

# Kentucky's Listing Methodology using Narrative Nutrient Criteria: Where we've been and where we're going

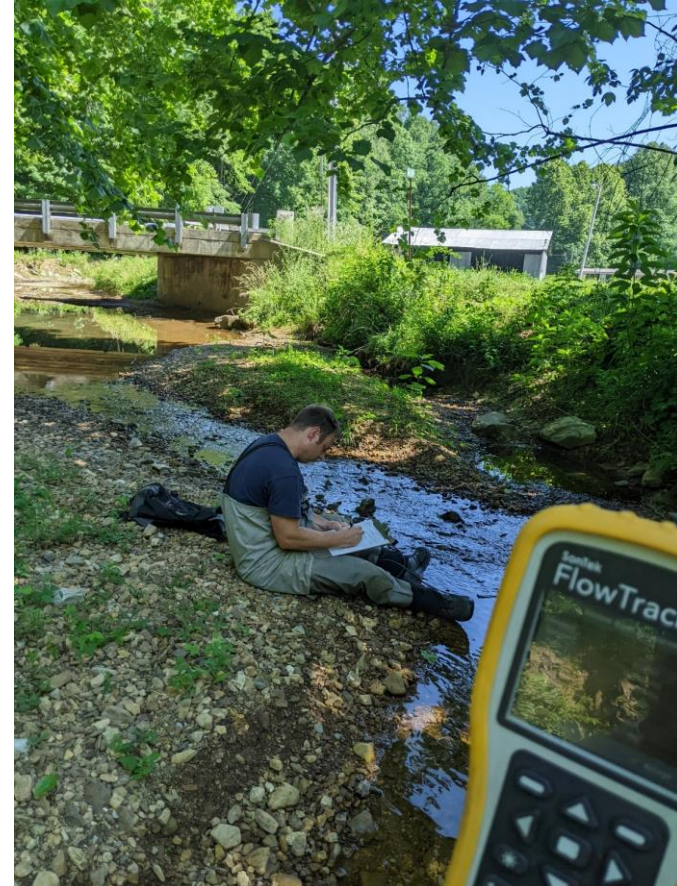
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TEAM   
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ENERGY AND  
ENVIRONMENT CABINET



# Narrative Nutrient Criteria Updates

## Approved by EPA November 15, 2013

- [401 KAR 10:031](#). Surface Water Standards

Nutrients Criterion. Nutrients shall not be elevated in a surface water to a level that results in eutrophication. [~~Nutrient limits. In lakes and reservoirs and their tributaries and other surface waters where eutrophication problems may exist, nitrogen, phosphorus, carbon and contributing trace element discharges shall be limited in accordance with:~~

- ~~1. The scope of the problem;~~
- ~~2. The geography of the affected area; and~~
- ~~3. Relative contributions from existing and proposed sources.]~~

- [401 KAR 10:001](#). Definitions for 401 KAR Chapter 10.

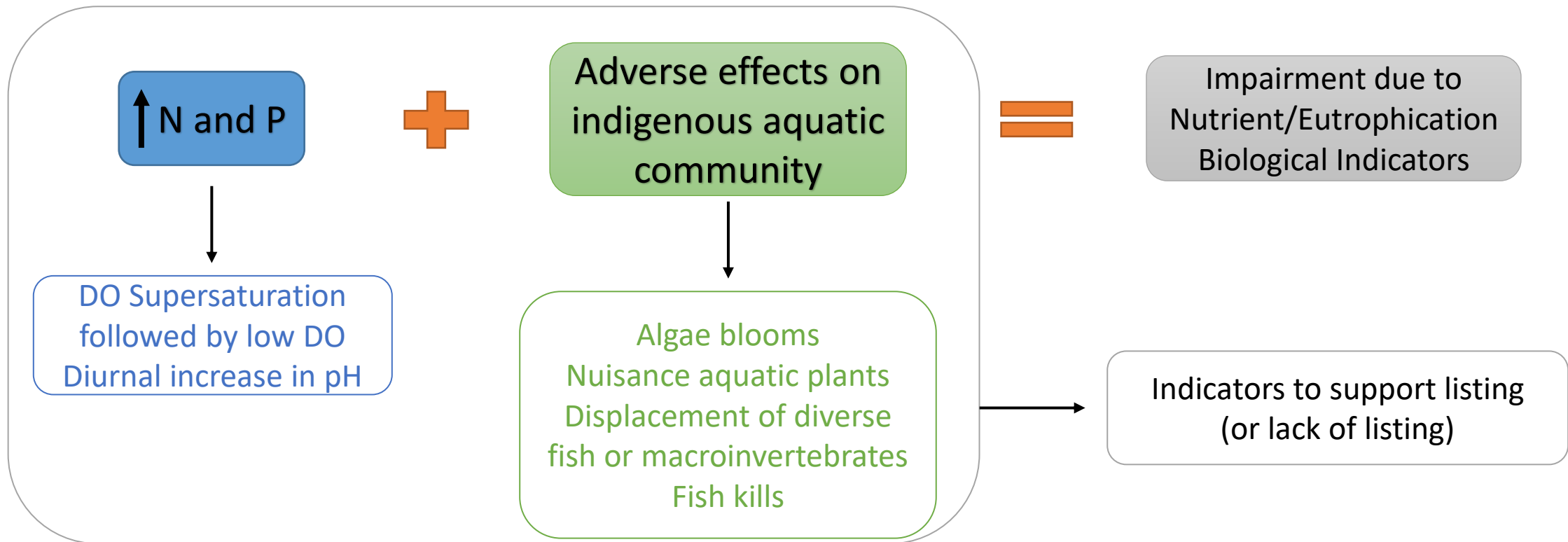
'Eutrophication' means the enrichment of a surface water with nutrients nitrogen and phosphorus resulting in adverse effects on water chemistry and the indigenous aquatic community. Resulting adverse effects on water chemistry manifest by daily dissolved oxygen supersaturation followed by low dissolved oxygen concentrations and diurnal increase in pH. Resulting adverse effects on the indigenous aquatic community include:

