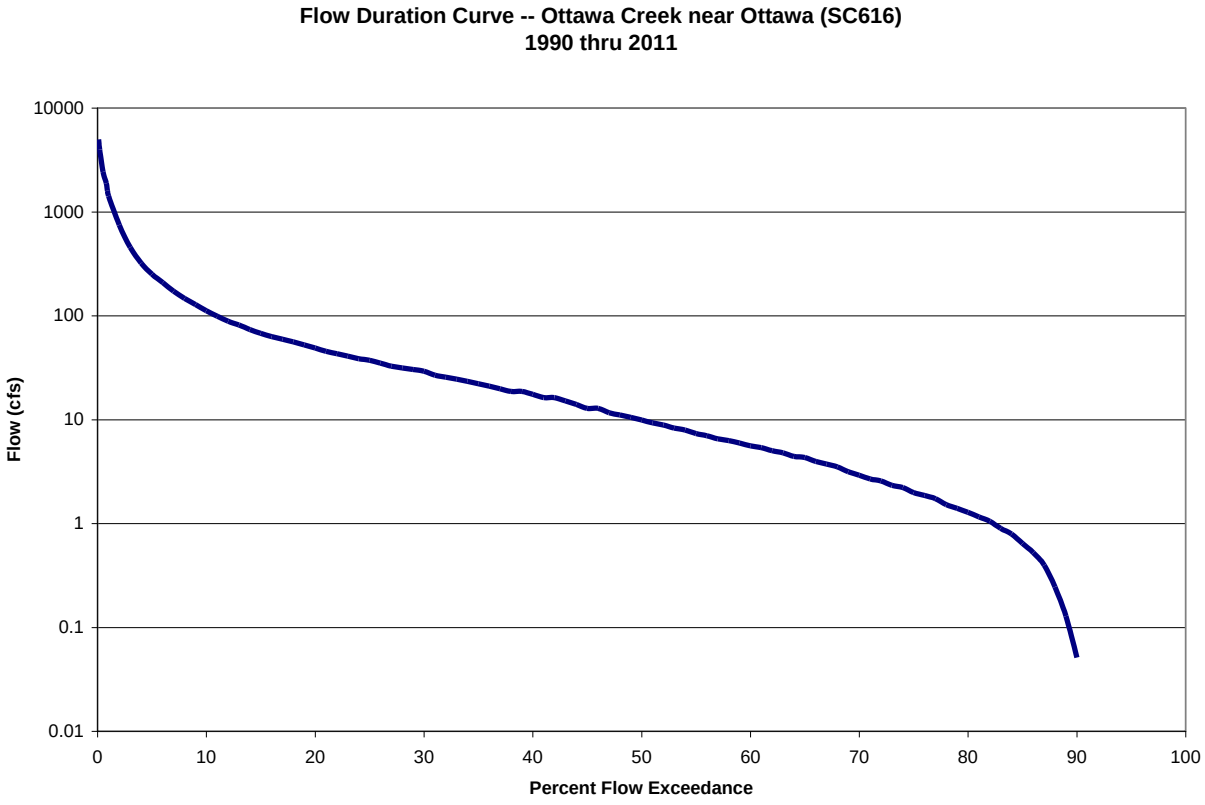
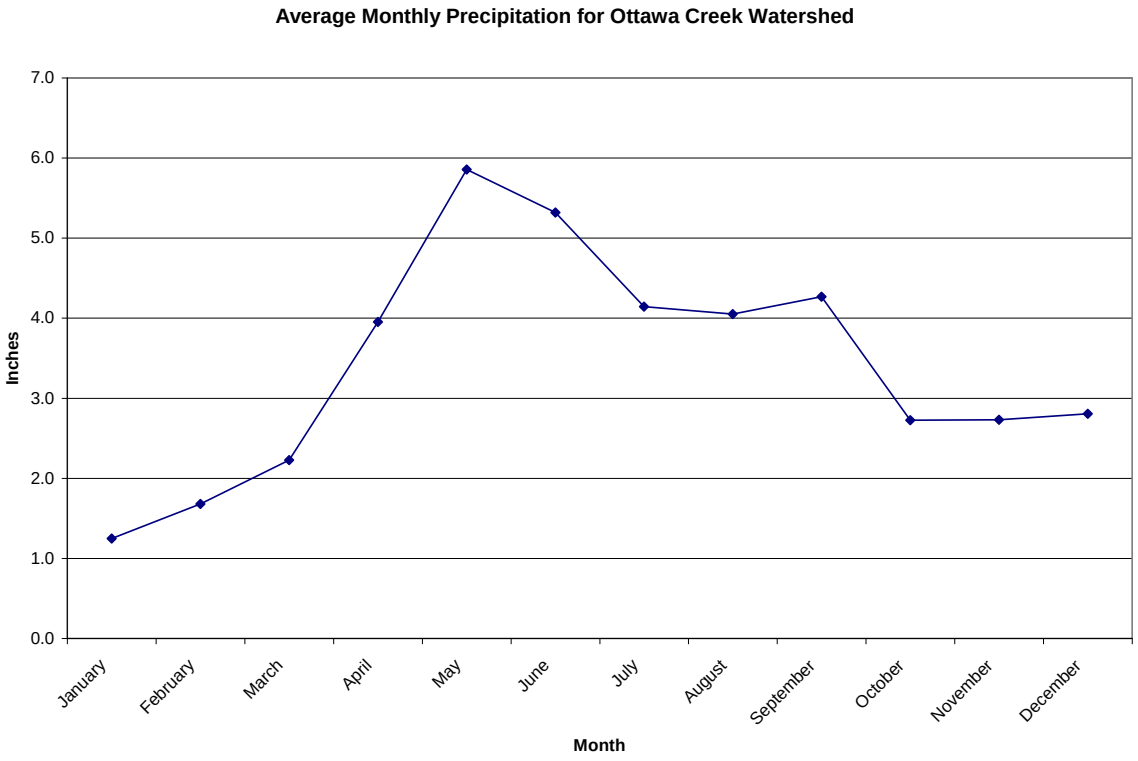


Table 3. Estimated flow-duration values, mean flow values and peak-discharge frequency values for stream segments in the SC616 contributing area. (Perry, C.A., D.M. Wolock and J.C. Artman, 2004). Note that SC616 is located on the upper portion of Ottawa Creek segment 9011, hence, drainage area and flow values for segment 9011 are slightly higher than those for Ottawa Creek at SC616 in Table 2. Flow duration values are in cubic feet per second (cfs) for the percentage of time flow equaled or exceeded.

