Kansas TMDLs *Developed as a Translation to Narrative Standards*

Kansas
Department of Health and Environment

Our Mission: To protect and improve the health and environment of all Kansans.

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 Examples

- ***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 Nutrient Reduction Strategy

- Emphasis on reduction rather than establishing numeric criteria
- Phosphorus was chosen as the key nutrient to control – TMDL Vision Priority
- **Point Source** reductions via updated treatment technologies/operations
- **Non-Point Source** reductions via targeted application of BMPs and collaboration with WRAPS(319) groups

303(d) Listing Methodology for Biology, Total Phosphorus, DO, and pH

- ***Total Phosphorus***
  - Median > 0.201 mg/L TP results in impaired for TP status
  - Value 3x the 2001 EPA ambient nutrient WQ recommendation in ecoregion V.
- ***Biology***
  - Must have samples for 3 of last 5 years
  - Average ALUS Index indicating Partial or Nonsupport of Biology results in impaired for biology status
- ***pH***
  - Surface Water Quality Standard: 6.5 to 8.5
  - Binomial
- ***DO***
  - WQS: 5 mg/L
  - Greater than 1 violation per 3 years on average

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

TMDL Endpoint

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

Measurables:

- ALUS Index Score greater or equal to 14 indicates the river is healthy enough to fully support the biology.

- Sestonic Chlorophyll *a* below 10 μg/L indicating algal growth is under control.

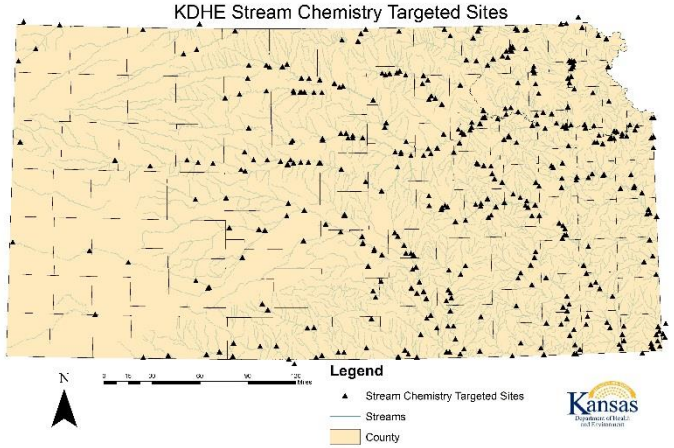
- DO greater than 5 mg/L and a pH below 8.5 indicating primary productivity (algal growth) is under control.

