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PUBLIC NOTICE[1]

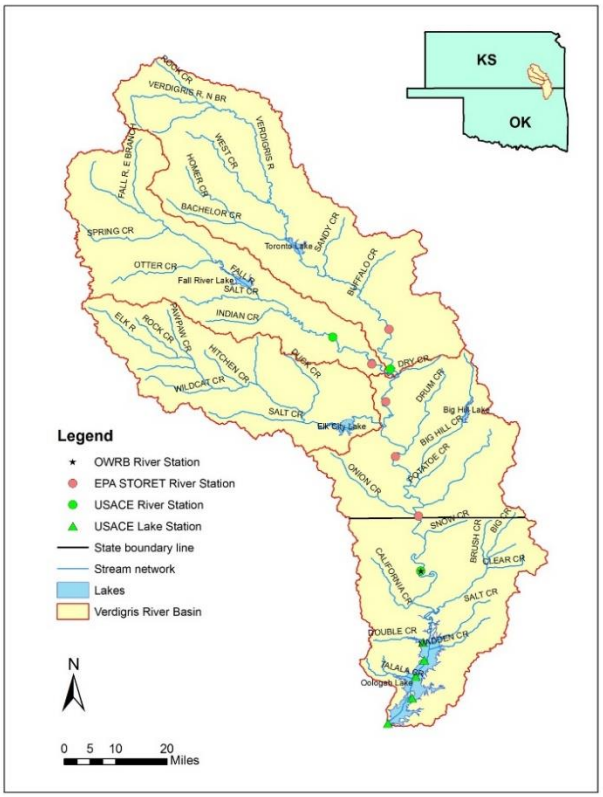
November 14, 2023

Availability of Draft Dissolved Oxygen (DO) and Turbidity TMDLs for Oologah Lake

Proposed Modification to Incorporate Oologah Lake DO and Turbidity TMDLs into Oklahoma's Water Quality Management Plan

Request for Public Comments

Public Comment Period Ends on Friday, December 29, 2023



The Oklahoma Department of Environmental Quality (DEQ) is seeking comments on a draft Total Maximum Daily Load (TMDL) report titled, "Oologah Lake TMDL Report". This report describes the reductions in total phosphorus (TP), total nitrogen (TN), total organic carbon (TOC), and total suspended solids (TSS) needed to achieve compliance with water quality standards for DO and turbidity and improve water quality in the Oologah Lake Area.

DEQ is also proposing to incorporate these TMDLs into Oklahoma's Water Quality Management Plan (208 Plan). The full TMDL report can be found online at: https://www.deq.ok.gov/water-quality-division/watershed-planning/tmdl/.

Beneficial Uses: The designated beneficial uses for Oologah Lake (WBID: OK121510010020_00):

- Aesthetics (AES)
- Agriculture (AG)
- Navigation (NAV)
- Fish & Wildlife Propagation - Warm Water Aquatic Community Subcategory (WWAC)
- Fish Consumption (FISH)
- Primary Body Contact Recreation (PBCR)
- Public & Private Water Supply (PPWS)

Table 1 is an assessment from Oklahoma's 2014 Integrated Report (IR) on whether or not the waterbodies in

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the Study Area met their designated beneficial uses.

Table 1: Assessed Beneficial Uses for the Waterbody in the Study Area

Waterbody Identification	Waterbody Name	AES	AG	NAV	WWAC	FISH	PBCR	PPWS
OK121510010020_00	Oologah Lake	F	F	F	N	I	F	I

F – Fully supporting that designated use; N – Not supporting that use; I – Insufficient information; X – Not assessed

Impairments: Based on an assessment of water quality monitoring data for the 2014 IR, Oklahoma DEQ has determined that Oologah Lake is not supporting its designated uses for Fish and Wildlife Propagation for WWAC because of low dissolved oxygen (DO) and high levels of turbidity. Within the 4,339 square mile drainage basin, sources of nutrient and TSS loading related to low dissolved oxygen and turbidity problems in Oologah Lake include loading from the Verdigris River basin and the outflows from the four federal reservoirs: Toronto Lake, Fall River Lake, Elk City Lake, and Big Hill Lake in Kansas State. In addition to the major inflow from the Verdigris River, nutrient loading to Oologah Lake is also contributed by local land use driven loading from several small tributaries and direct overland runoff. High levels of turbidity reflect sediment loading from the watershed and low levels of dissolved oxygen, particularly at depths deeper than the seasonal thermocline, reflect the effects of decomposition of organic matter below the thermocline and within the sediment bed and restricted mixing of dissolved oxygen from the surface layer of the lake to the lower layer of the lake during conditions of summer stratification.