- Nuisance algae blooms;
- Proliferation of nuisance aquatic plants;
- Displacement of diverse fish or macroinvertebrate community by species tolerant of nutrient-enriched environments; or
- Fish kills brought on by severe, sudden episodes of plant nutrient enrichment. [~~by the discharge or addition of a nutrient.~~]

# What does the data need to demonstrate?

(27) "Eutrophication" means the **enrichment** of a surface water with nutrients nitrogen and phosphorus resulting in adverse effects on water chemistry **and** the indigenous aquatic community. Resulting **adverse effects on water chemistry** manifest by daily dissolved oxygen supersaturation followed by low dissolved oxygen concentrations and diurnal increase in pH. Resulting **adverse effects on the indigenous aquatic community** include:

- (a) Nuisance algae blooms;
- (b) Proliferation of nuisance aquatic plants;
- (c) Displacement of diverse fish or macroinvertebrate community by species tolerant of nutrient-enriched environments; or
- (d) Fish kills brought on by severe, sudden episodes of plant nutrient enrichment.





# New narrative, new method

Goal: Improve confidence, reproducibility, and transparency in assessment decisions

- Increase data collection on response indicators and manage these data effectively
- Derive nutrient screening values based on accumulated data on biological response and natural regional variation
- Outline steps and considerations inherent in “BPJ” decisions
- Expand staff participation in assessments to increase capacity, redundancy, diversity of expertise involved
- Improve documentation of indicators in assessment process
  - Better understanding of the problem and the target for management (e.g., TMDL)
  - Increased ability to identify potential delistings
  - Prioritize follow up monitoring for listing where current data may be insufficient

Site #	Collection Date	CBOD-5 mg/L	Nitrate/Nitrite mg/L	Ortho-phosphorus mg/L	Phosphorus, Total mg/L	Total Kjeldhal Nitrogen mg/L	Total Suspended Solids mg/L	Dissolved Oxygen mg/L	Dissolved Oxygen % Saturation mg/L	pH	Organic Carbon mg/L	Temperature	Specific Conductance	Discharge cfs	Comments
DOW94018007	11/8/05 13:10	<2	3.99	0.162	0.286	0.274 J	2.5	9.17	n/a	7.76	1.01	13.16	439	5.43	
UT Cane Run @ UK Ag Research Farm	#####	<2	3.6	0.138	0.215	<0.2	3	10.64	n/a	7.92	1.31	14.53	444	2.036	
3K1288, -84.50708	#####	<2	3.06	0.13	0.20	<0.2	Not detected	n/a	n/a	7.92	1.16	8.22	395	1.46	DO meter malfunction
RM 10.8, UT RM 0.20	1/18/07 12:45	<2	4.17	0.211	0.460	0.457 J	18.5	9.84	n/a	8.1	1.81	8.54	395	33.46	Discharge was estimated with float method. Stage/discharge curve flow = 21.08 cfs
KV488799-10.8_00	2/13/07 12:00	<2	4.33	0.2	0.308	0.38 J	19.5	12.91	n/a	8.06	1.66	4.03	434	3.615	
	2/13/07 12:00	<2	4.32	0.155	0.264	0.451 J	9.5								
	3/8/07 12:30	<2	4.05	0.167	0.236	<0.2	3	n/a	n/a	n/a	1.17	n/a	n/a	4.371	duplicate data
No prior listing	4/12/07 12:10	<2	2.24	0.0687	0.119	<0.2	1.5	11.51	n/a	8.32	1.41	9.14	317	2.616	Hydrolab malfunction
	5/10/07 13:00	<2	1.21	0.0722	0.116	0.28 J	3	15.6	n/a	8.72	1.79	21.2	314	1.191	
	6/21/07 12:45	<2	0.023	0.204	0.586	0.829	56.5	n/a	n/a	n/a	2.78	n/a	n/a	0.286	Hydrolab unavailable, discharge estimated
	7/11/07 11:35	<2	0.0592	0.18	0.331	0.453	1.5	n/a	n/a	n/a	2.62	n/a	n/a	0.148	Hydrolab unavailable
Assess as NS for Total Nitrogen, Total Phosphorus	8/8/07 12:50	<2	0.109	0.174	0.318	0.514	4.5	7.82	88.6	7.35	2.5	26.51	429.9	0.191	
	9/5/07 14:00	<2	0.0783	0.136	0.475	0.696	24	3.89	47.2	7.23	3.39	24.8	289.3	0.325	discharge estimated
	10/4/07 0:00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	No flow/No sample taken

