



METHODOLOGY FOR THE EVALUATION AND
DEVELOPMENT OF THE 2014 SECTION 303(D) LIST
OF IMPAIRED WATER BODIES FOR KANSAS

Kansas Department of Health and Environment
Watershed Planning Section/Bureau of Water/Division of Environment
January 16, 2014

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1.0 BACKGROUND

1.1 REQUIREMENTS UNDER SECTION 303(D) OF THE FEDERAL CLEAN WATER ACT

Section 303(d) of the Clean Water Act requires that States develop a list of water bodies needing additional work beyond existing controls to achieve or maintain water quality standards. This Section 303(d) list is meant to identify waters that require Total Maximum Daily Loads (TMDLs) because technology-based effluent limitations, more stringent State or local effluent limitations, and other pollution control requirements such as best management practices, are not stringent enough to implement applicable water quality standards. 40 CFR 130.7(b)(1).

A TMDL refers to the “total maximum daily load” of a pollutant that achieves compliance with a water quality standard, therefore a TMDL is essentially a regulatory tool which caps the allowable pollutant load to a water body and a planning tool which directs and guides practices that will bring a water body into compliance with the applicable water quality standard.

Under the current federal rules, States are to submit their 2014 Clean Water Act Section 303(d) lists of impaired waters, as well as the methodologies used to prepare them, by April 1, 2014. On September 3, 2013 the U.S. Environmental Protection Agency issued a guidance memorandum regarding the 2014 Integrated Reporting (IR) including 303(d), 305(b) and 314 reports. This guidance builds on previous guidance issued on regarding preparation of the 2008, 2010, and 2012 Integrated Reporting (IR) and Listing Decisions documents, pursuant to sections 303(d), 305(b) and 314 of the Clean Water Act. The 2012 Kansas 303(d) list was submitted by KDHE on March 30, 2012 and was approved on June 5, 2012. The 2014 Kansas 303(d) list builds upon the prior approved lists, and seeks to further clarify the status of Kansas waters in light of ongoing water quality monitoring data.

1.2 WATER QUALITY STANDARDS (STATE OF KANSAS)

Kansas surface water quality standards create the ‘yardstick’ by which water bodies are measured against. Kansas surface water quality standards are defined by:

- 1) designating beneficial uses of the water as contained in K.A.R. 28-16-28d;
- 2) setting criteria necessary to protect the beneficial uses, contained in K.S.A. 28-16-28e; and
- 3) establishing an antidegradation policy, contained in K.A.R. 28-16-28c(a).

Beneficial uses of waters in Kansas include aquatic life, domestic water supply, food procurement, groundwater recharge, industrial water supply, irrigation, livestock watering and recreation. In general, most pollutants impair aquatic life, recreation, domestic water supply and food procurement.

1.3 DESCRIPTION OF 303(D) LIST PURPOSE AND LINKAGE TO 305(B) WATER QUALITY REPORT

The generation of this 303(d) List is an essential planning and guidance tool for the state. The Kansas 2014 303(d) list not only identifies those water bodies from the 2012 303(d) list which still

require TMDLs, but also determines those new water bodies and pollutants for which TMDLs will be needed. Water bodies are assigned a priority for TMDL development by assessing the frequency, magnitude and duration of impairment by a pollutant, as well as considering public comment.

2014 represents the fourth reporting cycle of integrating the 305(b) report and the 303(d) list in a single report. Nonetheless, fundamental differences remain for the two assessment procedures. The 305(b) report provides an assessment or measure of *all* waters in the state through probabilistic monitoring. The 305(b) report provides an overall picture of the water quality and recent status of support for the designated uses of waters within a state and is intended to represent a statistical analysis of overall water quality rather than provide information regarding individual water bodies.

In contrast, although the 303(d) list relies on the 305(b) assessments in initially identifying impaired water bodies within the state, the assessment procedures used for 303(d) listing, by necessity, are more intensive. The 303(d) list is a subgroup of all surface waters in the state; i.e., those water bodies not meeting one or more water quality standards because of pollutants and needing a TMDL. Because of the associated cost to the state in developing and implementing TMDLs, the state must determine the extent a water body is impaired and its relative severity among other water bodies with some degree of confidence. Hence the need for more vigorous assessment prior to listing a water body as impaired.

1.4 RELATIONSHIP OF KANSAS 303(D) LIST TO 2012 INTEGRATED REPORT GUIDANCE

In as much as practicable, the Kansas 303(d) list and supporting information will be developed and submitted to the EPA in accordance with the September 3, 2013 information memorandum. The list viewed for public review includes those waters identified by guidance as “Category 5”; those waters requiring development of a TMDL because of impairment by a pollutant. However, the public list will also list Category 2 waters that represent waters delisted from the 2008, 2010, and 2012 303(d) lists and Category 3 waters requiring additional information in order to make listing decisions for future 303(d) lists. Waters that now have a TMDL because of impairments identified from the 1998, 2002, 2004, 2008, 2010, and 2012 lists are included in the reporting database as Category 4a waters and are identified for the public by posting of approved TMDLs on the KDHE website. Waters that have addressed their impairment by other means than a TMDL are identified in the public report and database as 4b waters. Definitions of the five Categories for waters provided by the guidance from EPA and Kansas’ interpretation on using those Categories is provided in **Table 1**.

2.0 ASSESSMENT UNIT DEVELOPMENT

2.1 DESCRIPTION OF KANSAS AMBIENT SURFACE QUALITY NETWORK

Kansas has an extensive surface water quality monitoring network consisting of 328 active ambient stream chemistry monitoring sites spanning all the major river basins. Of these, there are 160 core sites currently visited on a quarterly basis every year, whereas the remaining 168 sites are monitored using a four-year rotational approach; i.e., samples are collected quarterly from

approximately 25 percent of these sites each year. The biological network of monitoring sites includes 222 monitoring sites. Of these, samples are generally obtained from 40-70 core stations annually. Fish tissue samples normally are obtained each year from 40 water bodies across the state, which include nine long-term and 17 long term lake monitoring sites. Water quality information currently is obtained from 120 lakes and wetlands, which includes all 24 federal reservoirs, most state-administered fishing lakes, various other state, county or locally owned lakes, several privately owned but publicly accessible lakes, and seven state or federally owned marshes. Probabilistic stream monitoring of random sites across the state began in 2006 with approximately 50 random sites which were sampled four times for chemistry and once for biology that year. Approximately another 50 sites were sampled each year over 2007 - 2012. The results from the probabilistic monitoring comprise the findings of the 305(b) assessment report regarding stream water quality.

2.2 DELINEATION ASSESSMENT UNITS (CONTRIBUTING AREAS TO MONITORING SITES)

Of the Kansas Department of Health and Environment's (KDHE) 330 ambient stream chemistry monitoring sites, 160 are fixed (permanent) sites sampled quarterly every year, and 168 are rotational sites sampled quarterly every four years. Assessment units (AU) were defined within the state by delineating the unique contributing area to each monitoring site. Groupings at the HUC 12 level were used as the basis for unique contributing areas to these monitoring sites. Once grouped by HUC 12, additional alterations to the boundaries were made using a digital elevation map (DEM) to create unique boundaries for each monitored area. This process ensures that no area has more than one monitoring station with it and that each AU boundary typically includes only tributary segments upstream of the monitoring station. The stream segments of the 2010 Kansas Surface Water Register (KSWR) were placed into each AU and a unique watershed name was assigned to each based on the main stem of each AU. The KSWR was also merged to the National Hydrography Dataset (NHD) (1:100,000) and this merge can be used as a translator from the AU stream routing structure in KSWR to a routing structure in NHD.

316 stream AUs were created from the 328 ambient stream chemistry monitoring sites. The discrepancy between the number of monitoring sites and AUs is because one monitoring station is located in Missouri, and monitors a watershed completely contained within Missouri, and the other stations are too new to have AUs assigned. When they meet minimum data requirements the AUs and the segment to station assignments will be revisited.

The 25 largest lakes and the largest wetland by surface area of the 118 monitored lakes and wetlands were also delineated in the same method, complimenting the existing stream AUs previously created. The establishment of these lake AUs creates unique contributing areas to the larger reservoirs in Kansas. The remainder of the monitored lakes and wetlands are identified simply as water bodies without a defined contributing area and have been identified as to which AU they are located within.

Generally, biological and fish tissue collection sites are located near a stream or lake monitoring site, so a best match for these sites were found from the existing AUs.

Based upon the combined area of all defined AUs within the state, almost 97% of the contributing areas of Kansas are monitored by the KDHE water quality monitoring program.

2.3 MAP AND TABLE FORMATS USED IN DESCRIPTION OF ASSESSMENT UNITS

For TMDL planning purposes, visual clarity and to make the public participation process consistent with the current state water planning process, the state was divided into 12 river basins. Maps locating the AUs and monitoring sites were created for each of these 12 river basins. These maps are available at: http://www.kdheks.gov/tmdl/download/Maps_AssessmentUnit.pdf. Tables of the registered streams in each assessment unit or in the case of a lake AU, streams and the lake itself, are available for each of the 12 river basins from the Watershed Planning Section.

3.0 DATA CONSIDERATIONS FOR 2014 LIST

3.1 APPLICATION OF 2012 303(D) LIST

Certain impairments listed in the 2012 303(d) list will be evaluated for delisting during the generation of the 2014 303(d) list. Section 4.6, 5.6 and 6.5 describes the assessment method for delisting decisions. Error corrections to the 2012 list will be made as set forth in Section 3.2.

3.2 2012 303(D) LIST - ERROR CORRECTIONS

Errors in the 2012 303(d) list will be corrected in the 2014 list. Examples of these corrections to the 2012 list are typographical list errors and water bodies that were never impaired but certain flaws in the original analysis led to the waters being listed.