Stream Name	CUSEGA #	Drainage Area (mi^2)	Mean Flow (cfs)	90%	75%	50%	25%	10%	2 year Peak (cfs)
W. Fk. Tauy Cr	102901019911	48.2	38.0	0	1.44	6.46	20.3	55.0	3,086
E. Fk. Tauy Cr	1029010185	37.1	29.6	0	0.76	4.41	14.6	40.9	3,580
Tauy Cr	1029010111	94.0	69.0	0	2.39	10.6	35.3	101	4,516
Walnut Cr	1029010190	40.5	30.4	0	0.27	3.34	12.8	39.0	3,692
Ottawa Cr	102901019011	138.7	97.4	0.22	3.11	13.9	48.0	143	5,662

Precipitation: According to the National Climatic Data Center, the average annual rainfall in the watershed during the 1990 thorough 2011 time period was 39.9 inches per year. Average monthly precipitation for the same time period is displayed in Figure 3.

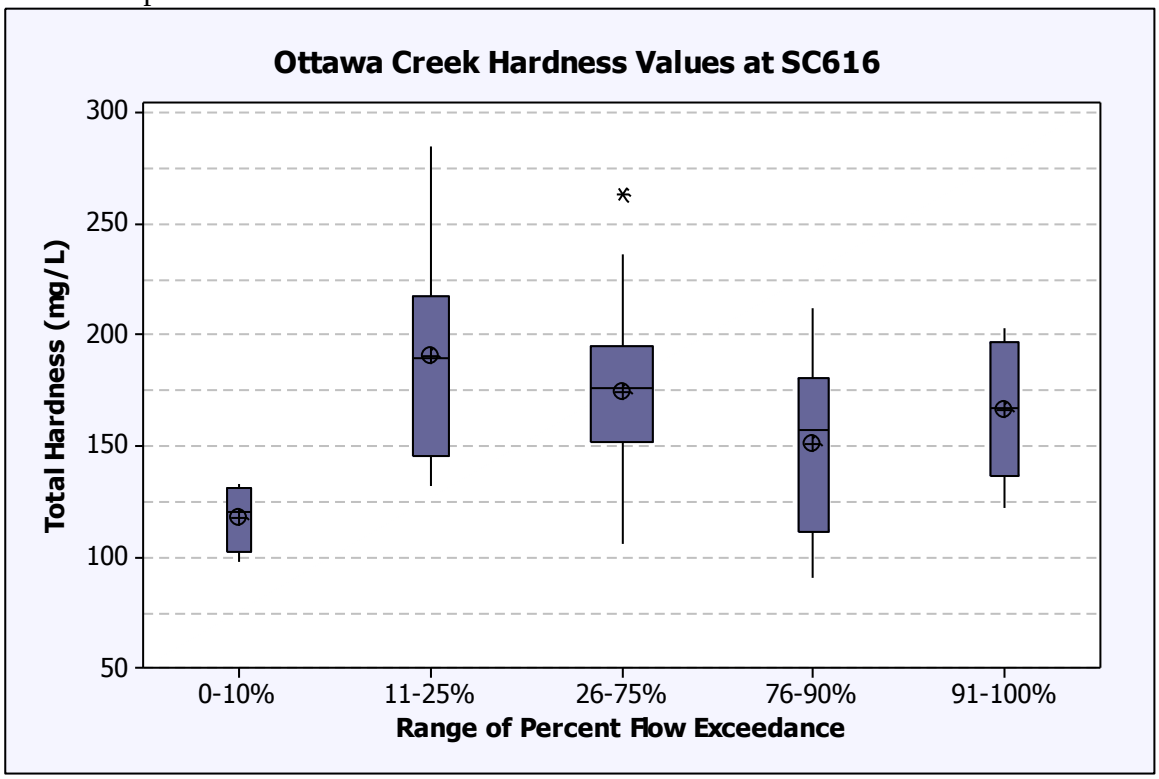
Figure 3. Average monthly precipitation as reported at Ottawa, KS (GHCND: USC00146128) for 1990-2011.



Current Conditions: Chronic lead (Pb) excursions in Ottawa Creek were observed in every season and across the range of flow conditions; however there were no acute lead violations at

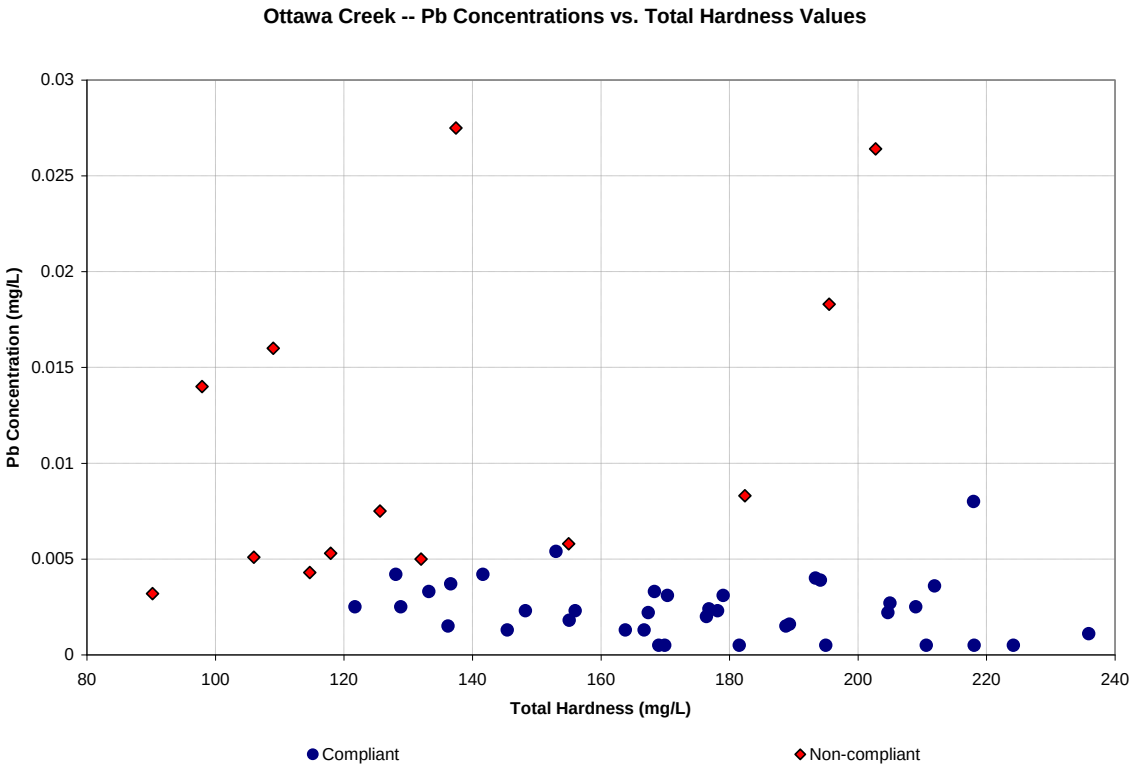
SC616 for the period of record. The Pb criterion is associated with the total hardness of each sample and hardness values in Ottawa Creek averaged 169 mg/L for the period of record. The range of hardness values in Ottawa Creek for the period of record was narrow at 90.2 mg/L to 285 mg/L and, as Figure 4 displays, the hardness and the respective criterion is lower during very high flow conditions.

