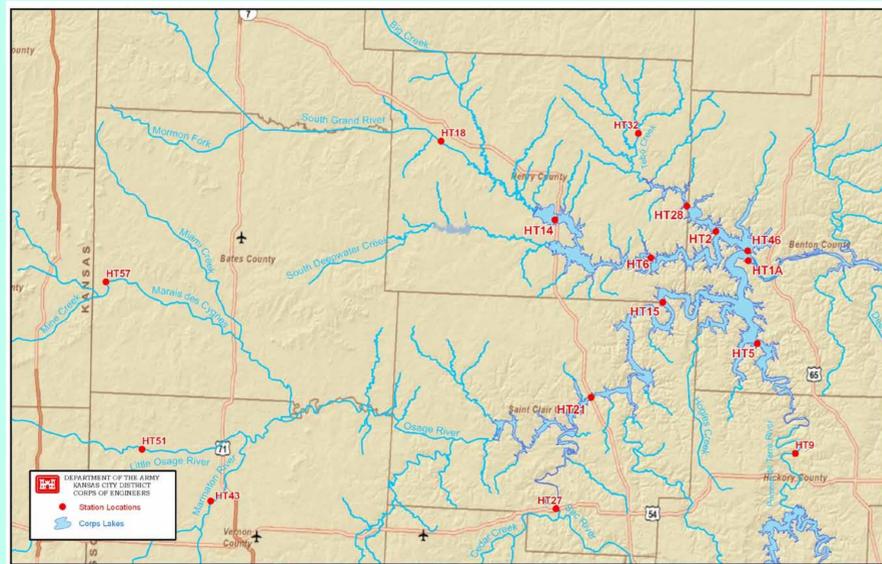


Water quality trends at Harry S. Truman Reservoir 2006-2011

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Abstract: U.S. Army Corps of Engineers-Kansas City District collects monthly (April through September) water quality samples from standardized sites at Harry S. Truman Reservoir and outflow annually and inflow streams every three years. Water quality sampling includes data describing nutrients, sediments, herbicides, metals, chlorophyll, secchi depth (water transparency), and profiles of physical water quality measured at 1 meter depth intervals. In most reservoirs and at Truman Lake, water quality improves as nutrients, herbicides and sediments are removed by settling, dilution, and biological processes as water moves from inflow streams to the dam. Western inflows originating in agricultural regions have significantly higher nutrients and sediment delivery than inflow streams originating in Ozark border regions. Truman Lake water quality 2006-2011 was conducive to project operating purposes of flood control, hydropower, recreation, fish and wildlife, and water supply.

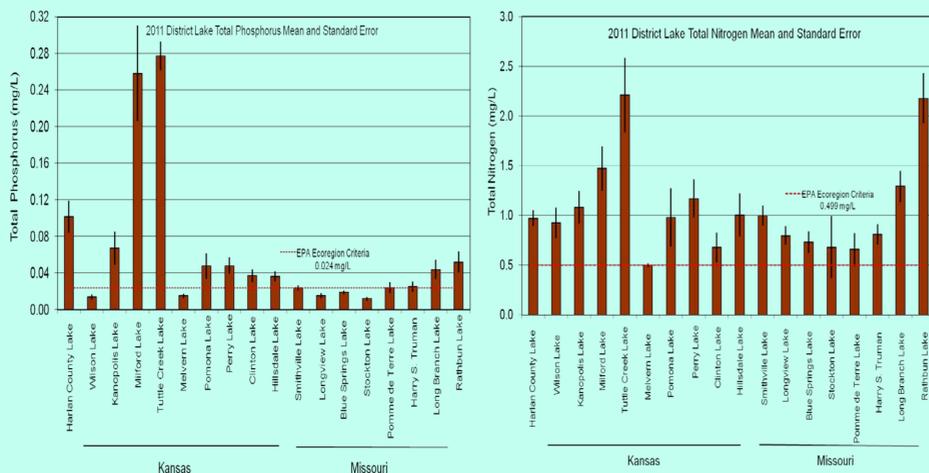


Harry Truman Lake

- Built on Osage River reaching full pool in 1977.
- Watershed = 8,914 square miles/ 5,704,960 Surface Acres (SA)
- Capacity:
 - Flood Control: 4,005,392 Acre-feet (AF) / 209,048 SA
 - Multipurpose: 1,181,640 AF / 55,406 SA / 958 miles of shoreline
 - Avg. annual inflow = 6,689,800 AF
- Project Operating Purposes: flood control, hydropower, recreation, fish and wildlife, and water supply.