3.3 2012 305(B) WATER QUALITY REPORT USE

Because of the relatively small number of sample points from the individual biological, lakes/wetlands and fish tissue network monitoring sites through time, the information and best professional judgment used to generate the assessment of these three sections of the 2014 305(b) report will be the primary basis for any associated listings in the 2014 303(d) list. The stream chemistry monitoring network sites have a larger number of samples for each monitoring site. This will allow a more intensive statistical assessment of impairment for these sites for inclusion in the 2014 303(d) list.

3.4 SPATIAL APPLICABILITY OF DATA

AUs have been defined based on contributing areas to ambient stream monitoring and lake stations. If an impairment is determined at a monitoring point, the stream segment or lake/wetland associated with that monitoring point will be listed. In the case of a stream AU, this will always be the main stem of the system within the AU and in the case of a lake/wetland AU, it will always be the

lake/wetland. If the lake/wetland AU is defined as just that water body, then reference to potential contributors in the surrounding watershed will not be made.

3.5 USE OF DATA (CHEMICAL, BIOLOGICAL, INTERNAL, EXTERNAL)

As required by Section 303(d) of the Clean Water Act and 40 CFR 130.7(b)(5), KDHE will compile and consider “all existing and readily available water quality related data and information” in identifying waters to be listed. Existing and readily available data and information includes, but is not limited to:

- 2012 303(d) List;
- 2014 305(b) Report’s waters that are not meeting a designated beneficial use;
- Clean Water Act 319 nonpoint source and Watershed Restoration and Protection Strategy assessments,
- Drinking water source water assessment under Section 1453 of the Safe Drinking Water Act;
- KDHE fish consumption advisories,
- Data, information, and water quality problems reported from local, State, or Federal agencies, Tribal governments, the public, and academic institutions.

Much of these data tend to corroborate existing listings or TMDLs generated from KDHE water quality data. Nonetheless, a targeted request will be made to U.S. Geological Survey, U.S. Army Corps of Engineers, Kansas Biological Survey, Kansas Geological Survey and Kansas State University for any water quality data collected since 2000 on Kansas lakes and streams.

As stated earlier, KDHE operates an extensive water quality monitoring network throughout Kansas and believes it is important that the decision to list a water body be based upon credible evidence. KDHE encourages the submittal of additional data and information from the general public during the list development and public comment period. Data and information can be in the form of analytical results, numeric data or information or narrative/qualitative submittals. When such information is submitted, the observation date, location(s), quality assurance methods and other pertinent information should also be provided. Other pertinent information includes the rationale supporting the observation being considered outside the normal range of conditions. If not verifiable, narrative and qualitative submittals may not be used in the 303(d) process. However, such information will be considered in the planning of future monitoring activities by KDHE.

In order to solicit available data from other entities, KDHE will publish public notice in the Kansas Register on September 26, 2013 to request data from various agencies and the public to be submitted to KDHE by November 15, 2013.

4.0 STREAM CHEMISTRY METHODOLOGY

4.1 SAMPLE SIZE REQUIREMENTS – STREAM CHEMISTRY

In most cases, a minimum of 12 samples will be required to make a determination of impairment for ambient stream chemistry monitoring sites and their associated AUs. An exception to the minimum sample size requirement would be the case where a sufficient number (3) of criterion excursions to list an AU as impaired has occurred prior to the collection of all 12 samples. In this case, regardless of the result of the remaining samples required to meet the minimum sample size, the assessment will always determine impairment once the sample size requirement is met. Similarly, data from the probabilistic stream monitoring network will indicate impairment if three or more criteria excursions are recorded.

4.1.1 TEMPORAL BOUNDS OF DATA – STREAM CHEMISTRY

In an effort to meet the sample size requirements in 4.1, data collected from January 2000, through December 2013, will be used for fixed stream chemistry sites or their associated AUs. Data collected from 1990 through December 2013, will be used for rotational chemistry sites or their associated AUs in the assessment of stream chemistry impairment. For chronic toxicity analysis for metals or selenium at rotational sites, samples taken in years between 2000 – 2013 will be evaluated.

4.2 DESIGNATED USE APPLICATIONS – STREAM CHEMISTRY

Where possible, the water quality for use support of all monitored waters will be evaluated for potential inclusion on the 2014 303(d) List. The designated uses of these waters will determine the level of assessment necessary to evaluate impairment. For a complete list of criteria in conjunction with designated uses see K.A.R. 28-16-28e(d) table 1a.

The assessment levels of the designated uses are generally tailored after those suggested in EPA's *Guidelines for the Preparation of the Comprehensive State Water Quality Assessments and 305(b) Reports and Updates: Supplement*, where impairment is defined as excursion rates greater than 10 percent.

4.2.1 AQUATIC LIFE CONSIDERATIONS

Kansas has two categories of aquatic life support. All parameter standards (except metals) associated with the *chronic* category of aquatic life support will have an assessment level by percent excursion of:

Not impaired: < 10% as determined by the binomial test (see section 4.3)

Impaired >10%, failing the binomial test (see section 4.3)

The standards associated with the *acute* category or for chronic toxicity (metals or selenium) will have a dual assessment level depending on the type of sampling site.

Fixed stream chemistry sites (using 12 continuous years of sampling):

Not impaired: 3 or less violations

Impaired > 3 violations

Rotational stream chemistry sites (3 to 4 separate years of sampling over 2000 - 2013):

Not impaired: 0 or 1 violation

Impaired > 1 violation

4.2.2 INTERPRETATION OF NARRATIVE CRITERIA FOR TOTAL SUSPENDED SOLIDS AND TOTAL PHOSPHORUS

In the 2008 303(d) analysis, KDHE decided to adopt an adaptive approach to identifying areas where significant total suspended solids or nutrient pollution exists using interpretive numbers that are neither adopted numeric criteria nor likely the final value that will be adopted should Kansas choose to establish numeric criteria for these parameters. The interpretive benchmarks for excessive suspended solids or nutrients identify areas that are the most severely impacted waters, without establishing the absolute concentrations that streams must attain to fully support aquatic life.

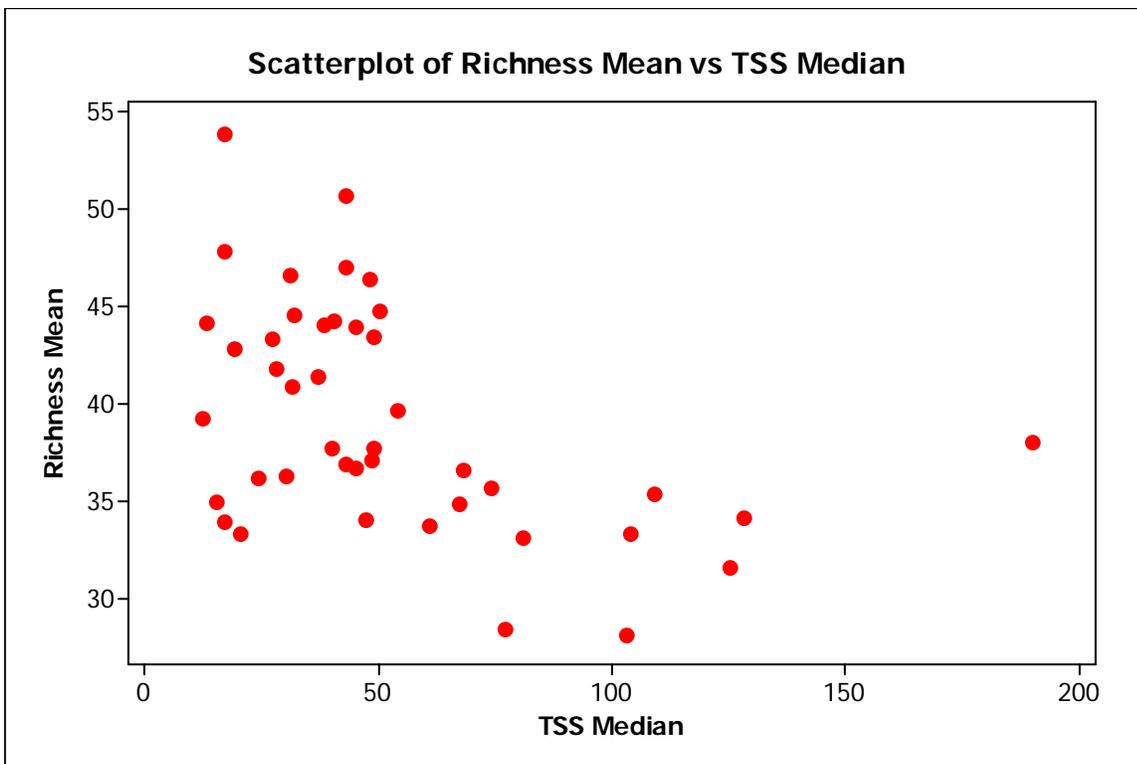
4.2.2.1 TOTAL PHOSPHORUS

K.A.R. specifies that “*The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life.*” In 2001 EPA issued ambient nutrient water quality criteria recommendations for rivers and streams in nutrient ecoregion V, the South Central Cultivated Great Plains, which covers over 65% of Kansas (EPA 822-B-01-014). The recommendations summarized a large dataset and established 67 µg/L total phosphorus as the overall guidance value for the area. While KDHE has not adopted any specific nutrient criteria for phosphorus, some value for interpreting the narrative criteria is needed. There are 3 other ecoregions covering Kansas, and the 67 µg/L value is larger than the TP values corresponding to two of the three ecoregions. Nonetheless, the 67 µg/L value is viewed as a reasonable indicator of acceptable total phosphorus levels in Kansas streams.