Figure 4. Total hardness values relative to the percent of flow exceedance in Ottawa Creek at SC616 for the period of record.



As Figure 5 details, samples with lead concentrations less than 3 µg/L and samples with a hardness value greater than 203 mg/L met the aquatic life water quality standard for chronic exposure to lead in Ottawa Creek.

Figure 5. Lead concentrations vs. Total Hardness in Ottawa Creek.



Sampling data was categorized into three defined seasons: Spring (April-June), Summer-Fall (July-October) and Winter (November-March) revealing violations occurred most frequently under high flow conditions during the Spring season (Table 4).

Table 4. Exceedances of the aquatic life support criteria for chronic exposure to Pb by percent flow exceedance and season in Ottawa Creek for the period of record.

Number of Samples Exceeding the Aquatic Life Criteria for Chronic Exposure to Lead							
Station	Season	Percent Flow Exceedance					
		0-10%	11-25%	26-75%	76-90%	91-100%	Cumulative Frequency
Ottawa Cr near Ottawa SC616	Spring	2	1	1	1	0	5/11 = 45%
	Summer-Fall	0	1	2	1	0	4/20 = 20%
	Winter	1	0	2	0	1	4/21 = 19%
	Cumulative Frequency	3/4 = 75%	2/8 = 25%	5/28 = 18%	2/6 = 33%	1/6 = 17%	13/52 = 25%

Both the frequency (Figure 6) and magnitude (Figure 7) of exceedances above the lead criterion have declined since the October 2001 sampling with only one of sixteen samples in violation. Twelve of the thirty-six samples taken prior to October 2001 were in violation of the chronic lead water quality standard for aquatic life.

Figure 6. Pb concentrations with aquatic life support criteria for chronic exposure in Ottawa Creek for the period of record.

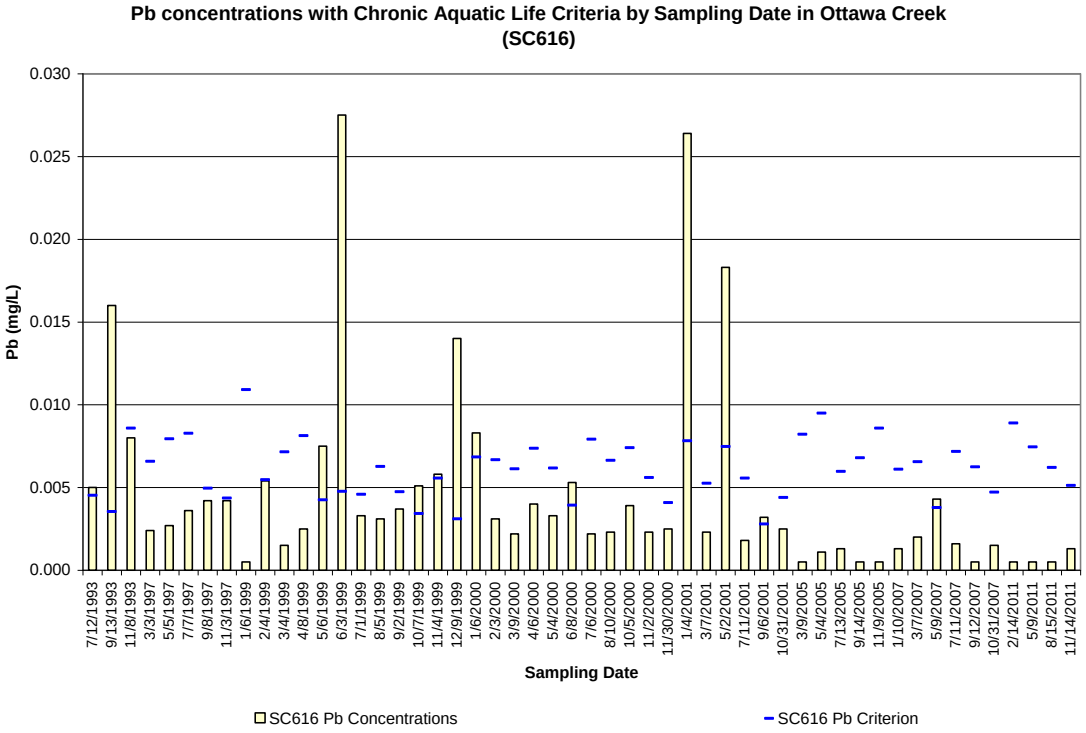
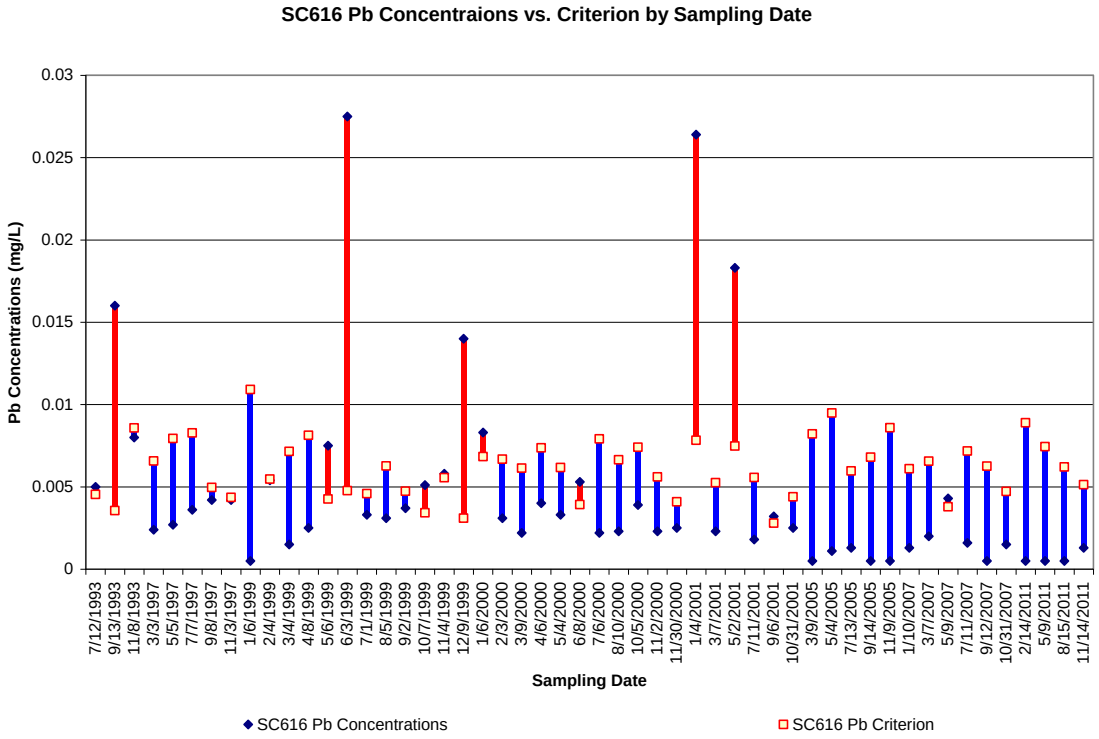