Duplicate values were removed from this data table

Chemistry Flags
n/d = not detected
Y flag = YC, none estimated by lab
J flag = estimated value

Assessment Flags
Datum exceeds a screening value (D.O. < 5.0, TKN > 1.0, Nitrate/Nitrite > 3.0, Total Phosphorus > 0.02, pH > 8.0)
Datum represents an exceedance for un-ionized ammonia, based on pH and temperature calculations as found in 401 KAR 10-031, or of the DO standard of 4.0 mg/L
Datum exceeds the screening value of D.O. > 9.0; this color was used instead of light yellow to distinguish these values
Datum likely represents a level of a pollutant that is decreasing to AL, but an assessment determination cannot be

NO<sub>2</sub>-NO<sub>3</sub> EXCEEDANCES  $\frac{7}{13} = 53.8\%$

TOTAL PHOSPHORUS EXCEEDANCES  $= \frac{13}{13} = 100\%$

UNIONIZED AMMONIA EXCEEDANCES  $\frac{2}{8} = 25\%$

TN EXCEEDANCES  $= \frac{8}{8} = 100\%$

Site	Date	Flow Event	Temperature (F)	Temperature (C)	pKa	Un-ionized Ammonia (mg/cm)	Conductivity (mS/cm)	DO (mg/L)	pH (SU)	Turbidity (NTU)	Discharge (ft <sup>3</sup> /sec)	NO <sub>2</sub> (mg/L)	NO <sub>2</sub> /NO <sub>3</sub> (mg/L)	NO <sub>3</sub> (mg/L)	NH <sub>3</sub> -N (mg/L)	TKN (mg/L)	TN (mg/L)	TP (mg/L)	OP (mg/L)
Goggin Ln	12/8/2008	low	41.8	5.44	9.89	0.0012	625	17.92	8.35	0.5	6	0.200		9.400	0.034	0.80	10.40	0.200	0.170
Goggin Ln	1/6/2009	moderate	44.9	7.17	9.83	0.0033	513	11.10	8.47	opaque	6	0.000		3.890	0.065	<0.20	3.89	0.131	0.078
Goggin Ln	2/3/2009	moderate	40.4	4.67	9.92	0.0013	404	13.02	8.13	8.6	62	0.018		4.180	0.067	0.63	4.82	0.130	0.083
Goggin Ln	3/3/2009	moderate	42.4	5.78	9.88	0.0125	411	16.75	8.70	5.3	36	<0.030		3.730	0.167	0.44	4.17	0.153	0.104
Goggin Ln	4/7/2009	moderate	47.7	8.72	9.77	0.0087	423	13.88	8.47	8.1	67	<0.030		3.000	0.154	0.35	3.35	0.146	0.051
Goggin Ln	5/5/2009	moderate	60.1	15.61	9.54	0.0217	432	12.79	8.54	6.1	53		3.75	10.000	0.200	0.48	4.23	0.209	0.219
Goggin Ln	6/2/2009	low	80.2	26.78	9.19	0.1136	489	13.36	9.29	1.5	5	0.087		10.000	0.170	0.71	10.80	0.312	0.284
Goggin Ln	7/1/2009	moderate	74.8	23.78	9.28	0.0706	483	12.64	9.98	3.1	8	0.020		5.480	0.177	0.36	5.86	0.187	0.082
BB Mouth	12/8/2008	low	46.1	7.81	9.81	0.0027	403	13.02	8.13	8.6	62	0.018		4.180	0.067	0.63	4.82	0.130	0.083



# Data Collection, Management, and Analysis

- Are we, and our data partners, collecting the right type of data?
  - New method triggered review of monitoring protocols
- Can we store this data? Including observations and photos
  - New method also coincided with data base updates
    - Started using K-WADE in 2015
    - Started using KATTS in 2018
- Can we query this data?
- What does our data tell us about the relationship between N & P and our biological indices?