Therefore, our initial analysis of total phosphorus concentrations focuses on waters most likely to be impaired and looks for values substantially larger than the 2001 guidance value as an ongoing condition. Specifically, for the purpose of developing the 2014 303(d) list, we shall consider a water as impaired by total phosphorus when a dataset of at least 12 samples over 2000 – 2013 for a monitoring site has a median concentration of total phosphorus exceeding 201 µg/L, or three times the 2001 guidance value. This interpretive value should not be seen as a final determination of nutrient concentrations acceptable to the state of Kansas, but rather as a first step in addressing the most seriously impaired waters while the state continues to deliberate specific nutrient criteria adopted in the future.

4.2.2.2 TOTAL SUSPENDED SOLIDS

Total suspended solids (TSS) can be highly variable in stream and river systems, with strong linkages to stream discharge. K.A.R. specifies that “*Suspended solids added to surface waters by artificial sources shall not interfere with the behavior, reproduction, physical habitat, or other factors related to the survival and propagation of aquatic or semiaquatic life or terrestrial wildlife.*” Prior to the development of the 2008 303(d) list of impaired waters, KDHE analyzed 15 years of suspended solids data and associated biological monitoring data. A strong threshold relationship exists at 50 mg/L median TSS, above which streams are unlikely to support a rich diversity of aquatic life. Species richness is strongly correlated with other measures of aquatic life use support, including proportion of ephemeroptera, plecoptera, and trichoptera species, a long-used indicator of acceptable biological condition in Kansas waters.



Therefore, for the purposes of 303(d) analysis, any stream or river with a dataset of at least 12 samples and a median concentration of greater than 50 mg/L TSS shall be listed as impaired, relative to aquatic life support.

4.2.2 CONTACT RECREATION

As applied to classified stream segments, Kansas has a Primary Contact Recreation (PCR) ‘not to exceed’ standard derived from a geometric mean calculated from at least five *E. coli* samples collected from separate 24-hour periods within a 30-day period for PCR classes as follows (K.A.R. 28-16-28e (c)(7)(D) (table 1i)):

PCR class A; 160 cfu/100mL (in effect from April 1 through October 31 each year)
PCR class A; 2,358 cfu/100mL (in effect from November 1 through March 31 each year)

PCR class B; 262 cfu/100mL (in effect from April 1 through October 31 each year)
PCR class B; 2,358 cfu/100mL (in effect from November 1 through March 31 each year)

PCR class C; 427 cfu/100mL (in effect from April 1 through October 31 each year)
PCR class C; 3,843 cfu/100mL (in effect from November 1 through March 31 each year)

A Secondary Contact Recreation (SCR) ‘not to exceed’ standard derived from a geometric mean calculated from at least five *E. coli* samples collected from separate 24-hours periods within a 30-day period for SCR classes is as follows (K.A.R. 28-16-28e (c)(7)(E)(table 1i)):

SCR class A; 2,358 cfu/100mL (in effect January 1 through December 31)
SCR class B; 3,843 cfu/100mL (in effect January 1 through December 31)

KDHE routine stream monitoring protocols to date do not collect data to evaluate compliance with the minimum five-sample geometric mean criterion, therefore these designated uses cannot be assessed by any stream monitoring site within the state. However, there were 16 streams identified in 2006 as candidates for Category 3 for bacteria because they were previously listed before the water quality standard changed in 2003. These 16 streams were sampled intensively (5 times in a 30 day period) four times in 2006 to determine if they were impaired under the new standard. Those that violated the applicable geometric mean just once were listed as impaired by bacteria in the 2008 303(d) list. Those that did not exceed the geometric mean in any of the four seasonal samplings (Apr-May, Jun-Jul, Aug-Sept, & Oct-Nov) were identified as Category 2 waters.

Since then, a total of 110 stations have been sampled intensively over 2006 – 2013. Those recording a single violation went to Category 5 or remained in Category 4a if a fecal coliform bacteria TMDL was already in place. Those streams that did not indicate impairment from the intensive monitoring went to Category 2. New Category 3 streams for bacteria are identified based on binomial analysis of the routine monitoring data, if they showed at least 10% of individual samples with counts higher than the criteria value for *E. coli* bacteria. These streams await intensive monitoring to determine if impairment has occurred. An inventory of the 110 stations is provided in Table 4. Additionally, all stations on the Kansas and Arkansas Rivers have been intensively monitored numerous times over 2004 – 2013, many times indicating continued impairment by bacteria.

4.2.3 DRINKING WATER, IRRIGATION AND LIVESTOCK WATERING USES

Kansas has a suite of parameters used to protect water supply uses (K.A.R. 28-16-28e(d) table 1a). The nitrate standard assessment levels excursion will be:

Not impaired: N = 0 or 1 since 2000
Impaired: N > 1 since 2000

All other parameters will be reviewed at assessment levels by binomial analysis:

Not impaired $\leq 10\%$

Impaired $> 10\%$

4.2.4 FOOD PROCUREMENT

Kansas has a variety of parameters used to protect food procurement use. Assessment will be made by fish tissue levels and consumption advisories.

4.2.5 GROUNDWATER RECHARGE AND INDUSTRIAL USES

Assessed in consultation with GMDs and given evidence of recharge impairment by poor water quality in streams.

4.3 STATISTICAL METHODS FOR LISTING ASSESSMENT – STREAM CHEMISTRY

In evaluating water body monitoring data associated with stream chemistry sites using EPA's historical 305(b) guidelines, no more than 10% of the samples obtained from the water body should exceed a regulatory standard for conventional pollutants. This method, called the raw score method, simply sets an upper bound on the percentage of measurements at a monitoring site that may violate a standard. Unfortunately, the raw score method does not provide sufficient information to properly deal with the uncertainty concerning impairment, especially when dealing with smaller sample sizes (National Research Council, 2001).

For the Kansas 2014 303(d) list, candidate water bodies will be screened for impairment based on a nonparametric analysis of a confidence limit on a percentile of interest. Where applicable that percentile of the distribution is given by the assessment level of the review above, again based on EPA's 305(b) guidelines of not more than 10% of the samples allowed to exceed a regulatory standard.

Conceptually, an assessment level of 10% excursion is really the same as the upper 90th percentile of the sample distribution. The question to answer in this evaluation is whether the true concentration for a particular constituent in a candidate water body meets or exceeds the assessment level of a regulatory standard. With only a certain number of samples to analyze from a monitoring site, the population's true concentration can never be known with certainty. However, it is possible to create an interval that will contain a particular percentile of the true concentration distribution with a given level of confidence. The confidence interval approach allows the incorporation of uncertainty in the true parameters of the distribution into a comparison to the regulatory standard.

In evaluating a stream's monitoring site data for impairment this confidence interval for the upper 90th percentile of the distribution can be used to determine, with a certain level of confidence, if a particular pollutant has exceeded the regulatory standard. This determination is based on whether or not the entire confidence interval exceeds the regulatory criterion. More conservatively, a one-sided lower bound on the true 90th percentile of the concentration distribution can be computed as a

100(1 - α)% Lower Confidence Limit (LCL), where for 90% confidence, $\alpha = 0.1$. Doing so tests the null hypothesis that the true 90th percentile of the concentration distribution is less than or equal to the regulatory criterion. If we reject the null hypothesis, the pollutant level in the water body is deemed to be an impairment to that water body's designated use(s) (Gibbons, 2001).

4.3.1 BINOMIAL ANALYSIS IN DETERMINATION OF IMPAIRMENTS

(Based on Gibbons, 2001 and Lin, 2000)

To construct a nonparametric confidence limit for the 90th percentile of the concentration distribution from a monitoring site, the fact that the number of samples falling below the $p(100)$ th percentile of the distribution (in this case, $p = 0.9$, where p is between 0 and 1) out of a set of m samples will follow a binomial distribution with parameters m and success probability p , where success is defined as the event that a sample measurement is below the $p(100)$ th percentile. The cumulative binomial distribution ($Bin(x; m, p)$) represents the probability of getting x or fewer successes in m trials with success probability p , and can be evaluated as

$$Bin(x; m, p) = \sum_{i=0}^x \binom{m}{i} p^i (1-p)^{m-i} \quad \mathbf{E4.1}$$

The notation $\binom{m}{i}$ denotes the number of combinations of m things taken i at a time, where

$$\binom{m}{i} = \frac{m!}{i!(m-i)!}$$

and the factorial $m!$ is given by

$$m! = m(m-1)(m-2)\dots 1$$

Where applicable, KDHE will use a 90% LCL on the 90th percentile of a concentration distribution ($LCL_{0.9,0.9}$) from a stream chemistry monitoring site.

As an example, find the minimum number of successes needed to keep a water body off an impaired water body list (or, more importantly, determine the critical number of failures needed to list a water body as impaired), where the number of samples m from a monitoring site is 12. Based on the 90th percentile and with as close to a LCL of 90% as possible, then from E4.1 starting with $i = 12$ as the first candidate and repeating additional candidates by $i - 1$ until the cumulative probability is as close to 90% as possible.

$$\binom{12}{12} 0.9^{12}(0.1)^0 = 0.282$$

$$\binom{12}{11} 0.9^{11}(0.1)^1 = 0.377 \quad (\text{cumulative probability is } 0.282 + 0.377 = 0.659)$$

$$\binom{12}{10} 0.9^{10}(0.1)^2 = 0.230 \quad (\text{cumulative probability} = 0.282 + 0.377 + 0.230 = \mathbf{0.889})$$

$$\binom{12}{9} 0.9^9(0.1)^3 = 0.085 \quad (\text{cumulative probability} = 0.282 + 0.377 + 0.230 + 0.085 = 0.974)$$

Comparing cumulative probabilities with an objective of getting as close to 90% as possible we choose the 0.889 option from the above. From this choice, the minimum number of successes out of 12 trials to keep a water body off an impaired list is 10 (or, conversely, 2 failures out of 12 trials). This is the same as saying that 3 failures out of 12 trials will get a water body listed as impaired (or finding only 9 successes out of 12 trials).

