Investigating Potential Nutrient Impairment in a Central Great Plains Reservoir

> A Pilot study on Crowder Lake, a Nutrient Limited Watershed

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Outline

- Water Quality Standards
- Nutrient Limited Watersheds

• Nutrient Impairment Study

- Monitoring Efforts
- Outcomes



Oklahoma Water Quality Standards

- 1. Beneficial Uses
- 2. Criteria to protect Beneficial Uses
- 3. Anti-degradation Policy
- 4. Implementation

Nutrient Limited Watersheds

• 21 reservoirs in OK

 When a beneficial use is potentially being adversely affected by excess nutrients



Deemed threatened
 when TSI(chl) >62

Only considered *threatened* until a nutrient impairment study is performed

OWQS and NLWs

§ 785:46-15-10(d-g)

- Demonstration that nutrients impact a use
- Consequence of identification as NLW
- Consequence of assessment that use is threatened by nutrients
- Result of impairment study
 - Impaired
 - Not Impaired

Effects of a NLW Designation

Requires an annual soil test for feeding operations

 May lead to stricter guidelines on waste applications for feed operations

Effects of a NLW Designation

NRCS uses the designation in the development of Technical Guidance Reports

Impairment Study



Nutrient Impairment Study



 Are the beneficial uses impaired, and if so caused by excess nutrients

 Requires consistent, recent data; emphasizing Summer sampling

Nutrient Impairment Study

Surface and at Depth Samples

Water Column Profiles



Where to Start?

• Pilot Study

• Location/Accessibility

SWS Designation

• Historical BUMP data



Crowder Lake



- Washita County
- 158 acres
- Owned by SWOSU
- Sensitive Water Supply

Has many University related recreational activities such as horseback riding and a ropes course. Utilized by the University for classes, trainings and field trips.

Beneficial Uses

Beneficial Uses		Turbidity	Hd	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved ^{solids}	Entero. & E. coli	Chlor-a
	Fish & Wildlife Propagation	NS	S	NEI*	S							
	Aesthetics					NEI*	S					
	Agriculture							S	S	S		
	Primary Body Contact Recreation										S	
	Public & Private Water Supply											NS

*NEI = Not Enough Information

Monitoring

- July 2014 –
 September 2016
- Growing season (May-September) 2x
 a month
- Non-Growing season (September-April) 1x a month



Monitoring



Temperature, pH,
 Dissolved Oxygen, SpC,
 Salinity, ORP, TDS and
 Barometric Pressure

 TKN, TP, ortho-P, NO₂/NO₃ hardness, alkalinity, turbidity, chlorophyll, and pheophytin

Date	Time	Site	Depth	Temp	DO	DO	рН	SpCond	Salinity	ORP
			m	С	mg/L	% sat	units	us/cm	g/L	mV
5/7/2014	19:53:43	1	0.513	19.707	9.18	100.7	8	1222.1	0.61	398.8
5/7/2014	19:54:25	1	1.02	19.504	9.08	99.3	7.99	1222.1	0.61	400.4
5/7/2014	19:55:16	1	2.026	19.444	9.14	99.8	7.99	1222	0.61	402
5/7/2014	19:55:51	1	2.972	19.129	9.01	97.7	7.98	1223.3	0.61	403.5
5/7/2014	19:56:47	1	3.986	18.306	8.27	88.2	7.88	1223	0.61	407.7
5/7/2014	19:58:09	1	5.041	17.663	7.23	76.1	7.77	1224.8	0.61	412.4
5/7/2014	20:01:24	1	6.048	16	4.4	44.7	7.57	1227.9	0.62	416.3
5/7/2014	20:02:25	1	7.037	15.908	1.97	20	7.34	1229.2	0.62	184
5/7/2014	19:44:10	2	0.426	19.915	9.23	101.8	8.01	1221.9	0.61	413.1
5/7/2014	19:46:37	2	1.074	19.873	9.24	101.7	8.01	1221.9	0.61	414.8
5/7/2014	19:47:43	2	1.871	19.759	9.22	101.3	8.01	1222.1	0.61	415.7
5/7/2014	19:48:49	2	3.019	19.586	9.2	100.8	8	1221.8	0.61	417
5/7/2014	20:09:19	3	0.437	21.759	9.21	105.2	8.03	1226.2	0.61	331.4
5/7/2014	20:10:02	3	1.022	21.734	9.22	105.3	8.04	1226.1	0.61	336.4
5/7/2014	20:10:55	3	1.193	21.745	9.22	105.2	8.04	1226.1	0.61	340.9

Lakes Monitoring



- Stratification
- Zoo- and Phytoplankton
- Field observations

Habitat assessment

Streams Monitoring

- Same parameters as in-lake samples
- Stream Flow
- Habitat assessment to be done next
 Summer



TP and **TSI**(chl)



Outcomes

 Definite determination of Beneficial Use impairment status

Threatened to either Impaired or Not Impaired

Outcomes

• Endpoints

 What % of samples need to be >62 to be definite or is there gray area?

Template

More data for Volumetric DO assessment

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