TR 49  
EPT 21  
%EPT 59.67  
%Dom 5 58.5

Aquatic Vegetation: lots filamentous algae, pondweed



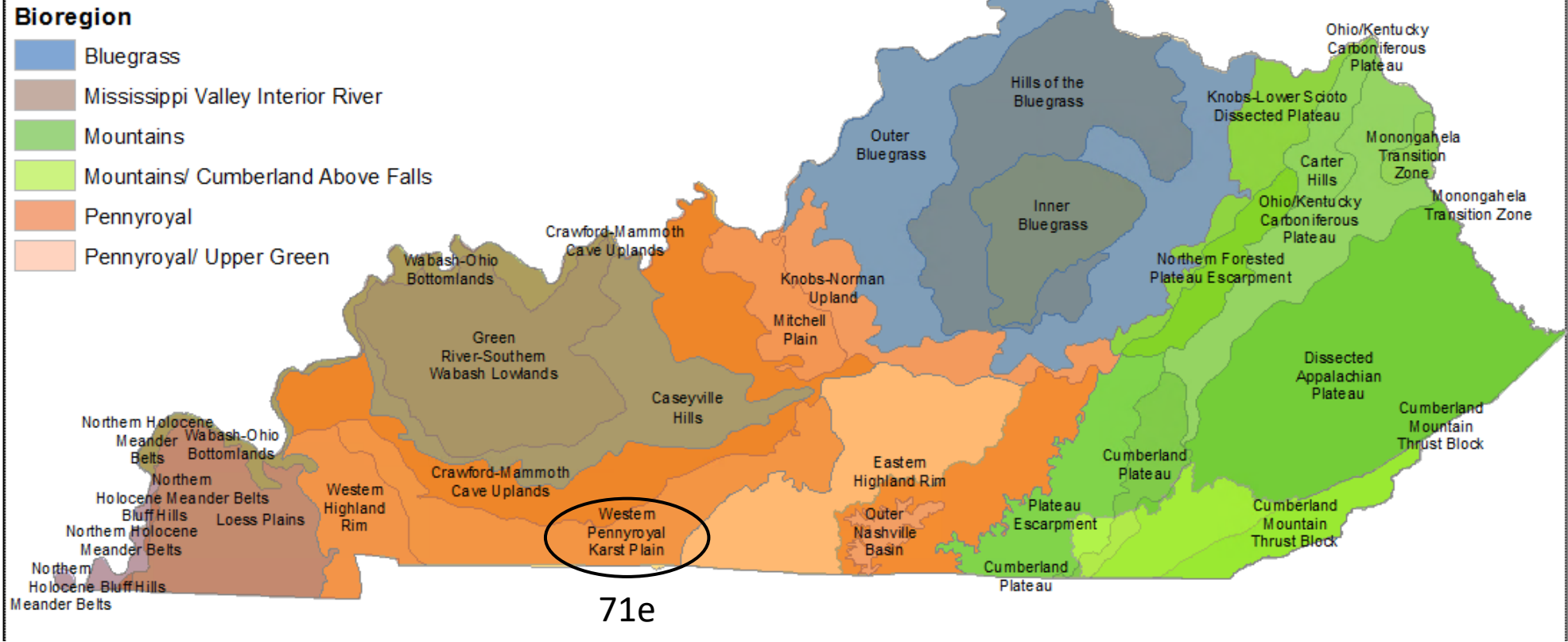
↑ N and P



DO Supersaturation followed by low DO Diurnal increase in pH

# What are elevated values of N & P in Kentucky? That depends...

Kentucky Division of Water - Bioregions of Kentucky (Generalized)



Reference Only	Bluegrass without Inner BG	Inner Bluegrass	Pennyroyal without 71e	71e*	MVIR	Mountains
75th percentile <b>NO2/3</b>	0.78	2.11	0.72	6.16	0.87	0.19

Reference Only	Bluegrass without Inner BG	Inner Bluegrass	Pennyroyal	MVIR	Mountains
75th percentile <b>Total P (mg/L)</b>	0.16	0.34	0.02	0.06	0.01