- **DO:** The WWAC beneficial use will be considered not attained with respect to DO if either the surface or water column criteria produce a result of not attained as below:
  - Surface Criteria for WWAC Lakes: More than 10% of the samples from the epillimnion during periods of thermal stratification or the entire water column when nostrification is present, are less than 5.0 mg/L from June 16 through March 31 (6.0 mg/L from April 1 – June 15).
  - Water Column Criteria for WWAC Lakes: 50% or more of the water volume has a DO concentration of less than 2 mg/L or more than 70% of the water column at any given samples site has a DO concentration of less than 2 mg/L if no volumetric data is available.
- **Turbidity:** When more than 10% of turbidity samples in a lake are greater than 25 NTU based on long-term record of most recent 10 years, the WWAC beneficial use will be considered not attained. Turbidity is a measure of water clarity, so it cannot be expressed as a mass load. Total suspended solids (TSS) are therefore modeled and evaluated as a surrogate for turbidity using a site-specific relationship derived from TSS and turbidity measurements.

Watershed: Reservoirs located upstream of Oologah Lake in the Verdigris River basin and the outflows from the four federal reservoirs: Toronto Lake, Fall River Lake, Elk City Lake, and Big Hill Lake in Kansas State. In addition to the major inflow from the Verdigris River, nutrient loading to Oologah Lake is also contributed by local land use driven loading from several small tributaries and direct overland runoff. The outflow from Toronto Lake, Fall River Lake, Elk City Lake, and Big Hill Lake federal reservoirs provide the upstream boundary inflow to the lake model domain of the Verdigris River and Oologah Lake. Drainage area of the entire watershed to Oologah Lake is 4,339 square miles.

Oologah Lake: Oologah Lake (OK121510010020_00) is a 29,460-acre reservoir located in northeastern Oklahoma in Rogers County about 2 miles southeast of Oologah and 27 miles northeast of Tulsa. The dam is located at river mile 90.2 of the Middle Verdigris River at Longitude: -95.679(W) and Latitude: 36.4225(N). The lake, with 180 miles of shoreline in Rogers and Nowata Counties, was constructed in 1974 by impounding the Middle Verdigris River for flood control, water supply, navigation, recreation, and fish and wildlife propagation. The reservoir, owned and operated by the USACE, Tulsa District.

Point Source Discharges:

- **OPDES regulated municipal and industrial wastewater treatment facilities:** There are seven (7) facilities in the Study Area. The watershed and lake models include the facilities with the effluent flow rate larger than 0.1 MGD. This can be found in Table 3-1 of the TMDL report. There are no direct NPDES point source discharges of wastewater into Oologah Lake