Figure 7. Sample and criterion lead concentrations relative to sampling date. Red up bars illustrate non-compliant samples and blue down bars illustrate compliant samples.



Flow condition has an effect on both the lead concentration and the total hardness and, consequently, lead water quality criteria. As can be seen in Figure 8 and 9, lead concentrations tend to be higher during high flow events while the criteria drop due lower total hardness concentrations at high flows. For Ottawa Creek the resulting average lead value for samples taken when Ottawa Creek was flowing at or above 15% exceedance is 9.8 µg/L while the criteria average 4.7 µg/L under the same flow conditions. Hence, four of six samples exceeded the chronic lead water quality standard at flows greater than or equal to 15% exceedance. When flow in Ottawa Creek is at base flow (16% to 84% flow exceedance), the average lead concentration is 3.5 µg/L and the average criterion is 6.4 µg/L. When Ottawa Creek is flowing between 85% and 91% flow exceedance, the average lead concentration is 6.0 mg/L while the criteria average 6.1 mg/L highlighting the effect of lower stream flows on both concentration and criterion. One of seven samples exceeded the lead criterion when flows in Ottawa Creek were between 85-91% flow exceedance indicating possible influence by point sources.

Figure 8. Pb concentrations with aquatic life support criteria for chronic exposure versus flow condition in Ottawa Creek for the period of record.

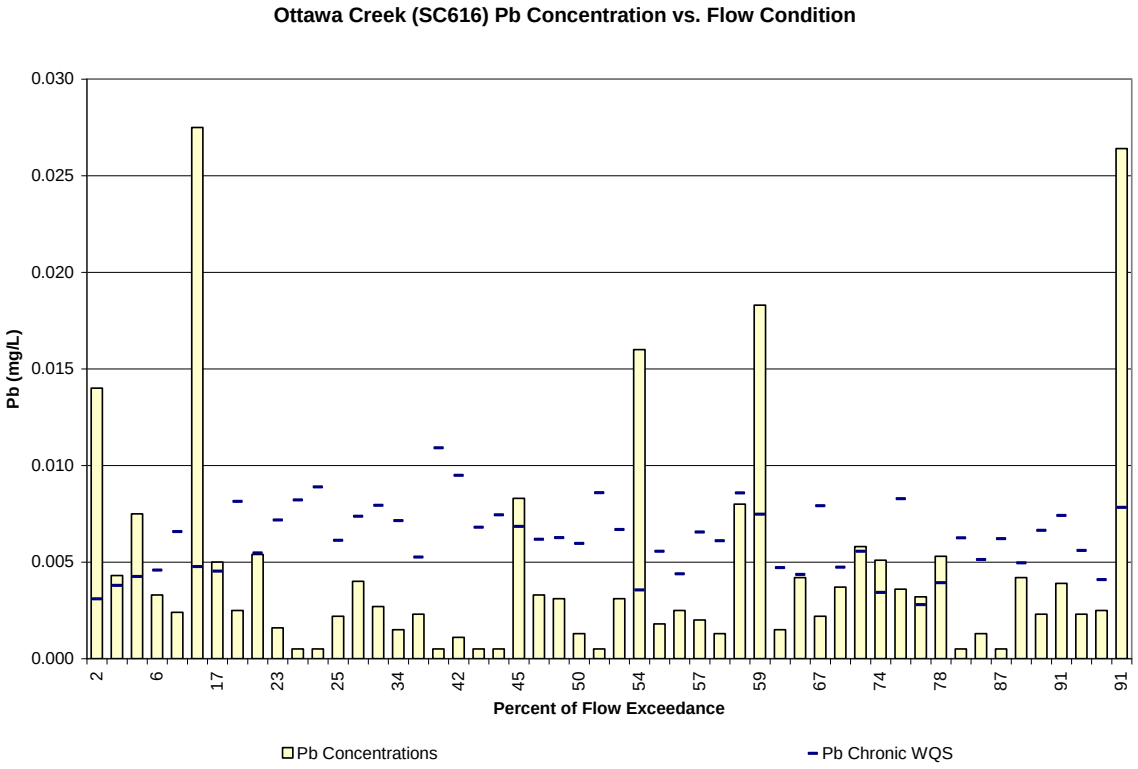
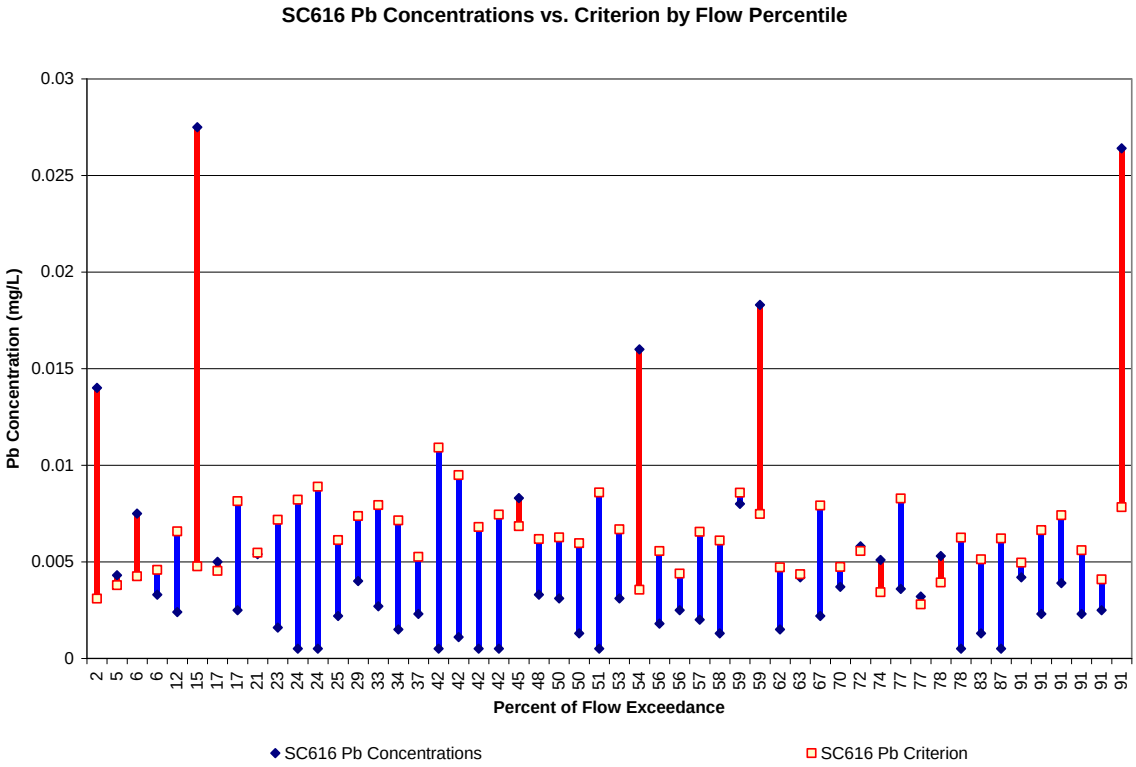