Biology Measurements to ALUS Index Value

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	

Total Phosphorus Milestones



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

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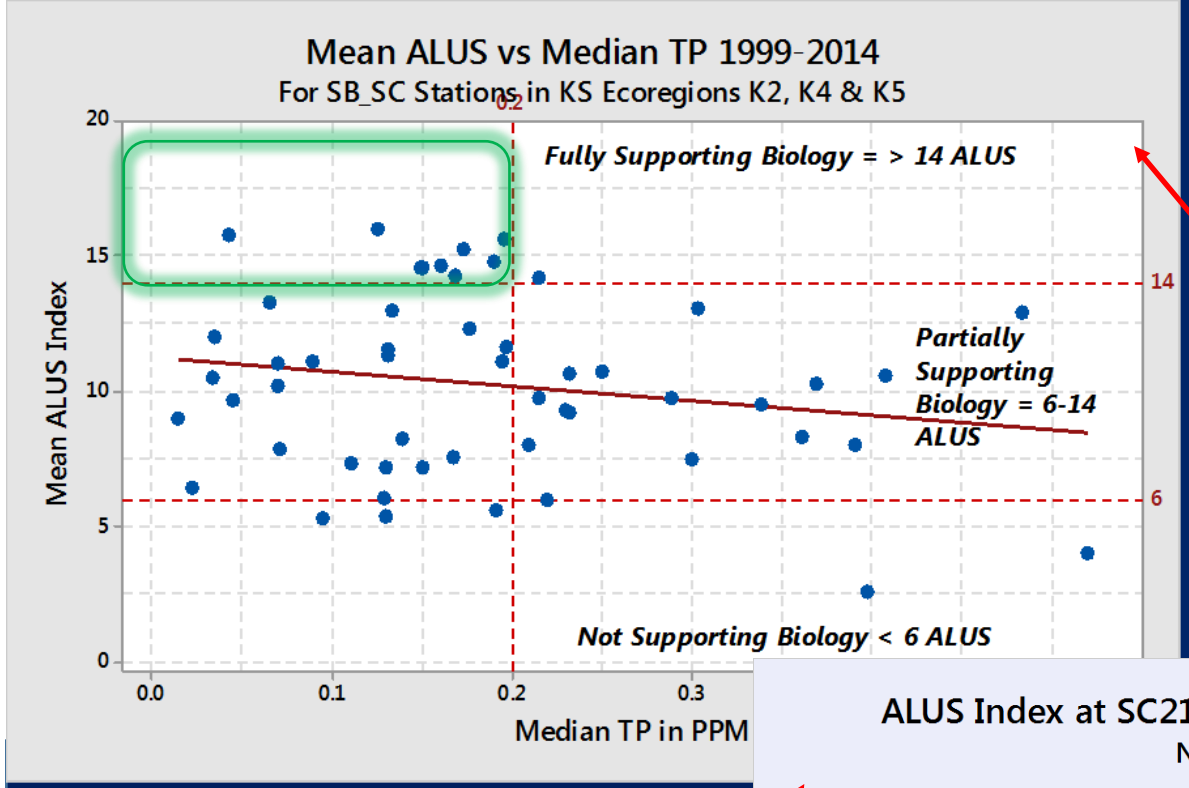
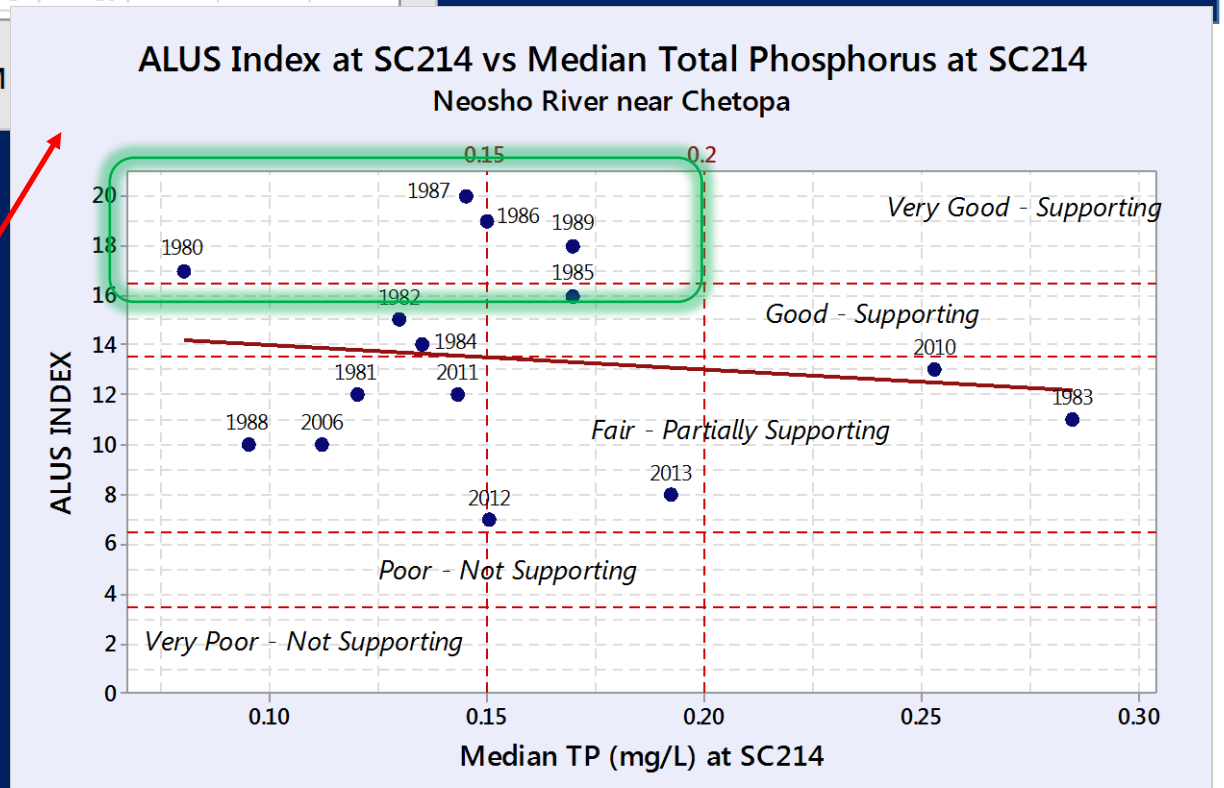
ALUS vs Median TP