- **OPDES regulated stormwater discharges:** DEQ regulates stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s), industrial sites, and construction sites. However, DEQ's stormwater program does not include the discharges from Indian Country lands, discharges related to oil & gas extraction, or discharges associated with agricultural purposes. For details about DEQ's Stormwater Program, go to http://www.deq.state.ok.us/WQDnew/stormwater/.
  - **MS4s:** Within the domain of the Oologah Lake watershed model, in the Oklahoma portion of the Study Area in Rogers, Nowata, and Washington Counties, there are no pollutant contributions from Phase II MS4 permits. In the Kansas portion of the Study Area, the City of Coffeyville has been issued a Phase II MS4 Stormwater Program permit (KSR440002) by the Kansas Department of Health and Environment (KDHE). The urban stormwater contribution of flow and pollutant loading from Coffeyville is included in the compilation of total nonpoint source loading for the HSPF model domain and will be accounted for by the Load Allocation (LA) estimated for the Oologah Lake TMDL.
  - **Multi-Sector General Permit (MSGP):** An NPDES permit authorization to discharge stormwater from an industrial activity must be obtained prior to the start of any operations. The owner/operator permit holder must also develop and implement a Storm Water Pollution Prevention Plan (SWP3) for the industrial facility maintained at the site. There are nine (9) MSGP facilities in the Study Area. These can be found in Table 3-6 of the TMDL report.
  - **Construction Sites:** A Construction General Permit (OKR10) is required for any stormwater discharges associated with construction activities that result in land disturbance of equal to or greater than one (1) acre, or less than one (1) acre if they are part of a larger common plan of development or sale that totals at least one (1) acre. A stormwater pollution prevention plan (SWP3) must be developed and implemented according to the requirements of the OKR10 permit. There were six (6) OKR10 permits issued between 2012 and 2014 for construction projects in the Oologah Lake Study Area. These can be found in Table 3-5 of the TMDL report.
- **No-Discharge Facilities:** For the purposes of these TMDLs, it is assumed that no-discharge facilities (such as towns with total retention lagoons) do not contribute to nutrients or TSS getting into the waterbodies. However, it is possible that the wastewater collection system associated with no-discharge facilities could be a source of pollutant loading to streams, or that discharges from the WWTP may occur during large rainfall events that exceed the storage capacity of the wastewater system. There are seven (7) facilities in the Study Area.
- **Sanitary Sewer Overflows (SSO):** SSOs are a common result of the aging wastewater infrastructure around Oklahoma. Oklahoma has been ahead of other states and, in some cases EPA itself, in its handling of SSOs. Due to the widespread nature of the SSO problem, DEQ has focused its limited resources to first target SSOs that result in definitive environmental harm (such as fish kills) or lead to citizen complaints.[2] All SSOs falling into these two categories are addressed through DEQ's formal enforcement process. While not all sewer overflows are reported, DEQ has some data. For example in the Oologah Lake Study Area between 1992 and 2017, 23 SSO occurrences were reported that spilled more than 1,000 gallons with a maximum bypass volume of over six (6) million gallons. Details about these SSOs are summarized in Table 3-4 of the TMDL report with specific details in Appendix F.
- NPDES regulated **Animal Feeding Operations (AFOs):** The Agricultural Environmental Management Services (AEMS) is a program within the Oklahoma Department of Agriculture, Food and Forestry (ODAFF). Through regulations established by the Oklahoma Concentrated Animal Feeding Operation (CAFO) Act, Swine Feeding Operation (SFO) Act, and the Poultry Feeding Operation (PFO) Registration Act, AEMS helps develop, coordinate, and oversee environmental policies and programs aimed at protecting the Oklahoma environment from pollutants associated with agricultural animals and their waste. This is done through the use of Best Management Practices (BMPs). BMPs include dikes, berms, terraces, ditches or other similar structures used to isolate animal waste from outside surface drainage. ODAFF is the NPDES-permitting authority for CAFOs and SFOs in Oklahoma under what ODAFF calls the Agriculture Pollutant Discharge Elimination System (AgPDES). PFOs are smaller animal feeding operations so they are not required to get NPDES permits. They are only required to register with ODAFF and follow PFO rules. In the Oklahoma portion of the Study Area, there are three (3) PFOS and no CAFOs

[2] For environmental complaints, go to: www.deq.state.ok.us/ECLSnew/Complaints/onlncmpl.htm

or SFOs. In the Kansas portion of the Study Area, there are twenty-four active CAFOs and no PFOs or SFOs.

Chicken litter data was not explicitly included in the watershed model. The impact of chicken litter on water quality, however, has been implicitly accounted for by agricultural land use in calibration of the watershed model.

Nonpoint Sources of Discharges in the Study Area:

- **Watershed Loading** – Streamflow, nonpoint source runoff, and pollutant loading to Oologah Lake are provided as time series output from a watershed model for input to the lake model. Simulated flow and watershed pollutant loading are dependent on land use characteristics, soils, topography and hydrologic inputs, including point source discharges from NPDES wastewater facilities to tributaries, for each sub-watershed catchment of the watershed model domain. Natural background conditions are not represented as an explicit component of watershed loading to Oologah Lake. All flow and pollutant loading data assigned for input to the lake model are derived from the watershed model.

- **Atmospheric Deposition** – Atmospheric deposition of nitrogen and phosphorus to a waterbody is contributed by both dry and wet deposition. Dry deposition is defined as a mass flux rate (as g/m2-day) for a constituent that settles as dust or is deposited on a dry surface during a period of no precipitation. The mass flux of a constituent from wet deposition is defined by the concentration of the constituent in rainfall and the rate of precipitation.

- **Internal Loading** – Benthic phosphate release rates, characteristic of eutrophic lakes and reservoirs, can also be estimated for Oologah Lake using an empirical methodology developed by Nurnberg (1984). Measured data collected by Dzialowski and Carter (2011) were used to confirm model results simulated by the internally coupled sediment diagenesis sub-model of the EFDC lake model that was developed for Oologah Lake.

TMDL Calculations:

The methodology for the MDL is based on calculations of the (a) long-term average load (LTA) of untransformed pollutant loading data calculated with data derived from NPDES wastewater dischargers and the watershed (HSPF) model; and (b) an estimation of the statistical variability of the time series for untransformed loading data based on calculations of the mean (μ), standard deviation (σ), variance (σ^2) and the coefficient of variation (CV). The lognormal distribution is used to represent nonpoint source loading data for Oologah Lake.