Figure 9. Lead sample and criterion concentrations relative to flow condition. The red up bars illustrate non-compliant samples and the blue down bars represent compliant samples.



Probability Data: In 2009 the KDHE Stream Probabilistic Program sampled Walnut Creek (CUSEGA: 1029010190) at site SPA382 (Figure 1). Site SPA382 was sampled four times during the year with the February and August samples coming in below the analytical reporting limit of 0.001 mg/L. The October sample was above the reporting limit but below the chronic criterion for lead based on its hardness and the April sample violated the chronic criterion for lead based on its hardness (Table 5). To give insight into flow conditions in the watershed on the days SPA382 was sampled, flow at SC616 is given in Table 5, revealing that the exceedance that occurred in April 2009 is likely due to a precipitation event in the watershed prior to sampling.

Table 5. Sample data for samples taken in 2009 at probabilistic site SPA382. The reporting limit (RL) for lead at the time of analysis in 2009 was 0.001 mg/L (KHEL).

Collection Date	Total Hardness (mg/L)	Pb (mg/L)	Pb Chronic Criteria (mg/L)	Flow at SC616 (cfs)
2/23/2009	208	< RL	0.008	8.87
4/27/2009	***66.9***	***0.0112***	***0.002***	***5,623***
8/17/2009	139	<RL	0.005	4.43
10/26/2009	117	0.0019	0.004	10.6

Desired Endpoints of Water Quality (Implied Load Capacity) in Ottawa Creek (SC616):

The ultimate endpoint for this TMDL will be to achieve the chronic lead Kansas Water Quality Standard fully supporting aquatic life for KDHE sampling station SC616. Excursions in the SC616 watershed appear across all seasons and seasonal variation is accounted for by applying the endpoint to all flow conditions throughout the year.

The endpoint will be achieved as a result of improvements in the riparian buffers within the watershed as a result of expected, though unspecified, reductions in sediment loading from the watershed resulting from implementation of corrective actions and best management practices as directed by this TMDL. Achievement of this endpoint will provide full support of the aquatic life function within the Ottawa Creek watershed and attain the chronic exposure criteria for lead.

