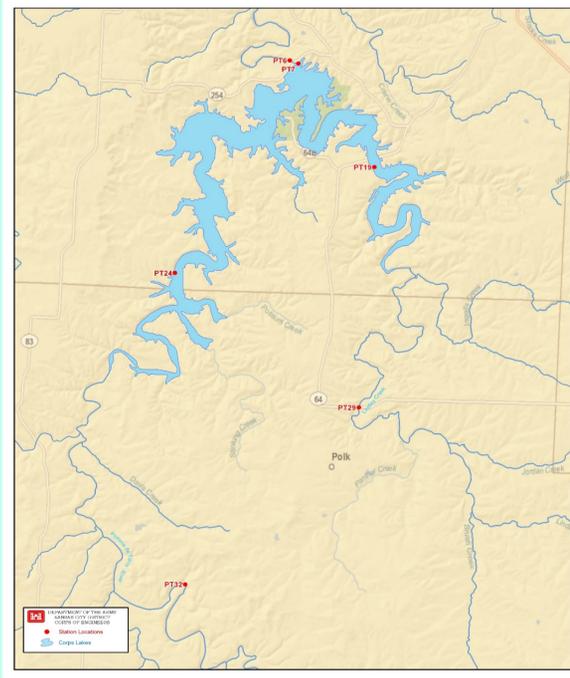


Pomme de Terre Lake Water Quality Summary

2009-2018

Pomme de Terre Lake

- Built on Pomme de Terre River reaching multipurpose pool in 1960.
- **Watershed**=611 square miles; 391,040 Surface Acres (SA)
- **Capacity**:
 - Flood Control: 406,821 Acre-feet (AF); 15,999 SA
 - Multipurpose: 237,356 AF; 7,790 SA; 113 miles of shoreline
 - Avg. annual inflow (2009-2018)= 458,503 AF;
 - 2018 inflow= 301,327 AF
- **Operating project purposes**: flood control, water quality, recreation, fish and wildlife.

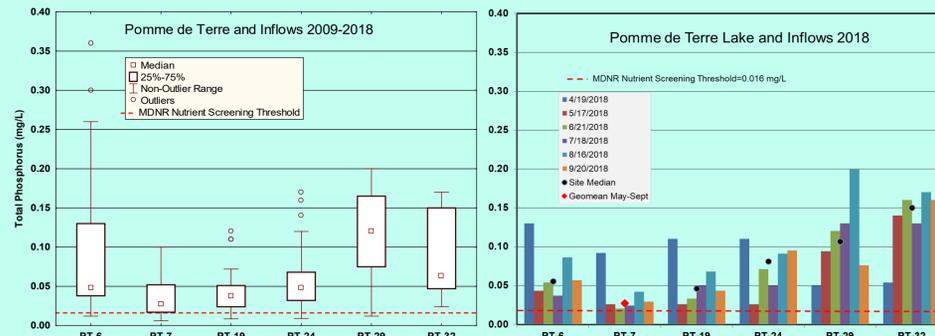


The **US Army Corps of Engineers (USACE)** Water Quality Program collects monthly water samples at Pomme de Terre Lake* from April through September. These figures present data collected between 2009-2018 from inflow streams (PT-29 and PT-32), three lake sites (PT-7, PT-19, PT-24) and the outflow (PT-6) below the dam. Thirty-four chemical, physical and biological parameters are measured to evaluate water quality. USACE uses this data to describe conditions and changes from the inflow streams, within the main lake, and outflow focusing on eutrophication, nutrients, sediment, herbicides, metals, and contaminants.

*Note: The term "lake" is substituted for technically correct "reservoir" throughout this document for consistency.