Recommendations:

The LA for TN, TP, TOC and TSS, determined from the lake model response to load reductions, are based on 40% reduction of the existing 2007 watershed loads estimated with the HSPF model. Load reductions are needed because the criteria for the turbidity in the lake are not in compliance under the existing loading conditions. Critical conditions for dissolved oxygen at the sampling site near the dam are also not satisfied under the existing loading conditions.

Table 2 present the total loading rates to Lake Oologah as the Long-Term Average (LTA) load for the existing conditions and for the projected 40% removal management scenario. The LTA load and the coefficient of variation (CV) of the time series external load data is used to compute the MDL for TN, TP, TOC, and TSS as presented in Table 3. The Maximum Daily load values derived for TN, TP, TOC and TSS are presented in Table 4.

Table 2 Long Term Average (LTA) Load for TN, TP, TOC, and TSS: Existing Conditions and 40% Removal in Oologah Lake

Water Quality Constituent Oologah Lake	LTA, Existing Annual kg/yr	Load Reduction %	LTA, Reduced Annual kg/yr	LTA, Reduced Daily kg/day
Total Nitrogen (TN)	8,160,833	40%	4,896,500	13,415
Total Phosphorus (TP)	1,214,873	40%	728,924	1,997
Total Organic Carbon (TOC)	33,328,891	40%	19,997,335	54,787
Suspended Solids (TSS)	1,842,230,207	40%	1,105,338,124	3,028,324

Table 3 Maximum Daily Load (MDL) for TN, TP, TOC and TSS to Meet Water Quality Targets for Turbidity and Dissolved Oxygen in Oologah Lake

Water Quality Constituent Oologah Lake	LTA, Reduced Daily kg/day	Load CV n=363	Z-Score for 95% Probability	MDL (TMDL) Load kg/day
Total Nitrogen (TN)	13,415	5.362	1.645	50,906
Total Phosphorus (TP)	1,997	6.432	1.645	7,407
Total Organic Carbon (TOC)	54,787	5.415	1.645	207,688
Suspended Solids (TSS)	3,028,324	41.188	1.645	6,524,666
LTA- Long Term Average Load CV- Coefficient of Variation				

Table 4 Maximum Daily Load (MDL), Waste Load Allocation (WLA) and Load Allocation (LA) for TN, TP, TOC and TSS for Oologah Lake

Water Quality Constituent Oologah Lake	WLA + LA (PS + NPS) %	WLA (PS) %	LA (NPS) %
Total Nitrogen (TN)	100%	0%	100%
Total Phosphorus (TP)	100%	0%	100%
Total Organic Carbon (TOC)	100%	0%	100%
Suspended Solids (TSS)	100%	0%	100%

Water Quality Constituent Oologah Lake	MDL (TMDL) Load kg/day	WLA (PS) kg/day	LA (NPS) kg/day	MOS kg/day
Total Nitrogen (TN)	50,906	0	50,906	Implicit
Total Phosphorus (TP)	7,407	0	7,407	Implicit
Total Organic Carbon (TOC)	207,688	0	207,688	Implicit
Suspended Solids (TSS)	6,524,666	0	6,524,666	Implicit

Providing comments

- DEQ invites your comments. The comment period will be open for 45 days. The TMDL report is a draft document and is subject to change based on comments received during the public participation process.
- You may also request a public meeting in writing. If there is a significant degree of interest, DEQ will schedule a public meeting.
- All official comments for the record must be submitted either in writing or by e-mail before the end of the comment period. DEQ will prepare a responsiveness summary addressing all comments received. After

evaluating comments received and making any necessary changes, the TMDL report will be submitted to EPA for final approval. The final version of the TMDL will be incorporated into Oklahoma's Water Quality Management Plan.

Please submit your comments in writing to: Soojung Lim, Water Quality Division, Oklahoma Department of Environmental Quality, P.O. Box 1677, Oklahoma City, OK 73101-1677; (405) 702-8192; E-mail: Water.Comments@deq.ok.gov

Comments must be received by 4:30 pm on Friday, December 29, 2023

Obtaining copies: You may view the full Oologah Lake TMDL Report by going to the DEQ website at: www.deq.state.ok.us/WQDnew/tmdl/index.html or by picking up copies at the DEQ main office, Water Quality Division, 707 North Robinson, Oklahoma City from 8:30 am – 5:00 pm. A document copying fee may apply.

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