3. SOURCE INVENTORY AND ASSESSMENT

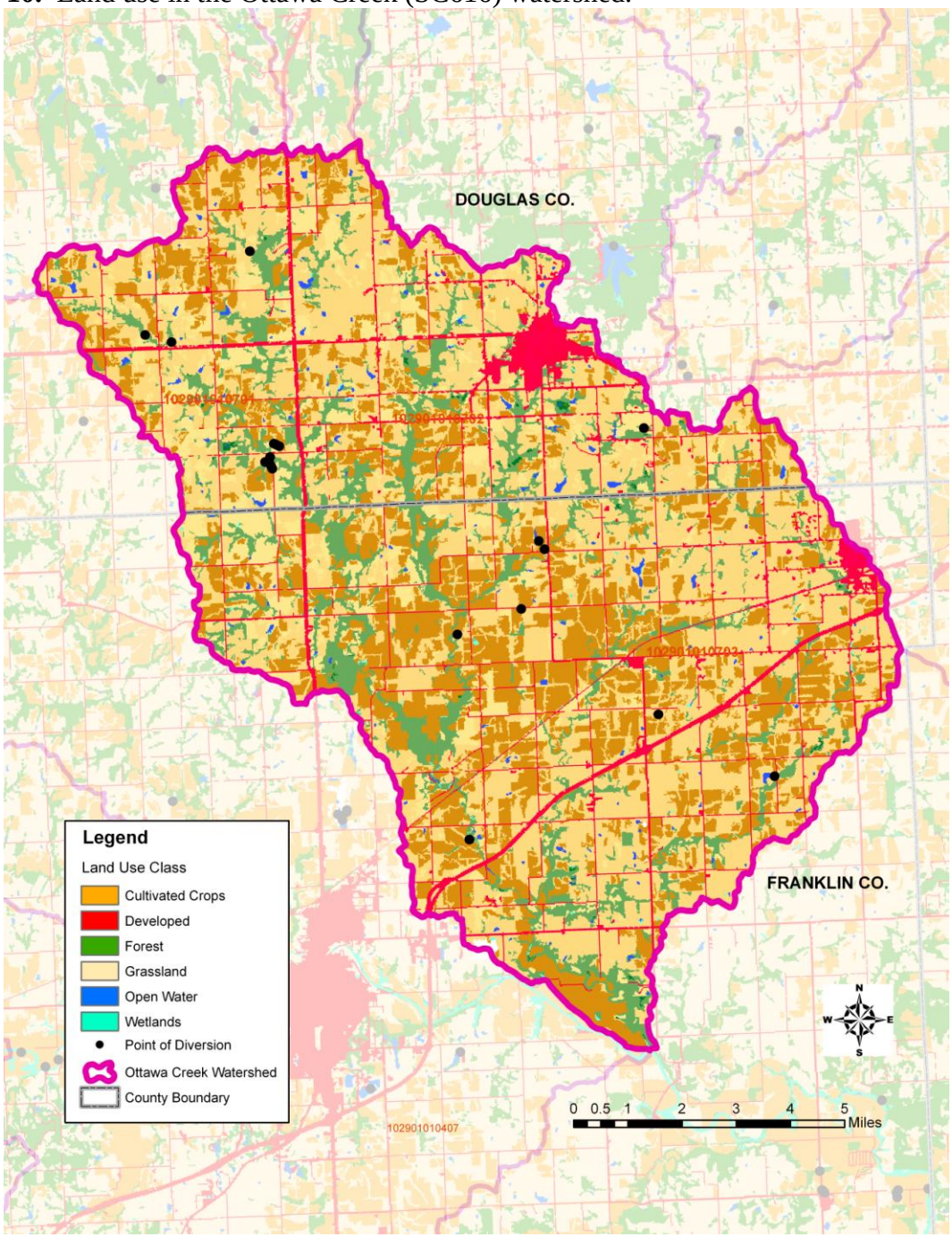
Point Sources: There are five NPDES permitted facilities in the Ottawa Creek watershed (Table 6). Of these facilities, one is a ready-mix concrete plant and two are non-overflowing lagoon systems. These three facilities are prohibited from discharging to the watershed and would only contribute a waste load under extreme precipitation or flooding events. The remaining two, the City of Wellsville and the City of Baldwin City are permitted to discharge and routinely do so; however, currently, their permits do not require monitoring of lead in their discharge.

Table 6. NPDES permitted facilities in the Ottawa Creek watershed.

Facility	Federal Permit #	Kansas Permit #	Type	Design Flow (MGD)	Receiving Stream	Expiration Date
Antiques & More	KSJ000181	C-MC31-NO06	1 Cell Non-Overflowing Lagoon	N/A	N/A	9/30/14
USD #348 Marion Springs School	KSJ000370	M-MC04-NO01	2 Cell Non-Overflowing Lagoon	N/A	N/A	3/31/15
Penny's Concrete – Leloup Quarry	KS0088579	I-MC48-PO03	Concrete Settling Basin	N/A	N/A	5/31/16
Baldwin City WWTF	KS0097381	M-MC04-OO03	2 Schrieber Aeration Basins	0.90	Tauy Cr via E. Fk. Tauy Cr	12/31/14
City of Wellsville WWTF	KS0097110	M-MC48-OO03	Aerobic Digester	0.30	Walnut Cr	9/30/14

Land Use: The predominant land uses in the Ottawa Creek watershed are grassland (53%) and cultivated cropland (26%), according to the 2001 National Land Cover Data. Together they account for nearly 80% of the total land area in the watershed with the remaining land area composed of forest (12%), developed land (8%), and open water (1%) (Figure 10).

Figure 10. Land use in the Ottawa Creek (SC616) watershed.



Livestock Waste Management Systems: There are eight registered, certified or permitted confined animal feeding operations (CAFOs) within the Ottawa Creek watershed (Table 7). These livestock facilities have waste management systems designed to minimize runoff entering their operation or detain runoff emanating from their facilities. In addition, they are designed to retain a 25-year, 24-hr rainfall/runoff event as well as an anticipated two weeks of normal wastewater from their operations. Typically, this rainfall event coincides with stream flow occurring less than 1-5% of the time. 2002 USDA Census of Agriculture livestock numbers for the watershed by HUC 12 are detailed in Table 8.

Table 7. Registered, certified and permitted animal feeding operations in the Ottawa Creek watershed. There are no federally permitted CAFOs in the watershed.

Kansas Permit #	County	Animal Type	Animal Total
A-MCDG-MOO7	Douglas	Dairy	86
933	Douglas	Swine	500
932	Douglas	Beef, Swine	360
A-MCFR-MA03	Franklin	Dairy	66
A-MCFR-M012	Franklin	Dairy, Goat, Horse	223
A-MCFR-BA07	Franklin	Beef	80
A-MCFR-MA07	Franklin	Dairy	60
A-MCFR-BA08	Franklin	Beef	70

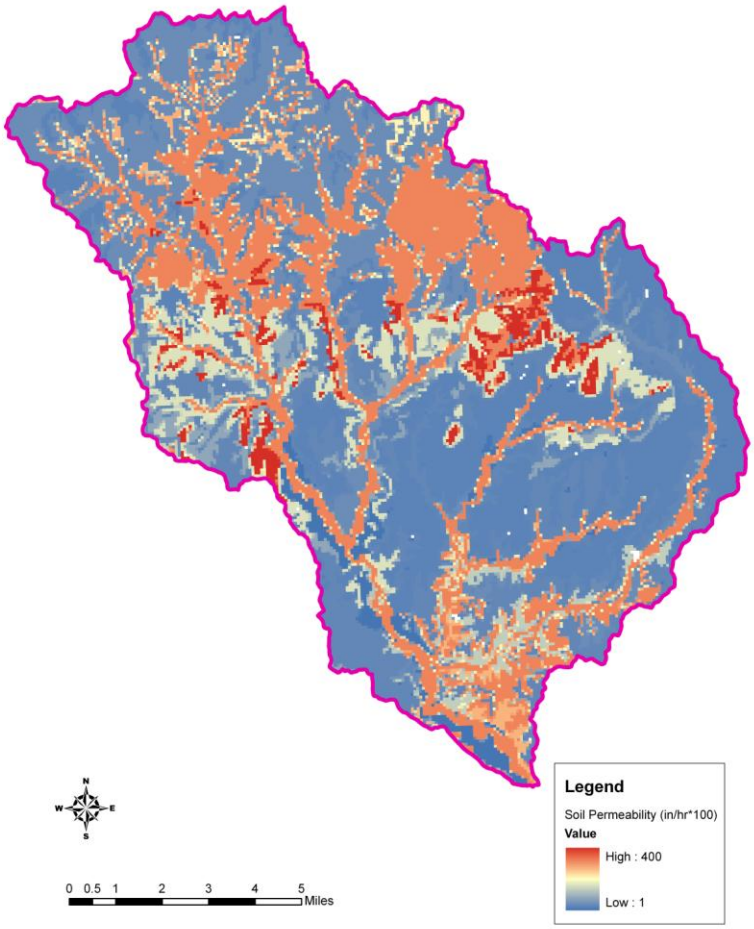
Table 8. Livestock numbers by HUC 12. USDA, 2002.