In practice, it is a nuisance calculating binomial probabilities by hand. The Microsoft Excel functions BINOMDIST does most of the work for the analyst. Table 2 was created using this Excel BINOMDIST function. Table 2 shows, using the BINOMDIST function to get as close to 90% confidence as possible, for $m = 3$ to 150 the minimum number of excursions needed to list a water body as impaired and the confidence level associated with that number.

4.3.2 SPECIAL CONSIDERATIONS IN BALANCING OF TYPE I AND TYPE II ERROR

In the case of determining whether or not a water body is impaired, two different kinds of errors can be made. The first is when an unimpaired water body is mistakenly determined to be impaired, called a Type I error. The second is if an impaired water body is erroneously determined to be unimpaired and is called a Type II error. Of special concern to KDHE is Type I error, which could lead to the dedication of time and resources in developing and implementing a TMDL for a water body that was determined to be impaired when it actually is not impaired. In a policy decision, KDHE has chosen to set the acceptable Type I error rate in advance. The 90% confidence limit used by KDHE in its nonparametric method of assessing water bodies for impairment simply means that about 10% of the time a Type I error will occur.

KDHE also has concerns about Type II errors because failure to detect an impairment in a water body when one actually exists also has negative consequences through potential unabated environmental damage stemming from delayed TMDL implementation, and this delay can lead to greater marginal fiscal costs to restore waterbodies. In an effort to reduce the Type II errors associated with the nonparametric method of assessing water bodies, KDHE has added additional considerations to minimize it; the choice of $\alpha = 0.1$ rather than 0.05, determine the necessary number of failures with at least 90% confidence, minimum sample size requirement, and recent trend weighting (explained in 4.3.3).

4.3.3 EMPHASIS OF RECENT TRENDS IN STREAMS

Table 2 shows with as close to 90% confidence as possible for $m = 3$ to 150, the minimum number of excursions needed to list a stream as impaired and the confidence level associated with that number. A final step in the listing methodology will be a check of recent excursions in the samples from a monitoring site. If the number of excursions is within one of the critical number of excursions needed to list a stream as impaired from Table 2, and any one of those excursions occurred in the most recent year of sampling, then that water body will also be placed on the 303(d) list in category 5. Doing so emphasizes recent impairments in the sample data and creates the final step to minimize Type II errors. If the last excursion did not occur in the last year of sampling the water will be put in Category 3 for follow up assessment in the next 303(d) cycle.

4.3.4 CASES WHERE ALTERNATE BACKGROUND CONCENTRATIONS EXIST

In some cases streams have established and approved alternate background concentrations. These alternate background concentrations are identified in Table 1h of the Kansas Surface Water Quality Standards: Tables of Numeric Criteria. These alternate background concentrations were established in each case through the development of a TMDL and subsequent adoption into the water quality standards. In each case a TMDL exists for a site with an alternate background concentration. For the purposes of developing the 303(d) list Kansas shall assess streams with approved alternate background concentrations in Table 1h by use of the average and median values for data from the assessment period of record for the monitoring site, as specified in section 4.1.1 of this document, which typically followed the development of the TMDL. A stream shall be considered impaired if the median value exceeds the alternate background concentration in Table 1h. The stream shall be considered unimpaired if the average and median concentration for the site is less than the alternate background concentration in Table 1h.

4.4 OVERVIEW OF 2014 LISTING METHODOLOGY – STREAM CHEMISTRY

All categories as defined in the EPA Guidance (category definitions available in Table 1) will be submitted as the Kansas 2014303(d) List. Category 5 waters will be submitted as the Kansas 2014 303(d) list. While all readily available data will be assessed, prior years' 303(d) lists have resulted in a suite of parameters for which listings are more likely. These pollutants and the specific assessment methodology used to determine impairment are detailed in the table below.

Impairment	Assessment Method	Notes	Data Source Note
Alachlor	Binomial		
Ammonia	Acute - >1 exceedence/3 years data		
Aquatic Plants	Best Professional Judgment		Lake
Arsenic	Binomial	Annual Average Also	
Atrazine	Binomial		
Boron	Binomial		
Beryllium	Binomial		
Biology	Best Professional Judgment		Biology
Biology/Sediment	Best Professional Judgment		Biology
Cadmium	Chronic - >1 exceedence/3 years data		
Cadmium	Acute - >1 exceedence/3 years data		
Chlordane	Best Professional Judgment		Fish Tissue
Chloride	Binomial	Alternate Background May exist	
Copper	Chronic - >1 exceedence/3 years data		
Copper	Acute - >1 exceedence/3 years data		
Diazinon	>1 detection		
Dissolved Oxygen	Acute - >1 exceedence/3 years data		
<i>E. coli</i>	Flag Binomial, GeoMean for confirmation		
Eutrophication	By chlorophyll a concentration	As outlined in 303(d) methods	Lake
Fluoride	Binomial	Alternate Background May exist	
Gross Alpha	Best Professional Judgment		Separate Monitoring
Lead	Chronic - >1 exceedence/3 years data		
Lead	Acute - >1 exceedence/3 years data		
Mercury	Acute - >1 exceedence/3 years data	Typically Fish Tissue	Fish Tissue
Nitrate	>1 exceedence		
PCB	>1 detection	Typically Fish Tissue	Fish Tissue
Perchlorate	>1 detection	Typically Fish Tissue	Fish Tissue
pH	Binomial		
Selenium	Chronic - >1 exceedence / 3 years data	Alternate Background May exist	
Siltation	Best Professional Judgment		Lake
Sulfate	Binomial	Alternate Background May exist	
Temperature	Acute - >1 exceedence/3 years data		
Total Phosphorus	Median >201ug/L		
Total Suspended Solids	Median >50 mg/L		
Uranium	Avg >30 ug/L		
Zinc	Chronic - >1 exceedence/3 years data		
Zinc	Acute - >1 exceedence/3 years data		

4.4.1 STREAM CHEMISTRY ASSESSMENT UNITS - CATEGORIZATION

The following ordered steps will apply:

- 1) Screen for the domestic water supply nitrate criteria where a greater than one excursion provides support for listing in Category 5.
- 2) Screen for acute aquatic life violations for each monitoring site. If more than 3 samples from a fixed monitoring site (2004-2013 data) exceed acute aquatic life criteria and more than 1 or 2 samples (depending on number of years of data) from a rotational monitoring site (1990 to 2013 data) exceed acute aquatic life criteria, then the monitoring site's AU will be listed on the 2014 303(d) List (Category 5). Table 3 provides information on the exact number of exceedences needed to list for a given number of monitoring years.
- 3) The 10% raw score will provide the next screen for the pollutant data from monitoring sites. Those sites that fail the raw score test (>10% excursion) will be subject to the binomial test described in Section 4.3.1.

- 4) If the binomial test indicates impairment then the AU will be placed on the 2014 303(d) List (Category 5).
- 5) If the binomial test indicates full support, those sites will be subject to the final screen, a check for evidence of recent excursions in the sample data. If the number of excursions is within one of the critical number of excursions (Table 2) needed to list an AU and any one of those excursions occurred within the most recent year of sampling at the monitoring site, then that AU will also be listed on the 2014 303(d) List in Category 5. If the last excursion occurred earlier, the AU will be placed in Category 3 for follow up assessment for the 2016 303(d) List.

4.4.2 CONTINUOUS DATA

USGS continuous data samplers are to be evaluated and considered. Daily averages are utilized to assess impairment utilizing methods described in section 4.4.1.

4.5 STREAM CHEMISTRY CATEGORY 5 PRIORITY FOR TMDL DEVELOPMENT

Consistent with Kansas' emerging TMDL Vision Strategy, establishing priorities for TMDL development between 2014 and 2022, certain AUs containing streams impaired by total phosphorus in certain HUC 8s will be designated for TMDL development. The targeted HUC 8s and impaired streams intended for TMDLs in 2014 are:

HUC 8 Subbasin	Stream Chemistry Station	Stream Assessment Unit	Targeted TMDL Development Year
11070201 Neosho Headwaters	SC273	Neosho River at Neosho Rapids	2014
	SC637	Neosho River near Parkerville	2014
11070203 Lower Cottonwood	SC274	Cottonwood River below Emporia	2014
11070205 Middle Neosho	SC564	Labette Creek near Labette	2014
11070207 Spring	SC567	Cow Creek near Lawton	2014
	SC212	Shoal Creek near Galena	2014

	SC570	Short Creek near Galena	2014
11030017 Upper Walnut	SC279	Walnut River below El Dorado	2014
	SC038	Whitewater River at Towanda	2014
11030018 Lower Walnut	SC106	Walnut River at Gordon	2014
	SC704	Eight Mile Creek near Douglass	2014
	SC744	Four Mile Creek near Gordon	2014

The HUC 8s and associated impaired streams impacted by phosphorus slated for TMDL development in 2015 are:

HUC 8 Subbasin	Stream Chemistry Station	Stream Assessment Unit	Targeted TMDL Development Year
10270101 Upper Kansas	SC518	Kansas River near Ogden	2015
10270102 Middle Kansas	SC260	Kansas River near Wamego	2015
	SC259	Kansas River at Willard	2015
10270104 Lower Kansas	SC257	Kansas River at Lecompton	2015
	SC255	Kansas River at Eudora	2015
	SC254	Kansas River at Desoto	2015
	SC203	Kansas River at Kansas City	2015

Subsequent years will be tied to TMDL development in certain HUC 8s for streams impaired by excessive total phosphorus. The year 2017 will be used to catch up on TMDL development in previous AUs that slipped past the end of their designated year and also to develop TMDLs for any emerging issues involving pollutants other than phosphorus. Targeted HUC 8 TMDL development will re-commence in 2018 – 2020 with another catch up period in 2021 prior to the grand evaluation of TMDL impacts, possible revision to existing TMDLs and designation of the next 10 years of priorities in 2022. Adjustments to targeted AUs will be made with the submission of each biennial Integrated Report.