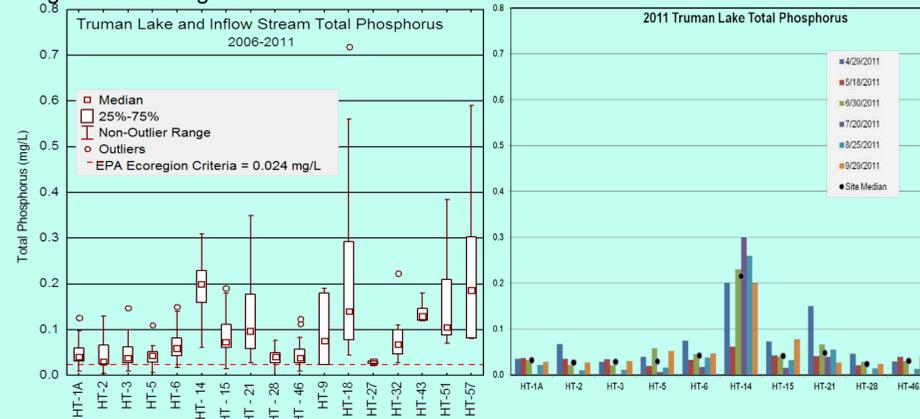
Nutrient enrichment

Nutrients (i.e. phosphorus and nitrogen) are essential for aquatic life and are the primary factor driving fish and aquatic plant growth rates and productivity. Excess nutrients from agricultural or natural sources increases the natural aging or eutrophication process in lakes. This can alter plant and aquatic life in lakes and water bodies, cause algal blooms and lead to low dissolved oxygen affecting fish survival. In 2011, Truman and other Missouri Corps' lakes ranked low in the Kansas City District for average nutrients measured at the site nearest the dam.



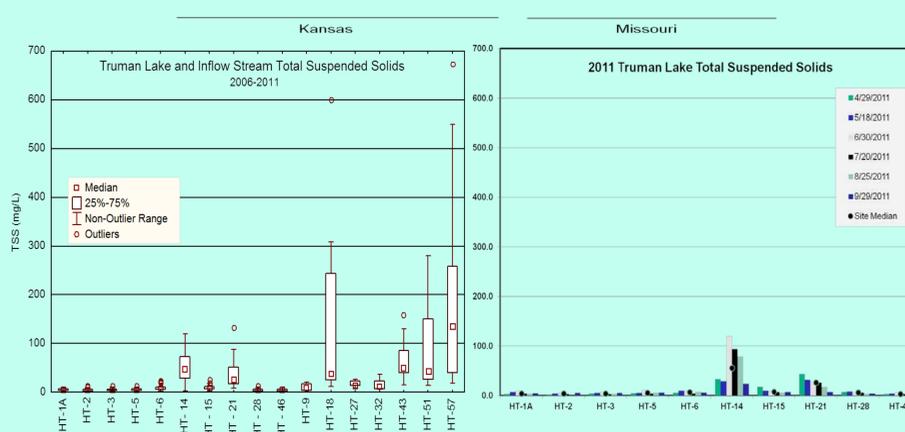
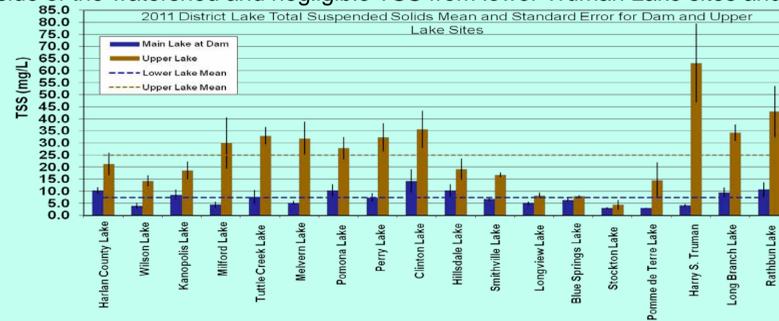
Total Phosphorus