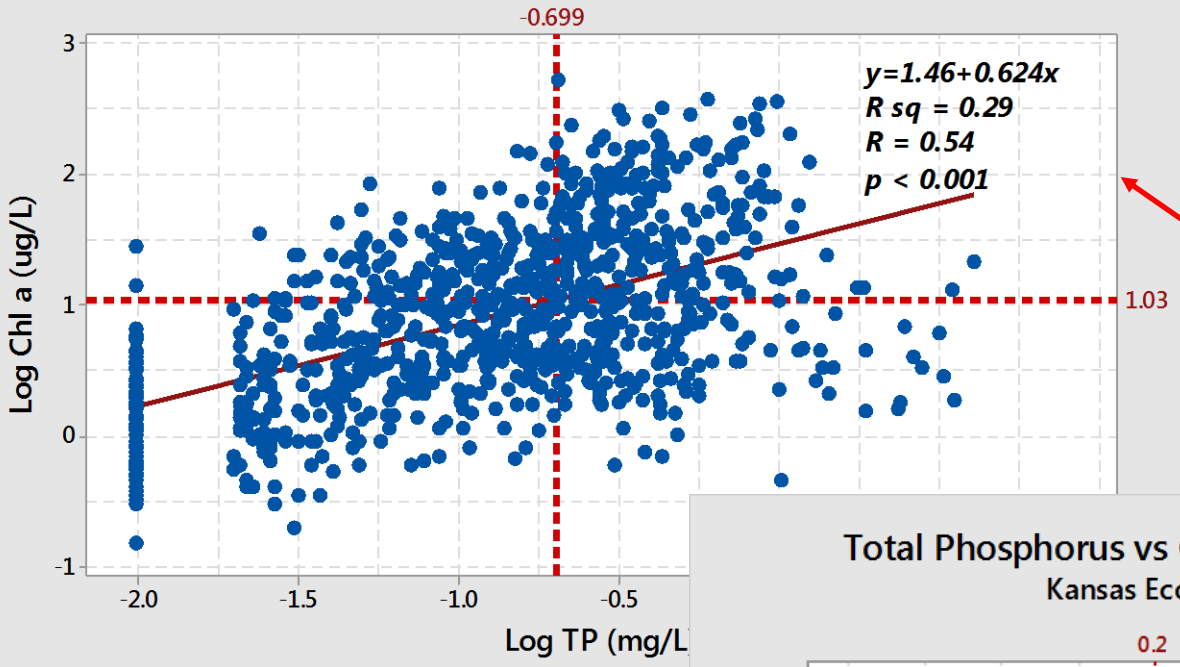


All Stations Located in Ecoregions Comprising the Watershed of Study

Single Station Watershed ALUS vs Median TP

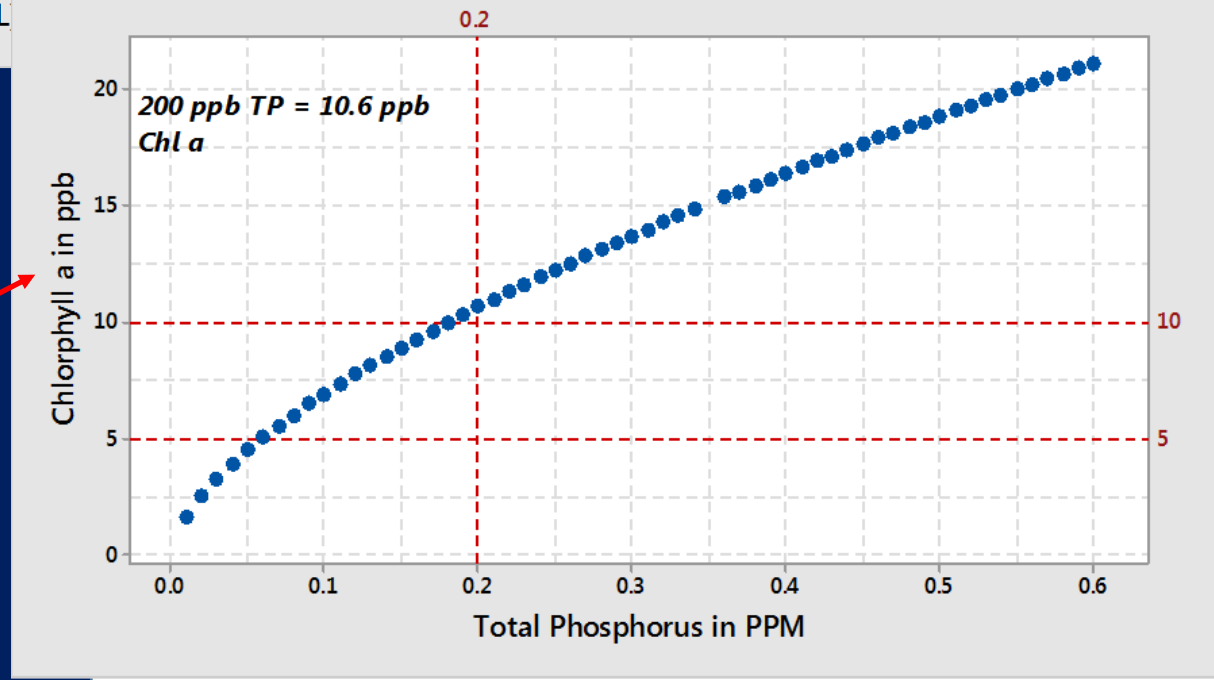


Chlorophyll *a* vs Total Phosphorus



Scatterplot of Individual Samples

Line Developed from Scatterplot Regression Line



Establishing Total Phosphorus Management Milestones

- TP milestones are phased
  - Municipal Mechanical WWTF Phase I and II WLA at 1 and 0.5 mg/L at design flow
- Stream biology sampling will take place once TP concentrations in the river approach the milestone
- If the biology in the river 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
  - Reasonable assurance
- Endpoints must be initially maintained over 3 consecutive years to constitute full support of the designated uses

TP WLA in NPDES Permits

- Total phosphorus goals are introduced in the first permit after TMDL approval
  - Concentration and annual pounds/year (rolling average)
- Permit may include a schedule of compliance
- TP mass **goals** should be met by end of first permit cycle
- TP mass **limits** are set in second permit after TMDL approval

Adaptive Management TMDLs

- Adaptive Management involves a sequence of point source reduction, NPS BMPs, & biological monitoring followed by another iteration of reduction as needed by biology
- Achievement of TMDL *may* result in site specific numeric total phosphorus criterion
- First TP TMDL approved in 2011
  - 228 TP TMDLs approved to date

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