HUC 12	Beef Cattle	Dairy Cattle	Hogs	Sheep	Horses	Chickens	Turkey	Ducks	Total
102901010701	1,398	102	271	77	116	95	2	2	**2,064**
102901010702	1,292	92	345	65	106	84	3	2	**1,989**
102901010703	1,701	110	922	56	132	89	7	3	**3,019**
Watershed Total	**4,391**	**304**	**1,537**	**198**	**354**	**268**	**12**	**8**	**7,072**

Population: According to the 2010 U.S. Census, the population in the Ottawa Creek watershed is approximately 8,749 people giving a population density of about 66 people per square mile. Baldwin City increased in population by 32.8% to a total of 4,515 people in 2010 while the City of Wellsville increased 15.6% from the 2000 census to 1,857 people in 2010 indicating population in the watershed is likely to increase in the future.

Contributing Runoff: The Ottawa Creek watershed has a very low mean soil permeability value of 0.53 inches/hour. Permeability ranges from 0.01 inches/hour to 4.0 inches/hour according to NRCS STATSGO database with nearly 90% of the watershed having a permeability value less than 1.29 inches/hour, which contributes to runoff during low to very low rainfall intensity events (Figure 11). According to a USGS open-file report (Juracek, 2000), the threshold soil-permeability values are set at 3.43 inches/hour for very high, 2.86 inches/hour for high, 2.29 inches/hour for moderate, 1.71 inches/hour for low, 1.14 inches/hour for very low, and 0.57 inches/hour for extremely low soil-permeability. Runoff is primarily generated as infiltration excess with rainfall intensities greater than soil permeability. As the watershed's soil profiles become saturated, excess overland flow is produced.

Figure 11. Soil permeability in the Ottawa Creek watershed.



Nonpoint Sources: The lead impairment in the Ottawa Creek watershed is likely associated with nonpoint sources. Lead will remain in the soil for prolonged periods once it is deposited and does not readily move through the soil (Rosen, 2002). The lead impairment is most likely due to erosion from cropland that is adjacent to streams within the watershed. Lead attached to soil particles from exposed land is prone to runoff during rain events that produce runoff and with such low soil permeability in the watershed even moderate periods of precipitation could generate runoff conditions.

Common lead sources are attributed to lead based paint, leaded gasoline and lead dust in the air The Ottawa Creek watershed is in close proximity to the City of Ottawa and lead dust could be carried to the watershed by the wind from this urban area. And, as US Interstate 35 cuts through the watershed, it is likely that leaded gasoline continues to be a source of lead contamination in the watershed. Tractors and other farm implements that used leaded gasoline are also a possible source of lead in the watershed.

Some micronutrient and phosphate fertilizers are known to contain excessive levels of lead, arsenic and cadmium making them a potential source of lead in the watershed (MDH, 1999).

Background: Background levels of lead are derived from geological sources and detectable concentrations are naturally present in the soil. However, it is difficult to determine the degree to which these sources are contributing to the impairment without performing a lead isotope study to differentiate between naturally occurring lead and non-naturally occurring lead in the watershed.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

A cubic regression between the chronic aquatic life criterion load for the samples at SC616 and the flow exceedance establishes the TMDL for lead in Ottawa Creek at SC616 (Appendix A). As can be seen in Figure 14, the total hardness values within the watershed are generally lower during high flow conditions and tend to increase during lower flow conditions. Therefore, the lead water quality criterion tends to be more restrictive as stream flow increases.

Point Sources: Because the lead violations in Ottawa Creek at SC616 are sometimes associated with low flow conditions, it is conceivable that point sources are contributing to the lead impairment. Therefore, a wasteload allocation (WLA) of 0.057 lbs/day of lead has been established at SC616 for discharging point sources within the watershed. The wasteload allocation for lead was established by setting the chronic lead criterion for the point source discharges based on the total hardness value of 157 mg/L, the median total hardness value of samples collected while the stream was at 75-90% flow exceedance. The resulting lead criterion of 5.7 μg/L and the discharging facilities' design flows were used to determine the daily wasteload allocation.

Nonpoint Sources: The TMDL assigned to the Ottawa Creek as SC616 watershed is illustrated in Figure 12. The TMDL load durations curve for the sampling station has been developed with a cubic regression based on the log transgression of the observed sample criterion load for each data set collected at the SC616. The TMDL for various flow conditions are detailed in Table 9.

Figure 12. Ottawa Creek SC616 Pb TMDL.