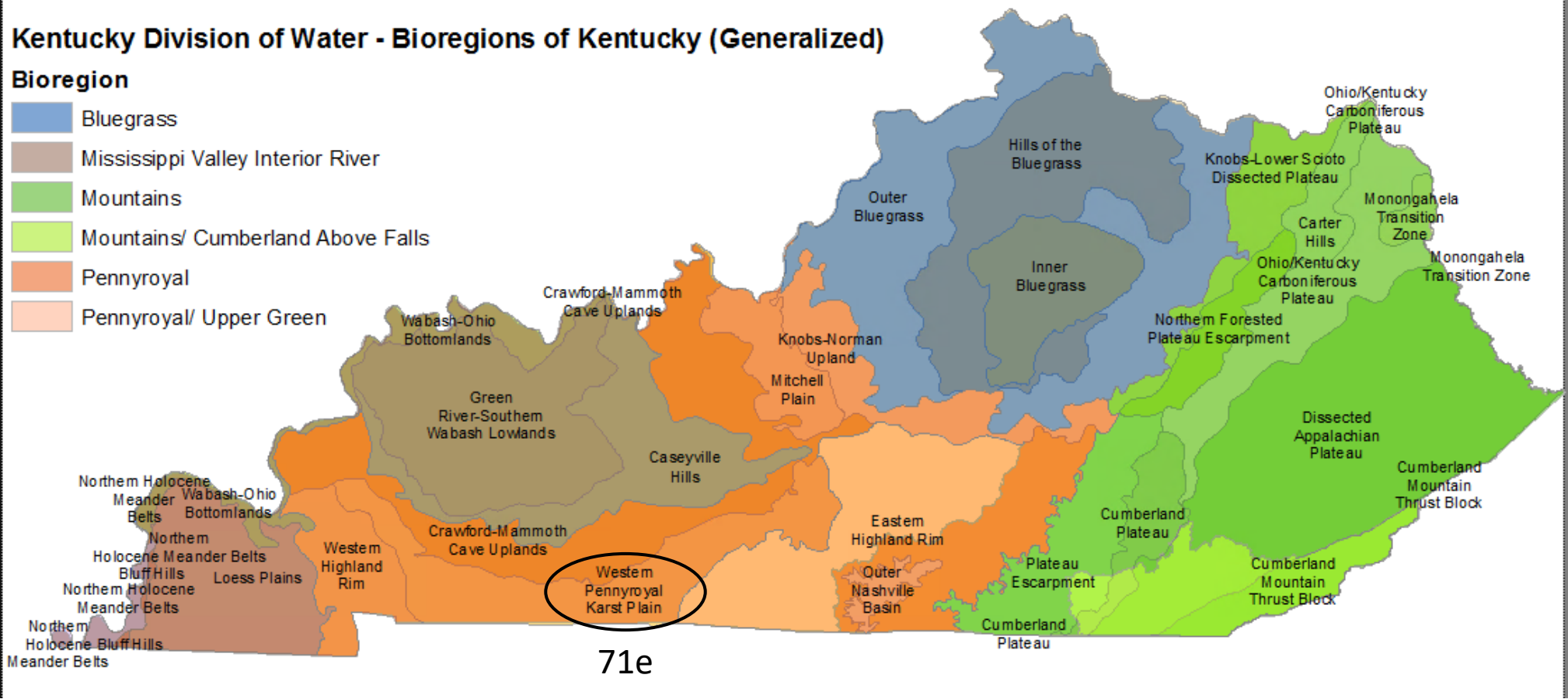
\* Included all programs, not just reference



# Kentucky Division of Water - Bioregions of Kentucky (Generalized)

## Bioregion

- Bluegrass
- Mississippi Valley Interior River
- Mountains
- Mountains/ Cumberland Above Falls
- Pennyroyal
- Pennyroyal/ Upper Green



↑ N and P

DO Supersaturation followed by low DO  
Diurnal increase in pH

Resulting adverse effects on water chemistry **manifest** by daily dissolved oxygen supersaturation followed by low dissolved oxygen concentrations and diurnal increase in pH.

Asked field crews to **target certain times of day** (switch up the order each time).  
**USGS gage** data brought in where available.  
**Calibration logs** from external data partners.

↑ N and P



DO Supersaturation  
followed by low DO  
Diurnal increase in pH

# First pass at ecoregion/bioregion scale screening values for NO<sub>2</sub>/3 and TP

- Related NO<sub>2</sub>/3 and TP to macroinvertebrates that scored a good or excellent on the MBI
  - Screening values for **nitrate/nitrite (mg/L)** per bioregion (71e separated from PR, and Inner Bluegrass separated from Bluegrass), based on the 95<sup>th</sup> percentile of sites that scored a good or excellent on the MBI
  - Screening values for **total phosphorus (mg/L)** per bioregion (Inner Bluegrass separated from Bluegrass), based on the 95<sup>th</sup> percentile of sites that scored a good or excellent on the MBI
- Growing season evaluation (April – October) for wadeable streams (<200 mi<sup>2</sup> catchment area)
- Minimum of monthly samples
- High flow events reviewed
- If more than one screening value excursion occurs outside high flow, then evidence for enrichment
- Statewide screening values for TKN and TOC

These excursions put us on the path of “nutrients as a candidate cause”, where the other parts of the narrative nutrient criteria are evaluated before listing.



Adverse effects on indigenous aquatic community



Algae blooms  
Nuisance aquatic plants  
Displacement of diverse fish or macroinvertebrates  
Fish kills

# Kentucky has a Macroinvertebrate Biological Index ([MBI](#)) and a Fish Index of Biological Integrity ([KIBI](#))

From original MBI and KIBI papers, general relationship between MBI/KIBI and nutrient enrichment demonstrated. Some individual metrics perform better than others. Bioregion level relationships not evaluated.

Table 14. Pearson correlation matrix of nutrients and macroinvertebrate metrics. Bolded values are **not** significantly different ( $p > 0.01$ ). TKN=Total Kjeldhal Nitrogen, TN=Total Nitrogen, TP=Total Phosphorus.

	<i>Ammonia</i>	<i>Nitrate-N</i>	<i>TKN</i>	<i>TN</i>	<i>TP</i>	<i>TN*TP</i>
TR	-0.39	<b>-0.20</b>	-0.27	-0.36	-0.52	-0.50
EPT	-0.48	-0.27	-0.46	-0.52	-0.67	-0.67
mHBI	0.55	0.31	0.51	0.60	0.59	0.64
m%EPT	-0.48	-0.28	-0.56	-0.57	-0.58	-0.64
%Ephem	-0.40	-0.21	-0.49	-0.47	-0.39	-0.41
%Chir+Olig	0.53	<b>0.11</b>	0.36	0.32	0.31	0.33
%Clingers	-0.30	<b>-0.20</b>	<b>-0.15</b>	-0.27	-0.23	-0.27

Table 9. Pearson's correlation matrix of chemical values vs. fish metric scores and KIBI.