Targeted HUC 8s	Intended TMDL Development Year
11030012 Little Arkansas	2016
11030013 Middle Arkansas – Slate	2016
TMDL Slippage & Ad hoc Addressed Impairments	2017
10260008 Lower Smoky Hill	2018
10250017 Lower Republican	2019
10260103 Delaware	2019
10260205 Lower Big Blue	2019
11030012 Little Arkansas	2020
11030013 Middle Arkansas – Slate	2020
TMDL Slippage & Ad hoc Addressed Impairments	2021
Evaluation and Revision of Existing TMDLs & Re-Designation of Priorities for 2023 - 2032	2022

4.6 STREAM CHEMISTRY ASSESSMENT UNITS - CONSIDERATIONS FOR DELISTING

4.6.1 GENERAL DELISTING CONSIDERATIONS

The assessment of water quality monitoring data from January 1st, 2000 forward provided KDHE with reason to delist a number of existing stream/pollutant impairments through the 2010 and 2012 303(d) listing cycles. In general, these delistings were concentrated in the permanent KDHE stream monitoring sites, which provide yearly data, increasing the sample size available for assessment. Rotational sites may show signs of improved water quality, but generally did not have adequate sample sizes at the time to propose delistings. The situation in 2014 is similar to that of 2010 and 2012. Additionally, existing TMDLs addressing impairments indicate the desired timeframe in which to subsequently collect and assess data to support removal of the impairment. Decisions to delist those streams will be predicated on the data collected during the timeframe indicated by the TMDL. A delisting shall be signified in the 303(d) list as a Category 2 stream, indicating a stream formerly listed as impaired, with (Category 4A) or without a TMDL (Category 5), but now no longer assessed as impaired. In general, if a stream was previously listed as a Category 5 water, and no longer meets the listing requirements as discussed in Section 4 of this document, the stream may be delisted. Other specific cases shall be assessed as follows.

4.6.2 DISCONTINUED SUBSTANCES

The first group of potential delistings relate to substances that are no longer produced or used in the United States. Because these substances should have no new loading sources they are expected to decline in concentration over time until they no longer pose a human health risk. These substances are assessed through the use of fish tissue analysis, and may be delisted if ongoing monitoring no longer supports KDHE designated consumption advisories and the advisory is withdrawn.

4.6.3 SUBSTANCES WITH APPROVED BACKGROUND CONCENTRATIONS

Kansas Surface Water Quality Standards provide that “In stream segments where background concentrations of naturally occurring substances, including chlorides and sulfates, exceed the water quality criteria listed in table 1a of the ‘Kansas surface water quality standards: tables of numeric criteria,’ as adopted by reference in subsection (d) of this regulation, at ambient flow, the existing water quality shall be maintained, and the newly established numeric criteria shall be the background concentration, as defined in K.A.R. 28-16-28b(e).”

These alternate background concentrations are found in Table 1h of the water quality standards, and shall be used to assess the presence of impairment on waters where such alternate background concentrations exist for the most recently approved Kansas Surface Water Quality Standards. In cases where monitoring data from the period of record assessed for 303(d) listing purpose has an average and median concentration less than the alternate background concentration, the stream/pollutant combination shall be delisted.

4.6.4 METALS

KDHE has listed a number of water bodies as impaired by cadmium, copper, lead and zinc for both chronic and acute aquatic life impairments. While some specific locations in the state with historic mining impacts continue to show ongoing impairment, other locations statewide have shown a sporadic pattern with regard to metal impairments, particularly copper and lead. Without attributing the decline to specific actions, KDHE believes that many of these listings are likely tied to unstable flow conditions. An analysis using aluminum concentrations as a signal of unstable flow is used to discount samples of high metal concentrations. Removing those outlier data tends to show no ongoing impairment based on the monitoring data for the 2014 303(d) listing cycle. These metal impairments can be divided into two groups, those with approved TMDLs and those that have been 303(d) listed, but do not have a TMDL developed. In the case of the former, a delisting assessment shall be based on the preponderance of evidence from all available sources of no impairment present in the stream since the TMDL was approved. In the case of the latter a delisting shall be implemented if the monitoring data no longer fails the chronic assessment procedure outlined in section 4.3 of this document, after discounting certain data thought to occur during unstable flow.

4.6.5 BACTERIA

In 2003 Kansas altered the water quality standards for bacterial contamination in surface waters. Prior to the change, streams were assessed and listed based on fecal coliform bacteria concentrations, and data analysis was similar to other pollutants with binomial assessments. After the adoption of new water quality standards the indicator was changed to *E. coli* and the requirement for listing became the geometric mean for five samples collected over 30 days exceeding the applicable criterion. Because this standard cannot be assessed with the regularly collected water sampling programs implemented by KDHE an alternative method of assessment was adopted. In this method streams with either existing TMDLs for bacteria or previous 303(d)

listings for bacteria were targeted on a rotating basin approach outlined in section 4.2.2 of this document. Where none of the intensive sampling events generated geometric mean violations in two separate years, the stream will be delisted from either the existing TMDL (Category 4A) or the 303(d) listing (Category 5). The stream stations that have undergone intensive bacteria monitoring are listed in Table 4.

4.6.7 TYPOGRAPHICAL ERRORS AND OTHER CORRECTIONS

Typographical errors and listing errors from the 2012 303(d) List will be corrected in the 2014 303(d) List. In cases where an impairment was previously reported, but the impairment reporting was based on typographical errors the site will be delisted if the monitoring data indicates that no impairment exists. Other corrections to the list will be made as needed to most accurately reflect the status of Kansas waters.

5.0 STREAM BIOLOGY METHODOLOGY

5.1 SAMPLE SIZE REQUIREMENTS AND TEMPORAL BOUNDS OF DATA - BIOLOGY

A minimum of 3 samples will be required to assess biological and fish tissue data. For data collected from biological and fish tissue surveys, the same assessment period that is used in the 2014 305(b) Report will be used for the 2014 303(d) List.

5.2 STREAM BIOLOGY - CATEGORIZATION FOR LISTING

- 1) Determine if the stream biological impairment appears on 2012 303(d) list and has not had a TMDL developed. If so, list in Category 5.
- 2) For biological monitoring stations with three or more samples over the latest five years, if Aquatic Life Use Support Index (ALUS index) indicate partial or non-support, list in Category 5.
- 3) If fish tissue samples show excessive amounts of bio-accumulative pollutants (PCB, chlordane, mercury, etc.) for three or more years over the latest five years, or if a consumption advisory exists for that water, list in Category 5.

5.3 STREAM BIOLOGY ASSESSMENT METHODOLOGY FOR AQUATIC LIFE USE SUPPORT

Biological condition was assessed with the Aquatic Life Use Support Index (ALUS Index). The index was designed to assess the response of macroinvertebrate communities to a wide variety of

stressors including various toxics, low dissolved oxygen and sedimentation. The index is composed of five metrics. Following EPA Rapid Bioassessment Protocol guidance (EPA 1999), data from candidate reference sites and regular targeted network sites were used to standardize the metrics to a dimensionless scale. Metric scores were aggregated to generate the ALUS index score. The ALUS Index score consists of five categorizations of biotic condition or three levels of aquatic life support.

The Biological metrics utilized in the ALUS Index are as follows:

1. Macroinvertebrate Biotic Index (MBI) (Davenport and Kelly 1983) - A measure used to evaluate the effects of nutrients and oxygen demanding pollutants on macroinvertebrate communities. The index provides order and family level tolerance values for several benthic macroinvertebrate classes. The value represents a weighted average tolerance value for the organisms in a sample. The value is weighted by the number of individuals in each taxa.
2. Kansas Biotic Index for Nutrients (KBI-N) (Huggins and Moffett 1988) – Mathematically equivalent to the MBI, however the tolerance values are species specific and restricted to aquatic insect orders.
3. Ephemeroptera, Plecoptera and Trichoptera Index (EPT) - The number of taxa belonging to the insect orders Ephemeroptera, Trichoptera, and Plecoptera. Most species in these insect orders are considered intolerant of water quality and habitat perturbations.
4. EPT Percent of Count (EPT % CNT) – The percentage of organisms in a sample consisting of individuals belonging to the EPT orders.
5. Shannon’s Evenness – A measure of diversity that describes how evenly distributed the numbers of individuals are among the taxa in a sample.

ALUS Index metrics with scoring ranges and standardized scores.

MBI	KBI-N	EPT	EPT % CNT	SHN EVN	SCORE
<=4.18	<=2.52	>=16	>=65	>=0.849	4
4.19-4.38	2.53-2.64	14-15	56-64	0.826-0.848	3
4.39-4.57	2.65-2.75	12-13	48-55	0.802-0.825	2
4.58-4.88	2.76-2.87	10-11	38-47	0.767-0.801	1
>=4.89	>=2.88	<=9	<=37	<=0.766	0

ALUS Index score range, interpretation of biotic condition, and supporting, partial and no supporting categories.