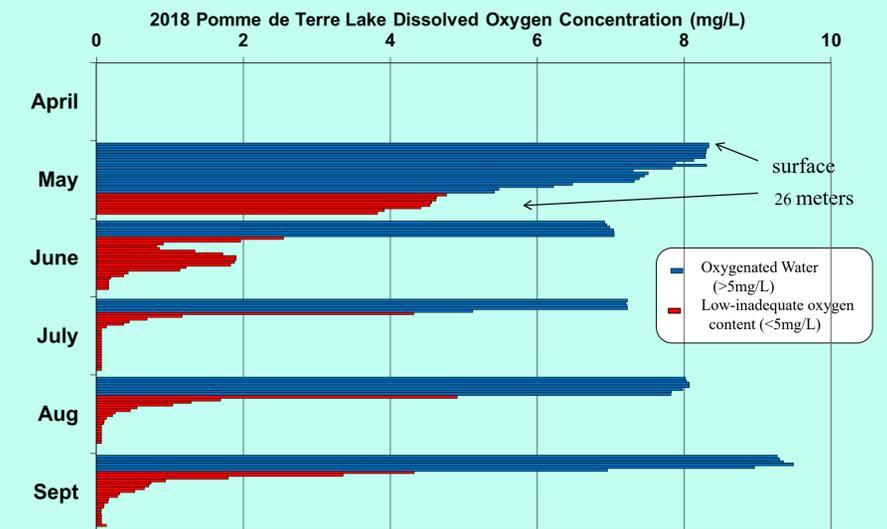
Total Phosphorus

Total phosphorus (TP) median concentrations from 2018 Pomme de Terre Lake samples were similar to the 10-year data (2009-2018) set except median value from Pomme de Terre River arm inflow site (PT-32) and upper lake site (PT-24) were above the 75% quartile. Increased phosphorus loads from Pomme inflows are of concern considering impairment to aquatic life for Pomme de Terre Lake. The geometric mean of TP at the dam (PT-7) exceeded MDNR Nutrient Screening Threshold. Similar to most impoundments, higher TP concentrations and a wider range of data is usually found in the upper lake sites and inflows due to mobilized nutrients bound to silt particles in moving water in inflows. Increase in TP from May-Sept. at PT-19 and PT-24 illustrates phosphorus concentrations released from bed sediment and stored in algae cells of growing algae populations.



Dissolved Oxygen

Dissolved oxygen (D.O.) is an important factor in aquatic species location, growth, and survival in lakes. Pomme de Terre Lake exhibits thermal stratification or separate water layers based on temperature and oxygenation. This process begins in late spring, remains throughout the summer, and breaks apart or mixes (i.e. "turns over") in the fall. The figure below illustrates dissolved oxygen measured in the water column in one-meter intervals (i.e. each row in each month represents one meter of depth) from April through September at the dam (PT-7). Pomme de Terre Lake stratifies every summer, however, adequate (>5 mg/L) dissolved oxygen is typically available in the lake. In 2018, Pomme de Terre Lake was oxygenated in the top 5 meters during the worst conditions in July. Significant fish kills were documented in 2018 at Pomme de Terre and Melvern Lake (KS) due to high temperatures and low oxygen levels causing bacterial infections in several species.



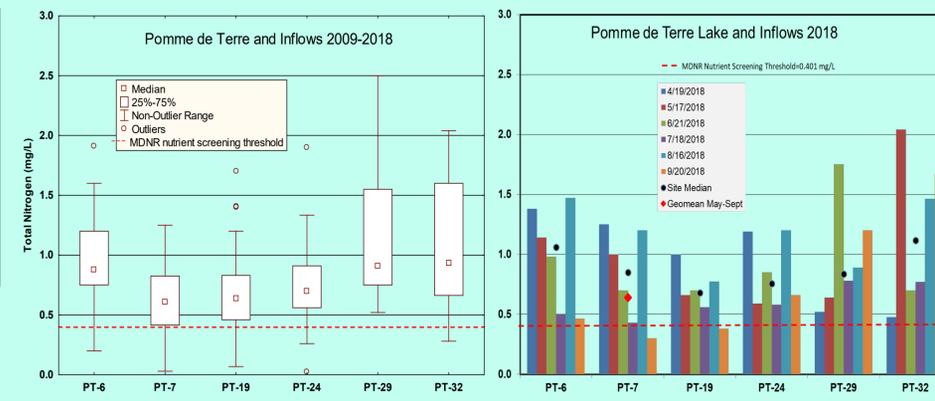
Water Quality (WQ) at Pomme de Terre Lake in 2018 was beneficial to operating purposes listed above. Missouri State WQ Standards Numeric Nutrient Criteria "screening threshold" was exceeded for Total Phosphorus (TP), Total Nitrogen (TN), and Chlorophyll a for designated use "aquatic life protection"(AQL). Water quality at Pomme de Terre Lake improves as nutrients, herbicides and sediments are partially removed by settling, dilution, biological and other natural processes as water moves from inflow streams toward the dam.