Metrics	Cond.	Ammonia	Nitrate	TKN	TN	TP	TN*TP
NAT	-0.34	-0.25	-0.23	<b>-0.03</b>	-0.22	<b>-0.01</b>	<b>-0.11</b>
DMS	-0.29	-0.31	<b>-0.09</b>	<b>-0.18</b>	-0.23	<b>-0.10</b>	<b>-0.19</b>
INT	-0.39	-0.31	<b>0.00</b>	-0.30	-0.23	-0.19	-0.24
SL	<b>-0.13</b>	-0.42	<b>-0.18</b>	-0.28	-0.37	-0.18	-0.31
%INSCT	-0.30	-0.29	<b>0.04</b>	<b>-0.14</b>	<b>-0.11</b>	<b>-0.11</b>	<b>-0.13</b>
%TOL	-0.23	-0.36	<b>0.15</b>	-0.25	<b>0.13</b>	<b>-0.12</b>	<b>-0.13</b>
%FHW	-0.28	-0.24	<b>0.16</b>	<b>-0.14</b>	<b>0.02</b>	<b>-0.09</b>	<b>-0.07</b>
KIBI	-0.35	-0.37	<b>-0.03</b>	-0.20	-0.21	<b>-0.15</b>	-0.21

Bolded values are **not** significantly correlated ( $p < 0.01$ )

Adverse effects on indigenous aquatic community



Algae blooms  
Nuisance aquatic plants  
Displacement of diverse fish or macroinvertebrates  
Fish kills

# Algae and macrophyte observations – new field form and database entry to accompany water chemistry results.

GENERAL OBSERVATIONS									
WEATHER	Today	Yesterday	Day before	STREAMFLOW CONDITION	STREAM MIXING CONDITION	LEAF OUT?	Visible runoff conditions?		
Heavy Rain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Dry	<input type="checkbox"/> Excellent	<input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> YES <input type="checkbox"/> NO		
Steady Rain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Pooled/no flow	<input type="checkbox"/> Good	STREAM SHADING			
Intermittent Showers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Low	<input type="checkbox"/> Fair	<input type="checkbox"/> Full (>75%)	Hydrograph Limb:		
Clear/Sunny	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Seasonal Normal	<input type="checkbox"/> Poor	<input type="checkbox"/> Partial (25-75%)	<input type="checkbox"/> Stable		
Cloudy/Overcast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Above Normal	If poor, explain:	<input type="checkbox"/> None (<25%)	<input type="checkbox"/> Rising		
Snow, sleet, or hail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> High			<input type="checkbox"/> Falling		
				<input type="checkbox"/> Flood			<input type="checkbox"/> Peak		
				<input type="checkbox"/> Unknown					

We send this same field form to external data partners. USACE sends us these observations, which we enter into our database, since the USACE database doesn't have observations.

INSTREAM OBSERVATIONS								
GARBAGE	SUDS	TURBIDITY	OIL/GREASE	ODOR INTENSITY	ODOR TYPE	STREAM	COLOR	FISHKILL
<input type="checkbox"/> None	<input type="checkbox"/> None	<input type="checkbox"/> None	<input type="checkbox"/> None	<input type="checkbox"/> None	<input type="checkbox"/> Livestock	<input type="checkbox"/> Clear	<input type="checkbox"/> Brown/Clear	<input type="checkbox"/> Yes
<input type="checkbox"/> Slight	<input type="checkbox"/> Slight	<input type="checkbox"/> Slight	<input type="checkbox"/> Slight	<input type="checkbox"/> Slight	<input type="checkbox"/> Effluent (treated)	<input type="checkbox"/> Blue	<input type="checkbox"/> Brown/Green	<input type="checkbox"/> No
<input type="checkbox"/> Moderate	<input type="checkbox"/> Moderate	<input type="checkbox"/> Moderate	<input type="checkbox"/> Moderate	<input type="checkbox"/> Moderate	<input type="checkbox"/> Raw Sewage	<input type="checkbox"/> Brown	<input type="checkbox"/> Green/Clear	
<input type="checkbox"/> Severe	<input type="checkbox"/> Severe	<input type="checkbox"/> Severe	<input type="checkbox"/> Severe	<input type="checkbox"/> Severe	<input type="checkbox"/> Anaerobic	<input type="checkbox"/> Green	<input type="checkbox"/> Gray	
<input type="checkbox"/> Extreme	<input type="checkbox"/> Extreme	<input type="checkbox"/> Extreme	<input type="checkbox"/> Extreme	<input type="checkbox"/> Extreme	<input type="checkbox"/> Chemical	<input type="checkbox"/> Tannic	<input type="checkbox"/> White	
					<input type="checkbox"/> Other (describe)		<input type="checkbox"/> Other	