ALUS Index Score	Biotic Condition	Support Category	Reporting Category
17 -20	Very Good	Supporting	1 – If Never Impaired 2- If previously impaired
16 -14	Good		
13 - 7	Fair	Partially Supporting	5 – If no TMDL Exists 4a – If TMDL exists
6 - 4	poor	Non-supporting	
3 - 1	Very Poor		

5.4 STREAM BIOLOGY CRITERIA FOR FISH CONSUMPTION ADVISORIES AND ASSESSMENT FOR FOOD PROCUREMENT USE SUPPORT

- 1) If a fish consumption advisory was in effect within a waterbody segment then food procurement use was assigned “Not Supported” for that segment.
- 2) If a fish consumption advisory was not in effect in a sampled segment, then the food procurement use was assigned “Fully Supporting” of Food Procurement Use.

Fish consumption advisories are issued, in general, based on data from a minimum of three duplicate (6 total) composite samples (3-5 fish) collected over a three year period. Fish consumption advisories were developed following EPA guidelines using risk assessment methodology (KDHE 2007a, EPA 1989, 1995 a-b, 2000 a-b).

5.5 STREAM BIOLOGY PRIORITY METHOD FOR TMDL DEVELOPMENT

Pursuant to Kansas’ TMDL Vision Strategy, priority will be given to those streams in certain eastern and central Kansas HUC 8s that are impaired by total phosphorus. For those streams that also are listed as having their aquatic biological communities impaired, the associated TMDLs will address any nutrient impacts on stream biology. If other pollutants are implicated as creating the stress on the aquatic community, those impairments will be addressed in subsequent (after 2015) TMDLs. Otherwise, the following criteria on data over the latest five years will continue to determine the priority among biology impairments.

Apply the following criteria on data over the latest five years to determine the priority:

- 1) Medium priority goes to streams with an ALUS index metric score showing partial support.
- 2) Lower priority goes to streams with an ALUS index metric score showing non-support with a poor biotic condition or impairments appearing through fish tissue analysis. Best professional judgment may be used to move a station from lower priority to medium priority.
- 3) Lowest priority goes to streams with an ALUS index metric score showing non-support with a very poor biotic condition.
- 4) Streams that have only one to two biological samples from the latest five years and show any designation of less than full support that has not previously had a TMDL developed, will be deemed Category 3.
- 5) Streams that are identified as fully supporting in the 2012 305(b) report and listed as partially supporting in the 2014 305(b) report, where the impairment is potentially drought linked, shall be listed as Category 3.

5.6 STREAM BIOLOGY ASSESSMENTS- CONSIDERATIONS FOR DELISTING

- 1) For biological monitoring stations listed in 2012, if the latest five years have three or more samples and indicate full-support for all of the biological metrics, delist.
- 2) For fish tissue samples listed in 2012, if the latest five years have three or more years of monitoring and indicate compliant amounts of bio-accumulative pollutants (PCB, chlordane, mercury, etc.), delist.

6.0 LAKE AND WETLAND METHODOLOGY

6.1 SAMPLE SIZE REQUIREMENTS AND TEMPORAL BOUNDS OF DATA – LAKE/WETLAND

There are not a minimum number of samples needed for assessing lake/wetland data. For data collected from lakes and wetlands, the assessment period from 2000-2013 will be used in the 2014 303(d) List.

6.2 CONTACT RECREATION – LAKE/WETLAND

As applied to classified lakes and wetlands, Kansas has a Primary Contact Recreation (PCR) ‘not to exceed’ standard derived from a single sample maximum or a geometric mean calculated from at

least five *E. coli* samples collected from separate 24-hour periods within a 30-day period for PCR classes as follows (K.A.R. 28-16-28e(c)(7)(B) (table 1j)):

PCR Swimming Beach; 160 cfu/100mL or single sample maximum of 732 cfu/100mL (in effect from April 1 through October 31 each year)

PCR: Swimming Beach; 800 cfu/100mL or single sample maximum of 3655 cfu/100mL (in effect from November 1 through March 31 each year)

PCR: Public Access; 262 cfu/100mL or single sample maximum of 1198 cfu/100mL (in effect from April 1 through October 31 each year)

PCR: Public Access; 1310 cfu/100mL or single sample maximum of 6580 cfu/100mL (in effect from November 1 through March 31 each year)

PCR: Restricted Access; 427 cfu/100mL or single sample maximum of 1950 cfu/100mL (in effect from April 1 through October 31 each year)

PCR: Restricted Access; 2135 cfu/100mL or single sample maximum of 9760 cfu/100mL (in effect from November 1 through March 31 each year)

A Secondary Contact Recreation (SCR) 'not to exceed' standard derived from a single sample maximum or a geometric mean of at least five samples collected during separate 24-hour periods within a 30-day period for SCR classes are as follows (K.A.R 28-16-28e (c)(7)(c) (table1j)):

SCR: Public Access and Restricted Access; 2135 cfu/100mL or single sample maximum of 9760 cfu/100mL (in effect from January 1 through December 31 each year)

6.3 LAKE AND WETLAND ASSESSMENT UNITS - CATEGORIZATION FOR LISTING

- 1) Determine if the lake or wetland assessment unit appears on the 2012 Section 303(d) list and has not had a TMDL developed or qualify for delisting for its specified impairment(s). If a TMDL has not been developed and the impairment does not qualify for delisting, list in Category 5.
- 2) For lakes not listed in 2012 for eutrophication, if the lake has a designated use of primary contact recreation but is not an active public water supply and the overall chlorophyll *a* average concentration is greater than 12 ppb or if the chlorophyll *a* concentration is greater than 12 ppb for more than one sample since 2000 and one of the excursions has been obtained during the two most recent sampling dates, list in Category 5.
- 3) For lakes not listed in 2012 for eutrophication, if the lake has a designated use of secondary contact recreation and the overall chlorophyll *a* average concentration is

greater than 20 ppb or if the chlorophyll *a* concentration is greater than 20 ppb for more than one sample since 2000 and one of the excursions has been obtained during the two most recent sampling dates, list in Category 5.

- 4) For lakes not listed in 2012 for eutrophication, if the lake has an existing use of domestic water supply and the overall chlorophyll *a* average concentration is greater than 10 ppb, list in Category 5.
- 5) If the lake or wetland, for any other parameter, exceeded water quality standards or regional norms for more than one year since 2000 and one of the excursions has been obtained during the two most recent sampling dates, list in Category 5.

6.4 LAKE PRIORITY (CATEGORY 5) DETERMINATION METHOD FOR TMDL DEVELOPMENT

While priority for TMDL development over 2014 – 2022 will focus on stream impairment from phosphorus or nitrate in selected HUC 8s, under certain circumstances, lakes that are impaired by eutrophication may be designated for TMDL development. Those lakes within the Neosho Headwaters, Middle Neosho, Spring, Upper Walnut, Lower Walnut, Middle Kansas or Lower Kansas HUC 8 subbasins that are noted through the 305b assessment as impaired by eutrophication and serve as an active or standby public water supply (as noted in Kansas’ proposed water quality standards) or have suffered an outbreak of cyanobacteria blooms since 2010 will be slated to have a TMDL established. The timing of preparing these lake TMDLs may be within the targeted year assigned to the respective HUC 8 or in the catch-up period of 2017 used to address ad hoc or ongoing impairment issues. The following table provides a guide of probable TMDL development in lakes within the seven targeted HUC 8s over the next two years.

Subbasin	Lake	Station Number	Rationale	Possible TMDL Development Years
Neosho Headwaters	Lake Kahola	LM043401	Emporia Water Supply	2014 or 2017
Upper Walnut	Augusta City Lake	LM040001	Augusta Water Supply, Cyanobacteria Bloom in 2011 & 2013	2014 or 2017
Lower Kansas	Strowbridge Reservoir	LM051201	Carbondale Water Supply	2015 or 2017
	Rose’s Lake	LM062501	Cyanobacteria Bloom in 2013	2015 or 2017

6.5 LAKE AND WETLAND ASSESSMENT UNITS - CONSIDERATIONS FOR DELISTING

- 1) For lakes used for public water supply and listed for eutrophication on the 2012 list, if the two latest sampling dates have chlorophyll *a* concentrations below 10 ppb and no TMDL has yet been developed, delist.
- 2) For lakes designated for primary contact recreation and listed for eutrophication on the 2012 list, if the two latest sampling dates have chlorophyll *a* concentrations less than 12 ppb and no TMDL has yet been developed, delist.
- 3) For lakes and wetlands designated for secondary contact recreation and listed on the 2012 list for eutrophication, if the two latest samples have chlorophyll *a* concentrations less than 20 ppb and no TMDL has yet been developed, delist.
- 3) For lakes and wetlands, if the two latest samples, for any other parameter, attain water quality standards or regional norms, delist.

7.0 ADDITIONAL CONSIDERATIONS

7.1 ADDITIONAL CONSIDERATIONS IN PRIORITY

Domestic water supply nitrate impairments for streams within the specific HUC 8s targeted for nutrient (total phosphorus) impairments in streams will be designated for TMDL development in 2014 and 2015. There currently are no such Category 5 nitrate streams in the Neosho Headwaters, Lower Cottonwood, Middle Neosho, Spring, Upper Walnut, Lower Walnut, Upper Kansas, Middle Kansas or Lower Kansas subbasins. Re-evaluation and designation of other streams impacted by nitrate in other basins and subbasins for TMDL development will be done during the development of the 2016 Integrated Report.

7.2 CATEGORY 3 WATERS

In addition to streams that are identified as needing more intensive bacteria sampling over the next listing cycle, a number of stream biology and lake stations are identified as Category 3 because they have insufficient data. In the case of stream biology, one additional seasonal sample is necessary to determine its listing status for 2016. For some lakes, no data have been collected since 1997, though the data from prior to 1998 indicated some degree of impairment. Contemporary sampling will determine the listing status for these lakes. Streams placed in Category 3 because of binomial analysis was one excursion short of listing and the last excursion occurred prior to the last year of sampling will be reassessed as part of the 2016 listing process.