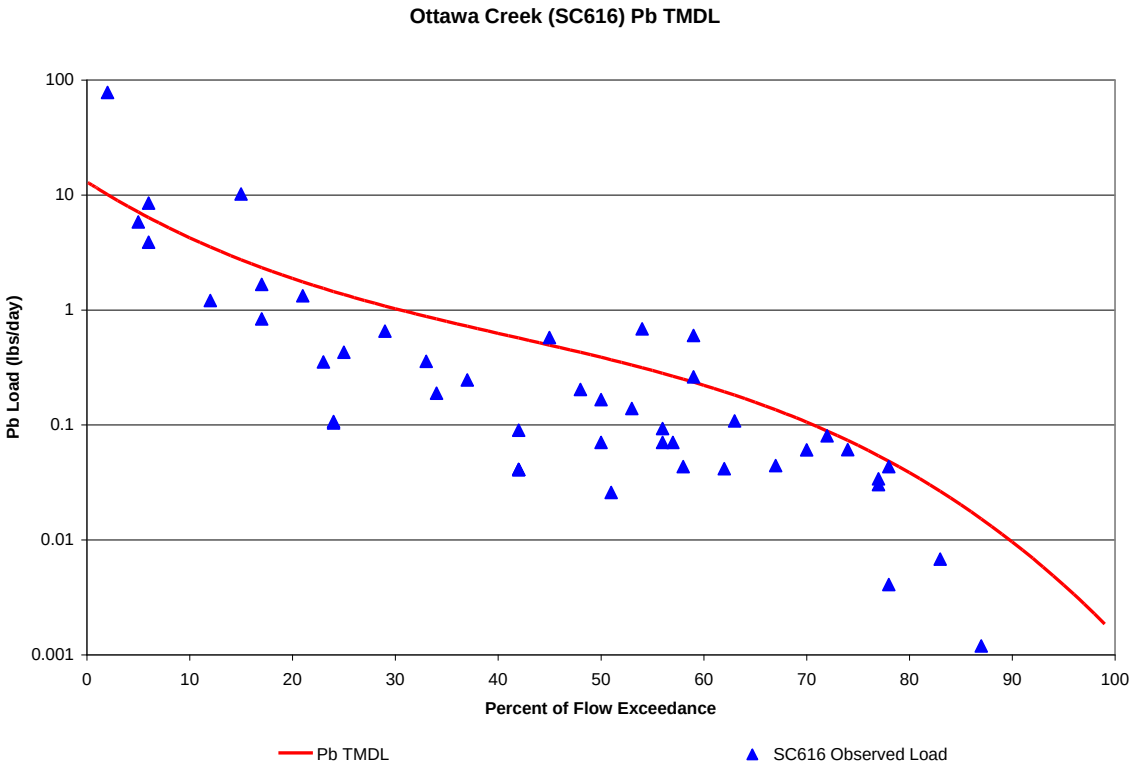


Table 9. Lead TMDL for KDHE sampling station SC616, Ottawa Creek near Ottawa.

% Flow Exceedance	Flow (cfs)	Load Allocation (lbs/day)	Margin of Safety (lbs/day)	Wasteload Allocation (lbs/day)	TMDL (lbs/day)
10%	112	3.762	0.424	0.057	4.24
25%	37.3	1.168	0.136	0.057	1.36
50%	9.92	0.2919	0.0388	0.057	0.388
75%	1.98	0.00274	0.00664	0.057	0.0664
Average Flow	79.7	2.790	0.316	0.057	3.16

Defined Margin of Safety: The margin of safety is explicit and provides some hedge against the uncertainty of daily allocated loading. The margin of safety for Pb will be 10% of the lead loading capacity when the stream is flowing which compensates for the lack of knowledge about the relationship between the allocated loadings and the resulting water quality. The margin of safety is detailed in Table 9.

State Water Plan Implementation Priority: Because of the uncertainty of the pollutant sources causing the lead impairment in the Ottawa Creek (SC616) watershed, this TMDL will be a Low Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Upper Marais des Cygnes Basin (HUC 8: 10290101) with a priority ranking of 5 (High Priority for restoration work).

Priority HUC 12: Because of the lack of certainty regarding potential sources and naturally occurring background concentration in the watershed, no priority subwatershed or stream segment will be identified.

5. IMPLEMENTATION

Desired Implementation Activities: There is potential that urban, construction and agricultural best management practices will improve the condition of Ottawa Creek.

Some of the recommended urban and agricultural practices are as follows:

1. Promote proper management of construction sites to minimize sediment runoff.
2. Identify sources of lead in the watershed and in stormwater runoff.
3. Install grass buffer strips where needed along streams.

Implementation Program Guidance:

Nonpoint Source Pollution Technical Assistance – KDHE

a. Support Section 319 project activities for reduction of streambank erosion, sediment runoff and livestock operations.
b. Provide technical assistance on practices geared to the establishment of vegetative buffer strips.

Riparian Protection Program – KDA Division of Conservation

a. Establish, protect or re-establish natural riparian systems, including vegetative filter strips and streambank vegetation.

Buffer Initiative Program – KDA Division of Conservation

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

Time Frame for Implementation: Initial implementation will proceed over the years from 2013-2022.

Milestone for 2017: During the next cycle of 303(d) activities in the Marais des Cygnes River Basin, data from SC616, Ottawa Creek near Ottawa will be reviewed to assess the incidence of exceedances of the lead water quality standard for chronic exposure.

Delivery Agents: The primary delivery agents for program participation will be the Kansas Department of Health and Environment and the Kansas Department of Agriculture Division of Conservation.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollutants and to assure allocations of pollutant to point and nonpoint sources can be attained.

1. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

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

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

5. K.S.A. 82a-901, et. seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

6. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the Kansas Water Plan, including selected Watershed Restoration and Protection Strategies.

7. The Kansas Water Plan and the Marais des Cygnes River 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 pollutant 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. Additionally, $2 million has been allocated between the State Water Plan Fund and EPA 319 funds to support implementation of Watershed Restoration and Protection Strategies. This watershed and its TMDL are a low priority consideration for funding.

Effectiveness: Buffer strips are publicized as effective filters for sediment before it reaches a stream and riparian restoration projects have been known to contribute significantly to stream

bank stabilization leading to reduced sediment runoff to the creek and fewer incidences of lead concentrations above the chronic water quality standard.

6. MONITORING

KDHE will continue its 4-year sampling schedule in order to assess lead levels in Ottawa Creek near Ottawa. Based on the sampling results, the 303(d) listing will be evaluated in 2018.

7. FEEDBACK

Public Notice: Draft TMDLs for the Marais des Cygnes River Basin were made available through the active Internet Website at www.kdhe.gov/tmdl on May 1, 2013.

Public Hearing: A Public Hearing was held May 23, 2013 in Ottawa to receive comment on this TMDL. Public comments for this TMDL were held open from May 4 through June 7, 2013. No comments were received on this TMDL.

Basin Advisory Committee: The Marais des Cygnes River Basin Advisory Committee met to discuss these TMDLs on September 14, 2012 in Fort Scott.

Milestone Evaluation: In 2017, evaluation will be made as to the degree of impairment continuing to occur within the watershed. Subsequent decisions will be made regarding the implementation approach, priority of allotting resources for implementation and the need for additional or follow up implementation in this watershed at the next TMDL cycle for this basin.

Consideration for 303(d) Delisting: Ottawa Creek at SC616 will be evaluated for delisting under Section 303(d), based on the monitoring data over 2014-2020. Therefore, the decision for delisting will come about in the preparation of the 2022 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 would come in 2013, which will emphasize implementation of WRAPS activities. At that time, incorporation of this TMDL will be made into the WRAPS. Recommendations of this TMDL will be considered in the Kansas Water Plan implementation decisions under the State Water Planning Process for Fiscal Years 2013-2021

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Appendix A. Cubic Regression Equation based on observed sample criterion allowable load.