ALGAE AND MACROPHYTE OBSERVATIONS				
FILAMENTOUS ALGAE		MICROALGAE MATS		AQUATIC MACROPHYTES
% COVER	GROWTH STAGE	THICKNESS	% COVER	% COVER
Ri Ru Po <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Absent	Ri Ru Po <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Growing	<input type="checkbox"/> Negligible	<input type="checkbox"/> Absent	Ri Ru Po <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Absent
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Sparse (5%)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Senescing	<input type="checkbox"/> Moderate	<input type="checkbox"/> Sparse (5%)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Sparse (5%)
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Common (5-25%)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Mixed	<input type="checkbox"/> Severe	<input type="checkbox"/> Common (5-25%)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Common (5-25%)
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Abundant (25-50%)		<input type="checkbox"/> Extreme	<input type="checkbox"/> Abundant (25-50%)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Abundant (25-50%)
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Extensive (>50%)			<input type="checkbox"/> Extensive (>50%)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Extensive (>50%)

DEFINITIONS FOR ALGAE AND MACROPHYTES		
FILAMENTOUS ALGAE	MICROALGAE	MACROPHYTES
% COVER—how much of the in-stream habitat is covered with filamentous algae, eg. <i>Cladophora</i> . This can be in long flowing strands, or short clumps (after peak flow event). Look carefully—it can look like moss.	THICKNESS—how thick is the unicellular (NOT filamentous) algae on the in-stream rock surfaces.	Macrophytes are NOT algae, they include mosses and any vascular plants growing in the wetted width of the stream, either fully submerged, or emergent.
GROWTH STAGE—'Growing' if >75% of the filamentous algae is bright green.	'Negligible' algae not noticeable, or barely noticeable on surfaces.	Estimate the percentage of the surface area in each habitat category that is covered by submerged or emergent mosses and/or vascular plants.
'Senescing' if >75% of the algae is yellow-brown (not just covered in silt). 'Mixed' if both conditions occur and neither is >75%.	'Moderate' algae is noticeable on surface of substrate, but not slick or thick.	
	'Severe' algae is noticeably thick in many areas of the stream channel.	
	'Extreme' microalgae is so thick that it dominates the character of the stream, it can be scooped up, or looks like a rug.	



## Trial Run: 2018/2020 and 2022 cycles

- All the comments/observations/ photos/etc. entered into database (K-WADE) along with water chemistry results and *in situ* measurements
  - Training and QC ensures data management occurring as expected
- Scorecard data reports generated that compiles all pertinent information for listing (R-script)
  - Field staff complete scorecards, which helps them in making more informed comments/observations when in the field





Field	activity_date	ALGAL MAT SEVERITY	AQUATIC MACROPHYTES % COVER - POOLS
KWAD	05/07/2019	SEVERE/HEAVY	
STATION	05/21/2019	SEVERE/HEAVY	
STATION	06/04/2019	MODERATE	
project	06/18/2019	NOT ASSESSED	
	07/01/2019	MODERATE	
	07/16/2019	MODERATE	
2019	07/30/2019	MODERATE	
2019	08/13/2019	MODERATE	
2019	08/27/2019	MODERATE	
2019	09/10/2019	MODERATE	
2019	10/29/2019		
2019	11/21/2019		ABSENT
2019	12/05/2019		
2019	01/23/2020		SPARSE (<5%)
2019	02/19/2020		
2019	03/11/2020		SPARSE (<5%)
2020			
2020			
Water project	Station Info		
	PROGRAM_NAME		
	PROJECT_NAME		
	STATION_CATEGORIES		
	STATION_NAME		
	LOCALE_NAME		
Screener project	LOCATION_DESC		
	COMMENTS		
	CATCHMENT_AREA		
	LAT_DECIMAL		
	LON_DECIMAL		
	RECEIVING_WATER		
	MAJOR_RIVER_BASIN		
	BMU		
	ELEVATION		
	PRIMARY_SECONDARYCOUNTY		
	PRIMARY_SECONDARYCOREGION		
	PRIMARY_SECONDARYPHYREGION		
	PRIMARY_SECONDARYBJOREGION		

type	METRIC_NAME	METRIC_VALUE	METRIC_SCORE	lower_bound	Above Reference
supplementary	% 5 Dominant	92.8	11.35	41.3	no
supplementary	% Hydropsychidae	0.6	100	67.87	yes
supplementary	% Intolerant	0	0	17.32	no
supplementary	% Non-insect	60.2	40.11	78.83	no
supplementary	% Nut. Tolerant Taxa	78.8	23.82	29.66	no
supplementary	% Predator	0.6	1.71	25.61	no
supplementary	% Shredder	10.3	78.15	5.3	yes
supplementary	% Tolerant	55	49.22	33.54	yes
supplementary	Genus Clinger Richness	5	17.86	45	no
supplementary	Genus Intolerant Richness	2	7.14	28.57	no
supplementary	Genus Predator Richness	2	8.7	34.78	no
supplementary	Genus Shredder Richness	2	28.57	22.86	yes
supplementary	Hilsenhoff Biotic Index	6.42	52.92	55.01	no
MBI	% Chiro and Oligo	12.9	87.9	86.7	yes
MBI	% Clinger	34.1	43.71	52.08	no
MBI	% Ephem	0	0	18.57	no
MBI	Genus EPT Richness	2	7.14	40	no
MBI	Genus Taxa Richness	24	37.5	56.29	no
MBI	m % EPT	1.7	2.32	39.54	no
MBI	mHBI	6.58	50.57	59.53	no
mMBI	m % Clinger	33.2	51.06	33.03	yes