7.3 BASING ADVISORY COMMITTEE INPUT

In some cases, Basin Advisory Committees associated with the *State Water Plan* and comprising individuals residing within each of the twelve river basins will offer input to revise the priority listing of certain waters within their basins. Typically, this input serves to elevate a waterbody that was originally not scheduled to have a TMDL developed in the next cycle and directs that a TMDL to be prepared while TMDL development occurs in that given basin. Similarly, input from watershed and lake-specific WRAPS groups may offer input on priorities of listed waters.

7.4 CONSIDERATION OF ANTIDegradation IN 303(D) LISTINGS

40 C.F.R. 131.6 lists the minimum elements required of water quality standards that are submitted to EPA for review and approval, including *(d) An antidegradation policy consistent with §131.12*. Antidegradation is defined in Kansas surface water quality standards as “...*the regulatory actions and measures taken to prevent or minimize the lowering of water quality in surface waters of the state, including those streams, lakes, and wetlands in which existing water quality exceeds the level required for maintenance and protection of the existing uses.*” (K.A.R. 28-16-28b (y)). This is accomplished through the Kansas antidegradation policy, described at K.A.R. 28-16-28b (ff), and adopted by reference by the water quality standards. Kansas’ antidegradation policy is described in more detail at K.A.R. 28-16-28c (a). Four tiers of water quality are maintained and protected by the Kansas antidegradation policy, in accord with 40 C.F.R. 131.12:

1. Levels of water quality in surface waters of the state shall be maintained to protect the existing uses of those surface waters (Tier 1).
2. For waters with existing water quality better than applicable water quality criteria, that water quality shall be fully maintained and protected and may be lowered only if such lowering is needed to allow for important social or economic development in the geographic area of such waters. Existing uses shall be maintained and protected and the highest statutory and regulatory requirements for all new and existing point sources of pollution and all cost-effective and reasonable best management practices for nonpoint sources of pollution shall be achieved (Tier 2).
3. For exceptional state waters, discharges are allowed only if existing uses and existing water quality are maintained and protected (Tier 2.5).
4. For Outstanding National Resource Waters, existing uses and water quality are to be maintained and protected and new or expanded discharges shall not be allowed (Tier 3).

These four tiers of waters comprise the inventory of classified waters in Kansas. Such waters are classified as General Purpose, Exceptional State Waters or Outstanding National Resource Waters. The purpose of the Kansas 303(d) program is to restore waters to Tier 1 status, maintaining existing uses. Tier 2 waters are protected from new or expanded discharges of pollutants on a case-by-case and pollutant specific basis. This analysis is conducted through the NPDES permitting process to determine alternatives to discharging or protective conditions attached to permitted discharges. Tier 2.5 and 3 waters are protected by discouraging or prohibiting new or expanded discharges into such waters.

There are seven Tier 3 Outstanding National Resource Waters in Kansas. Five of these waters have TMDLs or are listed for certain pollutants. The remaining two are associated with impaired waters within their watersheds or adjoining them. There are 68 stream segments and 8 lakes or wetlands designated as Tier 2.5; exceptional state waters. Many of these are long reaches of rivers such as the Neosho, the Marais des Cygnes, the Cimarron, the Chikaskia, the Walnut, the Fall or the Smoky Hill rivers. Many of these exceptional state waters are also in Category 4A or Category 5. Because of the Kansas antidegradation policy, and the location of high quality waters relative to population centers and industrial activity, the vast majority of any impairment on the higher quality waters is caused by non-point sources of pollutants.

Therefore, the antidegradation policy portion of the Kansas water quality standards offers independent protection to high quality waters but only from the narrow niche of future new or expanding sources of pollutants. The policy does not apply well to non-point sources of pollutants. While adherence to the antidegradation policy essentially shields certain Kansas waters from 303d listing, the policy does not address the act of degradation in water quality nor does the Kansas water quality standards. Degradation in water quality can be determined by analysis of trends in water quality and where such trends are seen or suspected, the associated water is placed in Category 3 for additional assessment and determination or Category 5 if the evidence is substantial that water quality standards will not be achieved in the future on that water. Because of the predominant non-point source loading into Kansas waters, trends are a function of changing land use and weather patterns and are often confounded by the wide variability inherent in most water quality data.

Kansas assessment protocols under the 303(d) methodology attempt to be fairly conservative in listing possible impairments by emphasizing deficient conditions seen in the most recent years as potential evidence of water quality standards not being achieved, even though the statistical analysis shows compliance. Along with the placement of uncertain waters in Category 3 for subsequent assessment in the next listing cycle, the conservative assumptions underlying Kansas listings analysis provides some modicum of protection to waters on the brink of failing to meet their water quality standards. In taking these steps, Kansas is upholding the spirit and letter of Section 303(d) of the CWA.

8.0 PUBLIC PARTICIPATION

The public was invited to comment on this methodology and the draft list generated through this methodology. A draft of this methodology was posted on the KDHE TMDL Web site <http://www.kdheks.gov/tmdl/index.htm>. The draft list will be released on February 1, 2014 for public review and comment. The priorities within the list may be modified based on feedback provided by the Basin Advisory Committees (BACs) and Watershed Restoration and Protection Strategy (WRAPS) groups. BACs set priorities within their basins and these priorities may influence which TMDLs will be developed within the basin. WRAPS incorporate high priority TMDLs into their watershed plans and direct implementation of pollutant load reduction practices in their watersheds to achieve TMDLs.

8.1 PUBLIC HEARING DATES AND LOCATIONS

KDHE will hold a public hearing to receive comments on the proposed 2014 Section 303(d) List in Topeka at the end of February, 2014.

8.2 PUBLIC COMMENTS AND AGENCY RESPONSE

Public comments will be taken at the public hearing through March 14 2014. Late interest in commenting on the list of impaired waters and the methodology may prompt KDHE to extend the open period. After the public record closes, KDHE will consider the received comments, formulate a response to those comments and will post the comments and responses on its TMDL Web site.

9.0 SUBMITTAL TO EPA REGION 7

The finalized Section 303(d) List for 2012, public comments received by KDHE regarding the 303(d) List, and KDHE response to public comments will be submitted to EPA Region 7 on March 28, 2014.

10.0 REFERENCES

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Table 1

Five EPA Reporting Categories and Kansas Interpretation

- Category 1:** All designation uses are supported, no use is threatened; **Kansas:** Water has never been listed
- Category 2:** Available data and/or information indicate that some, but not all of the designated uses are supported; **Kansas:** Water use was previously listed but now has water quality sufficient to support designated uses
- Category 3:** There is insufficient available data and/or information to make a use support designation; **Kansas:** No recent data to indicate use support, water falls short of statistical impairment, bacteria data
- Category 4:** Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed
Kansas:
4a: TMDL has been developed for water
4b: NPDES permits addressed impairment or watershed planning is addressing atrazine problem
4c: Pollution (typically insufficient hydrology) is causing impairment
- Category 5:** Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed; **Kansas: 303(d) list**

Table 2
Binomial Listing Criteria Critical Values

Samples	Exceedences	Confidence Level %
3	3	0.999
4	3	0.996
5	3	0.992
6	3	0.985
7	3	0.977
8	3	0.967
9	3	0.955
10	3	0.943
11	3	0.929
12	3	0.915
13	3	0.900
14	4	0.965
15	4	0.957
16	4	0.949
17	4	0.940
18	4	0.930
19	4	0.920
20	4	0.910
21	5	0.962
22	5	0.956
23	5	0.949
24	5	0.943
25	5	0.935
26	5	0.928
27	5	0.920
28	5	0.913
29	6	0.958
30	6	0.953
31	6	0.947
32	6	0.941
33	6	0.936
34	6	0.930
35	6	0.924
36	7	0.961
37	7	0.956
38	7	0.952
39	7	0.947

Samples	Exceedences	Confidence Level %
40	7	0.942
41	7	0.937
42	7	0.932
43	7	0.927
44	8	0.960
45	8	0.956
46	8	0.952
47	8	0.948
48	8	0.944
49	8	0.940
50	8	0.936
51	9	0.964
52	9	0.960
53	9	0.957
54	9	0.954
55	9	0.950
56	9	0.946
57	9	0.943
58	9	0.939
59	9	0.935
60	10	0.961
61	10	0.958
62	10	0.955
63	10	0.952
64	10	0.949
65	10	0.946
66	10	0.942
67	10	0.939
68	11	0.962
69	11	0.960
70	11	0.957
71	11	0.954
72	11	0.951
73	11	0.948
74	11	0.945
75	11	0.942
76	12	0.963

Samples	Exceedences	Confidence Level %
77	12	0.961
78	12	0.959
79	12	0.956
80	12	0.953
81	12	0.951
82	12	0.948
83	12	0.945
84	13	0.965
85	13	0.963
86	13	0.960
87	13	0.958
88	13	0.956
89	13	0.953
90	13	0.951
91	13	0.948
92	14	0.966
93	14	0.964
94	14	0.962
95	14	0.960
96	14	0.958
97	14	0.955
98	14	0.953
99	14	0.951
100	15	0.967
101	15	0.965
102	15	0.964
103	15	0.962
104	15	0.960
105	15	0.958
106	15	0.956
107	15	0.953
108	15	0.951
109	16	0.967
110	16	0.965
111	16	0.963
112	16	0.961
113	16	0.960

