

Assessing for Nutrient Impacts Using Narrative Criteria



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Kansas Narrative Criteria - Nutrients

- *The introduction of plant nutrients into surface waters designated for domestic water supply use shall be controlled to prevent interference with the production of drinking water K.A.R 28-16-28e(d)(3)(D).*
- *The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement or aquatic biota or the production of undesirable quantities or kinds of aquatic life K.A.R. 28-16-28e(d)(2)(A).*
- *The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation K.A.R. 28-16-28e(d)(7)(A).*

Kansas Narrative Criteria – Related Regs

- **Taste-producing and odor-producing substances of artificial origin shall not occur in surface waters at concentrations that interfere with the production of potable water by conventional water treatment processes, that impart an unpalatable flavor to edible aquatic or semiaquatic life or terrestrial wildlife, or that result in noticeable odors in the vicinity of surface waters.**
- **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 semi aquatic life or terrestrial wildlife.**

Kansas Numeric Criteria Related to Nutrients

- ***Nitrate***
 - 10 mg/L (DW MCL)
 - More than 1 sample > 10 mg/L in the most recent 10 years
- ***Ammonia***
 - 2013 Recommended Criteria for Aquatic Life
- ***Chlorophyll a (Lakes)***
 - 10 µg/L for Lakes and Reservoirs that have Municipal Water Right Allocated
 - Where the in lake long term average is < 10 µg/L, WQS is site specific and equal to the average

303(d) Listing Methodology

- **Total Phosphorus**
 - Median > 0.201 mg/L TP results in impaired status
 - Value is 3 X the 2001 EPA reference condition for ecoregion V
- **Nitrate***
 - More than 1 sample > 10 mg/L in most recent 10 years
- **Biology**
 - Must have samples for 3 of last 5 years
 - Average ALUS Index indicating *Partial or Nonsupport* of Biology
- **Chlorophyll a***
 - Domestic Water Supply Lakes: Average > 10 µg/L or > site specific Primary/Secondary Contact Rec Use: Average > 12/20 µg/L
- **pH***
 - WQS: 6.5 to 8.5
 - Binomial
- **DO***
 - WQS: 5 mg/L
 - Greater than 1 violation per three years on average

*numeric water quality standard

Kansas Nutrient Reduction Strategy

- Emphasis on **reduction** rather than establishing numeric criteria
- **Phosphorus** was chosen as the key nutrient to control
- **Point Source** reductions via updated treatment technologies/operations
- **Nonpoint Source** reductions via targeted application of BMPs and collaboration with WRAPS groups

Total Phosphorus TMDLs

3 Objectives

1. Establish biological endpoints that indicate narrative criteria are met, i.e., the impacts from excessive nutrients no longer exist
2. Establish ambient TP concentration milestones to trigger assessment of post-implementation biology
3. Sequence the implementation of controls between the point and non-point sources in the watershed



TP TMDL Biological Endpoint

Ultimate endpoint is to achieve the Kansas Surface Water Quality Standards by eliminating excessive primary productivity and its effects.

Endpoints must be initially maintained over 3 consecutive years to constitute full support of the designated uses and be considered for delisting.

Measurables:

- ALUS Index Score ≥ 14 , indicating the stream is healthy enough to fully support biology (aquatic life).
- Sestonic chlorophyll *a* below 10 mg/L indicating algal growth is under control.
- DO greater than 5 mg/L and a pH below 8.5, indicating primary productivity (algal growth) is under control.

Biology Measurements to ALUS Index

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	Biotic Condition	Support Category
17-20	Very Good	Supporting
14-16	Good	
7-13	Fair	Partially Supporting
4-6	Poor	Non-supporting
1-3	Very Poor	

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Developing Total Phosphorus Milestones

- Watershed Delineation
 - Kansas Ecoregions
 - EPA Level III & IV Ecoregions within Kansas
 - Stream Chemistry Watershed
- Analysis of Total Phosphorus vs ALUS Index Data
 - Sites located in the selected ecoregion(s) with both biology and chemistry data
- Analysis of Total Phosphorus vs Chlorophyll a Data
 - Sites located in the selected ecoregion(s) with both chlorophyll a and TP data

Adaptively Managing with Total Phosphorus Milestones

- TP milestones are phased with each phase establishing a lower in-stream TP milestone
- Stream biology sampling will take place once TP concentrations in the river approach a milestone
- If biology does not respond to the Phase I reduction, Phase II will begin with further reductions in TP loading to achieve the Phase II TP milestone
- Biological assessments are the key to delisting ultimately, as well as to inform the next iteration of controls
- Achievement of TMDL may result in site specific numeric total phosphorus criterion

Implementation of Nutrient TMDLs

- Major NPDES facilities make initial investment in nutrient removal, balance of time spent on Nonpoint Sources
- Nonpoint Source Implementation:
 - Implementing and maintaining conservation farming practices
 - Improving riparian conditions
 - Ensuring land applied manure and chemical fertilizers are being applied properly with runoff control measures implemented
- Implementation of urban and construction stormwater best management practices by MS4 permittees



Example of Phased TMDL

SC Site	TMDL Phase	Total Phosphorus Milestones (mg/L)	Anticipated Action	Biological Endpoint
SC906	I-1 (NPDES)	0.150	Mechanical Municipal WWTF BNR system upgraded and optimally operated. City to exploit alternative discharge methods. MS4 plan implemented.	ALUS Index Score \geq 14 Chl a $<$ 10 mg/L DO \geq 5 mg/L pH $<$ 8.5
	I-2 (Nonpoint Source)	0.150	Riparian & Livestock Management BMP Implementation	
	II-1 (NPDES)	0.100	Mechanical Municipal WWTF to implement ENR. Continued MS4 BMP implementation.	
	II-2 (Nonpoint Source)	0.100	Targeted Tributary Riparian Management (adjacent to cropland)	



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