Metric > Reference	Percentage
6	29

INDEX_CALC_BY	INDEX_CALC_DATE	INDEX_CALC_METHOD	INDEX_RATING_CLASS
Jessica Schuster	03/27/2023	MDEA v 2022.01	BLUEGRASS

activity_date	INDEX_NAME	INDEX_SCORE	lower_bound	INDEX_RATING	Fair/Good Cutoff
05/23/2019	MBI-W	38.1905	21	Poor	57
05/23/2019	mMBI-W	39	20	Poor	54
05/23/2019	O/E	0.41	0.78	Below Reference	

Pr	BENTHIC ALGAE - MICROALGAE MAT THICKNESS	BENTHIC ALGAE - MICROALGAE MATS % COVER	Ca
PR			Est
PR			50
PR			50
GR			50
ST			25
PR			75
CH			75
CH			50
OT			25
AN			75
MA			75
AN	Moderate	ABUNDANT (25-50%)	75
AN	Negligible	ABUNDANT (25-50%)	0-
RE	Moderate	COMMON (5-25%)	0-
TA	Moderate	COMMON (5-25%)	0-
AC	Moderate	COMMON (5-25%)	0-
AC	Moderate	ABUNDANT (25-50%)	0-
AC	Moderate	ABUNDANT (25-50%)	0-

# Assessment Decisions and Documentation in Assessment Database (KATTS)

- Narrative criteria related to indicators -> Indicators related to parameter -> Parameter status (meeting, not meeting, insufficient) informed by indicators
  - Assessors use all available scorecards from an AU to make final assessment decision

Parameters

Indicator\* 9 selected ▾

Parameter Group

Parameter\*

Status


Source Group

Source

Comments

- Select all
- 16229 - MBI Poor - Nonpoint Source Monitoring
- 16229 - MBI Metric: % Clinger outside Reference - Nonpoint Source Monitoring
- 16229 - MBI Metric: % Ephemeroptera outside Reference - Nonpoint Source Monitoring
- 16229 - MBI Metric: Genus EPT Richness outside Reference - Nonpoint Source Monitoring
- 16229 - MBI Metric: Genus Taxon Richness outside Reference - Nonpoint Source Monitoring
- 16229 - MBI Metric: m%EPT outside Reference - Nonpoint Source Monitoring
- 16229 - Supplementary Metric: Genus Clinger Richness outside Reference - Nonpoint Source Monitoring
- 16230 - Epifaunal Substrate Marginal - Nonpoint Source Monitoring
- 16230 - Embeddedness Poor - Nonpoint Source Monitoring
- 16230 - Sediment Deposition Poor - Nonpoint Source Monitoring
- 16230 - Riparian Vegetative Zone Width - Reach Marginal - Nonpoint Source Monitoring
- 16230 - Habitat Poor - Nonpoint Source Monitoring
- 16231 - Algal Obs: Algal Mats Severe - Nonpoint Source Monitoring
- 16231 - Algal Obs: Algal Mats Moderate - Nonpoint Source Monitoring
- 16232 - Specific conductivity > SV, > 25% - Nonpoint Source Monitoring
- 16232 - DO < WQS (WAH) (one time) - Nonpoint Source Monitoring
- 16232 - NO<sub>2</sub>/3 > SV, > 25% - Nonpoint Source Monitoring
- 16232 - TOC > SV, > 25% - Nonpoint Source Monitoring
- 16232 - Total P > SV, > 25% - Nonpoint Source Monitoring
- 16232 - TKN > SV, 11 - 25% - Nonpoint Source Monitoring

Indicator - Program	Parameter	Status	Source	Delete
	Benthic Macroinvertebrates Bioassessments	Non Support	Multiple...	
	Habitat Assessment	Non Support	Multiple...	
	Nutrient/Eutrophication Biological Indicators	Non Support	Multiple...	
	Organic Enrichment (Sewage) Biological Indicators	Non Support	Multiple...	
	Sedimentation/Siltation	Non Support	Multiple...	
	Specific Conductivity	Non Support	Multiple...	



# Next Steps

- Since Screening Values developed, around 400 new macroinvertebrate index scores and about 200 new fish index scores
  - Accompanied by water chemistry, in situ, observations, etc.
- Review/update Screening Values using newly available data
- Data analysis to review relationships between individual metrics per bioregion/ecoregion that are sensitive to elevated nutrients
- Expand method in KY's CALM





Thank You! Questions?