Samples	Exceedences	Confidence Level %
114	16	0.958
115	16	0.956
116	16	0.954
117	16	0.952
118	17	0.967
119	17	0.965
120	17	0.963
121	17	0.961
122	17	0.960
123	17	0.958
124	17	0.956
125	17	0.954
126	18	0.968
127	18	0.966
128	18	0.965
129	18	0.963
130	18	0.962
131	18	0.960
132	18	0.958
133	18	0.957
134	18	0.955
135	19	0.968
136	19	0.966
137	19	0.965
138	19	0.963
139	19	0.962
140	19	0.960
141	19	0.959
142	19	0.957
143	20	0.969
144	20	0.968
145	20	0.966
146	20	0.965
147	20	0.964
148	20	0.962
149	20	0.961
150	20	0.959

Table 3
Acute Listing Criteria Critical Values

1 Year of Data- 1 exceedence shall be Category 3, 2 or more exceedences shall be Category 5 unless a TMDL already exists, in which case the station/pollutant combination shall be 4a

2-5 Years of Data- More than 1 exceedence shall be Category 5, unless a TMDL already exists, in which case the station/pollutant combination shall be 4a

6-8 Years of Data- More than 2 exceedences shall be Category 5, unless a TMDL already exists, in which case the station/pollutant combination shall be 4a

9-10 Years of Data- More than 3 exceedences shall be Category 5, unless a TMDL already exists, in which case the station/pollutant combination shall be 4a

Table 4. Stream Monitoring Stations that have Undergone Intensive Bacteria Sampling Since 2006

Station	Basin	Year(s)	Stream	Station	Basin	Year(s)	Stream	Station	Basin	Year	Stream
SC203	KLR	2006, 2008	Kansas River At Kansas City, Kansas	SC635	NEO	2007, 2011	South Cottonwood River Near Canada	SC595	UARK	2009	Walnut Creek At Ness City
SC254	KLR	2006, 2008	Kansas River At De Soto	SC637	NEO	2007, 2011	Neosho River Near Parkerville	SC109	KLR	2010	Wakarusa River Near Topeka
SC255	KLR	2006, 2008	Kansas River At Eudora	SC691	NEO	2007, 2011	Mud Creek Near Marion	SC238	KLR	2010	Shungauganga Creek Near Topeka
SC257	KLR	2006, 2008	Kansas River At Leocompton	SC289	VERD	2007, 2011	Verdigris River Near Virgil	SC251	KLR	2010	Mill Creek Near Shawnee
SC259	KLR	2006, 2008	Kansas River At Willard	SC563	VERD	2007, 2011	Verdigris River Near Independence	SC252	KLR	2010	Cedar Creek Near Cedar Junction
SC260	KLR	2006, 2008	Kansas River At Wanego	SC575	VERD	2007, 2011	Fall River Near Climax	SC253	KLR	2010	Kill Creek At Desoto
SC318	KLR	2006, 2008	Kansas River Near Ogdan	SC607	VERD	2007, 2011	Big Hill Creek Near Avian	SC500	KLR	2010	Wakarusa River Near Eudora
SC218	LARK	2006	Arkansas River Near Arkansas City	SC693	VERD	2007	Elk River Near Howard	SC501	KLR	2010	Stranger Creek Near Linwood
SC281	LARK	2006, 2009	Arkansas River At Derby	SC696	VERD	2007, 2011	Chetopa Creek Near Neodesha	SC554	KLR	2010	Delaware River Near Half Mound
SC323	LARK	2006	Arkansas River Near Hutchinson	SC654	WALN	2007, 2011	Rock Creek Near Rock	SC602	KLR	2010	Stranger Creek Near Easton
SC324	LARK	2006	Arkansas River Near Yoder	SC655	WALN	2007, 2011	Little Walnut River Near Douglas	SC603	KLR	2010	Grasshopper Creek Near Muscotah
SC328	LARK	2006, 2009	Slate Creek Near Wellington	SC239	KLR	2008, 2013	Soldier Creek Near Topeka	SC207	MDC	2010	Little Osage River Near Fulton
SC336	LARK	2006	Arkansas River Near Maize	SC258	KLR	2008	Kansas River At Topeka	SC208	MDC	2010	Marmaton River Near Fort Scott
SC729	LARK	2006, 2009	Arkansas River At Wichita	SC262	KLR	2008	Kansas River At Manhattan	SC270	MDC	2010	Marais Des Cygnes River Near Ottawa
SC274	NEO	2006, 2011	Cottonwood River Near Emporia	SC506	KLR	2008	West Branch Mill Creek Near Alma	SC557	MDC	2010	Bull Creek Near Henson
SC369	NEO	2006	Shawnee Creek Near Crestline	SC517	KLR	2008	Clarks Creek Near Grandview Plaza	SC578	MDC	2010	Salt Creek Near Lyndon
SC102	SMSA	2006	Smoky Hill River Near Arnold	SC519	KLR	2008	South Branch Mill Creek Near Alma	SC579	MDC	2010	One Hundred Forty Two Mile Creek Near Reading
SC224	SMSA	2006	Smoky Hill River At Elkader	SC520	KLR	2008	Vermillion Creek Near Louisville	SC742	MDC	2010	Marais Des Cygnes River Near Reading
SC265	SMSA	2006	Smoky Hill River At Enterprise	SC521	KLR	2008	Mill Creek Near Maple Hill	SC201	MOU	2010	Wolf River Near Sparks
SC314	SMSA	2006, 2012	Smoky Hill River Near Mentor	SC551	KLR	2008	Cross Creek Near Rossville	SC204	MOU	2010	Indian Creek At Kansas City, Missouri
SC315	SMSA	2006	Chapman Creek Near Sutphen	SC639	KLR	2008, 2013	Muddy Creek Near Grantville	SC205	MOU	2010	Blue River Near Stanley
SC340	SMSA	2006, 2012	Big Creek Near Munjor	SC648	KLR	2008, 2013	Mission Creek Near Valencia	SC234	MOU	2010	South Fork Nemaha River Near Bem
SC673	SMSA	2006	Spillman Creek Near Lincoln	SC652	KLR	2008	Wildcat Creek Near Manhattan	SC292	MOU	2010	Walnut Creek Near Reserve
SC014	SOLM	2006, 2012	North Fork Solomon River At Portis	SC681	KLR	2008	Vermillion Creek Near Onaga	SC601	MOU	2010	Turkey Creek Near Bem
SC343	SOLM	2006, 2012	South Fork Solomon River Near Osborne	SC727	KLR	2008	Nehring Creek Near Hessdale	SC215	VERD	2011	Verdigris River Near Coffeyville
SC345	SOLM	2006	Bow Creek Near Stockton	SC280	LARK	2009	Ninnescah River Near Belle Plaine	SC038	WALN	2011	Whitewater River At Towanda
SC668	SOLM	2006	Twin Creek Near Corinth	SC282	LARK	2009	Little Arkansas River At Valley Center	SC279	WALN	2011	Walnut River Near El Dorado
SC669	SOLM	2006	Carr Creek Near Cawker City	SC288	LARK	2009, 2013	Cow Creek Near Hutchinson	SC653	WALN	2011	Timber Creek Near Winfield
SC670	SOLM	2006, 2012	Beaver Creek Near Gaylord	SC522	LARK	2009, 2013	Cow Creek In Wichita-Valley Center Floodway	SC267	SMSA	2012	Saline River Near New Cambria
SC223	UARK	2006	Arkansas River At Coolidge	SC529	LARK	2009, 2013	Cow Creek Near Willowbrook	SC268	SMSA	2012	Smoky Hill River Near Salina
SC284	UARK	2006, 2009	Arkansas River Near Great Bend	SC530	LARK	2009	Chikaskia River Near Corbin	SC541	SMSA	2012	Big Creek Near Hays
SC286	UARK	2006	Arkansas River At Pierceville	SC530	LARK	2009, 2013	Bluff Creek Near Caldwell	SC550	SMSA	2012	Smoky Hill River Near Trego Center
SC384	UARK	2006, 2009	Arkansas River Near Dundee	SC534	LARK	2009	Emma Creek Near Sedgwick	SC641	SMSA	2012	Gypsum Creek Near Solomon
SC387	UARK	2006, 2009	Arkansas River Near Kinsley	SC535	LARK	2009	Sand Creek Near Sedgwick	SC642	SMSA	2012	Holland Creek Near Sand Springs
SC394	UARK	2006	Arkansas River Near Ford	SC618	LARK	2009	Bluff Creek Near Bluff City	SC644	SMSA	2012	Turkey Creek Near Abilene
SC398	UARK	2006	Arkansas River Near Deerfield	SC619	LARK	2009	Sandy Creek Near Ruella	SC748	SMSA	2012	Smoky Hill River Near Freemount
SC275	NEO	2007, 2011	Cottonwood River Near Plymouth	SC620	LARK	2009	Little Sandy Creek Near Corwin	SC665	SOLM	2012	Kill Creek Near Bloomington
SC609	NEO	2007, 2011	Deer Creek Near Iola	SC656	LARK	2009, 2013	Little Cow Creek Near Lyons	SC666	SOLM	2012	Covert Creek Near Osborne
SC610	NEO	2007, 2011	Owl Creek Near Humboldt	SC657	LARK	2009, 2013	Cow Creek Near Lyons	SC721	SOLM	2012	Deer Creek Near Kirwin
SC614	NEO	2007, 2011	Turkey Creek Near Le Roy	SC658	LARK	2009, 2013	Peace Creek Near Sterling	SC737	SOLM	2012	South Fork Solomon River Near Woodston
SC615	NEO	2007, 2011	Big Creek Near Le Roy	SC661	LARK	2009	Smoots Creek Near Murdock	SC659	LARK	2013	Salt Creek Near Hutchinson
SC627	NEO	2007, 2011	Cottonwood River Near Elm Dale	SC702	LARK	2009, 2013	Cowskin Creek Near Belle Plaine				
SC628	NEO	2007, 2011	Allen Creek Near Emporia	SC586	UARK	2009	Pawnee River Near Burdett				