Nutrient Enrichment

Nutrients (i.e. phosphorus and nitrogen) are essential for aquatic life and are the primary factor driving fish, aquatic plant growth rates, and productivity. Excess nutrients from urban, agricultural or natural sources speeds up the natural aging, or eutrophication, process in lakes. Eutrophication is responsible for changes in plant and aquatic life in lakes and water bodies including algal blooms, low dissolved oxygen that affects fish survival, and taste and odor issues in drinking water. Missouri Department of Natural Resources (MDNR) led a multi-agency work group to establish Missouri Numeric Nutrient Criteria for Lakes to minimize and eliminate adverse effects of nutrient enrichment to aquatic life in Missouri lakes. Geometric mean of summer total phosphorus (TP), total nitrogen (TN) and Chlorophyll exceeded nutrient screening threshold near the dam (see respective sections). Chlorophyll exceedance is an indicator of impairment to Pomme de Terre Lake state designated use of support to aquatic life as outlined in state regulations (10 CSR 20-7). The U.S. Environmental Protection Agency (EPA) Osage Highlands Ecoregion, including Pomme de Terre, has lower thresholds and criteria than other Ecoregions in Missouri.

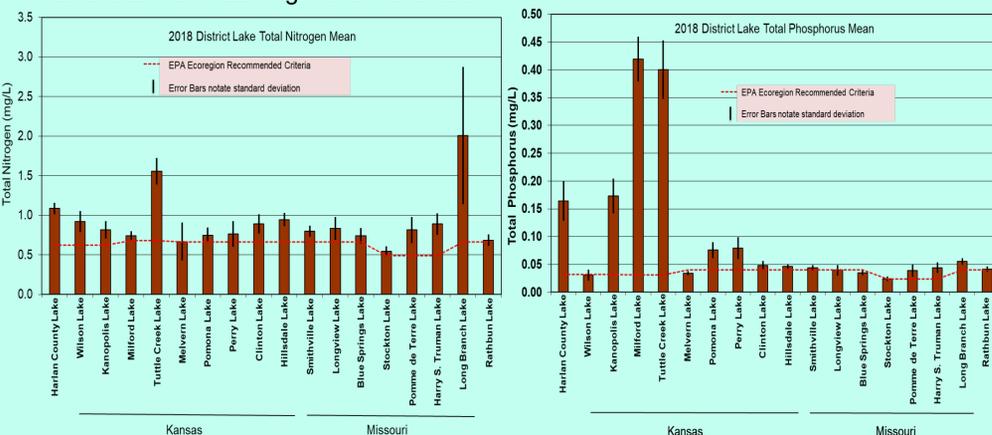
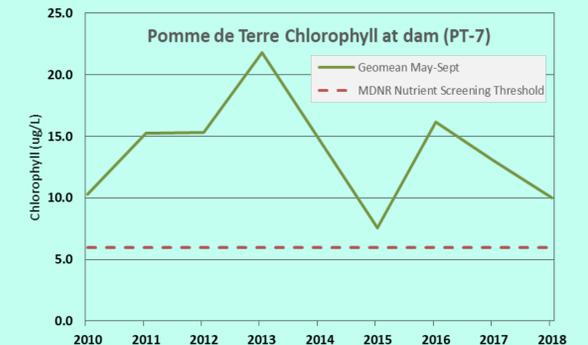
Total Nitrogen

Median Total Nitrogen (TN) concentrations at all sites were within the 50% quartile of 2009-2018 TN data, except PT-7. All lake sites and outlet experienced two nitrogen peaks in April and August resulting from organic sources (e.g. algae cells). Geometric mean of summer TN samples at PT-7 exceeded the MDNR Numeric Nutrient Screening Threshold, indicating possible impairment. Total Nitrogen concentrations typically peak in the spring and are highly variable between sites and years related to inflows, biological activity, and upstream land use. Much of the nitrogen (nitrate) available for plant growth is used up by the healthy algae community through the summer months and cycles between different forms of available and stored nitrogen related to algae uptake.



Algae

Algae and green plants are the base of the food chain in aquatic food webs converting nutrients and CO₂ through photosynthesis into biomass for all aquatic life. MDNR Numeric Nutrient Criteria uses Chlorophyll as the keystone metric to describe lake impairment to aquatic life. Excessive algae, as measured by chlorophyll concentration, indicates that high nutrients are having a direct impact on aquatic life. Annual geometric means of summertime chlorophyll at PT-7 typically exceed MDNR Nutrient Screening Threshold. Chlorophyll Blue-green algae is present, but algae populations in Pomme de Terre are typically dominated by beneficial species.



Water Quality Concerns:

- Nutrients
- Bacteria
- Dissolved Oxygen