Truman Lake total phosphorus (TP) concentrations at most sites are near the low end of eutrophic range (0.024-0.096 mg/L) providing nutrients which benefit planktonic algae species and fish growth. However, some areas have more nutrients than recommended by EPA Ecoregion Criteria. Median phosphorus concentrations in 2011 were similar to 5-year trends. HT-14 (upper S. Grand R. Arm) has the highest TP fed by flows from the S. Grand River measured at site HT-18. High levels of TP from upper lake sites like HT 14, 15, and 21 are typically bound to suspended sediment particles and/or processed via biological attenuation before they reach lower lake sites as demonstrated by the decline in TP from HT18 to HT6. Inflow streams had highly variable TP results dictated by land use and soil types as observed by results of Ozark influences on the Sac River (HT 27) TP median of 0.31 mg/L compared to plains influence and associated land use (i.e. row crop) on Osage (HT-51), Marais de Cygne (HT-57), South Grand (HT-18) with medians from 0.104 mg/L to 0.185 mg/L.



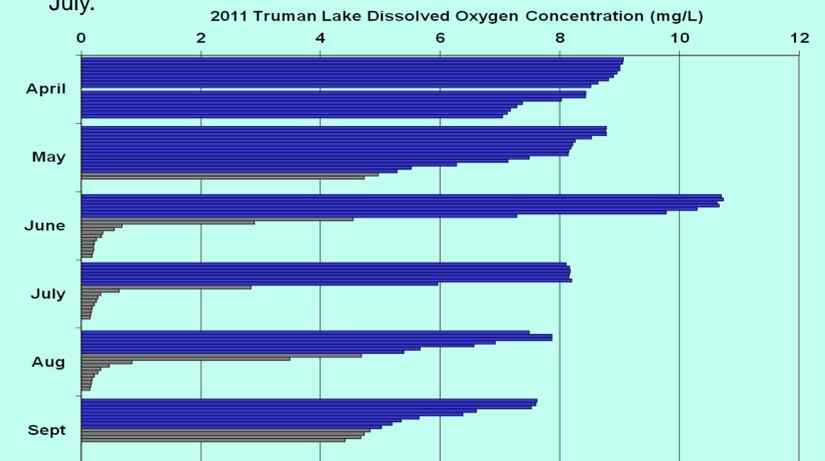
Total Suspended Solids

Total suspended solids (TSS) or filterable solids in streams and lakes is a function of watershed characteristics including soil composition, land use, weather patterns, and characteristics of inflowing streams. TSS may be an indicator of erosion in watersheds, sedimentation or filling rates of downstream reservoirs, and is also closely linked to nutrient and contaminant transport through river systems. Due to particle size and soil characteristics, a high percentage of suspended solids carried by streams settles out before it reaches lower end of the lake. In 2011, Truman mean TSS values in the upper lake were the highest of District lakes, however 93% of TSS settled out as water moved from the upper lake to the dam. Five-year TSS trends show the highest values and high sample variation found in the west side of the watershed and negligible TSS from lower Truman Lake sites and outflow.



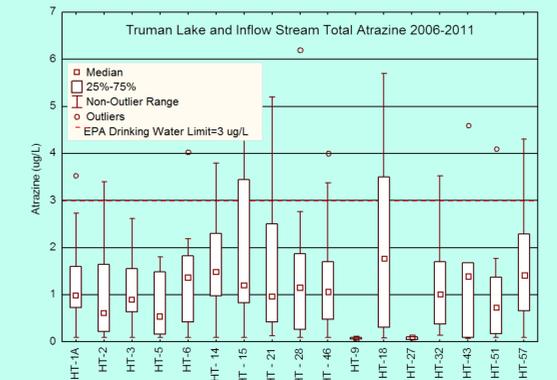
Dissolved Oxygen

Dissolved oxygen is a factor in aquatic species location, growth, and ultimately survival in lakes. The figure below shows dissolved oxygen measured in the water column at one-meter intervals (e.g. each row in each month represents one meter of depth) from April through September. Truman Lake typically stratifies for a short period of the summer, however adequate (5 mg/L) dissolved oxygen is typically available in the lake. In 2011, Truman Lake had adequate oxygen in the top 7 meters during the worst conditions in July.



Herbicides-Atrazine

Herbicides (atrazine, alachlor, metachlor, cyanazine, and acetochlor) are sampled every three years from Truman Lake and inflows. Atrazine is the most widely used and most frequently detected herbicide throughout the Midwest and the only herbicide exceeding water quality standards. Atrazine is dispersed throughout the water column, and must be removed for drinking water. From 2006-2011, total atrazine occasionally exceeded drinking water standards (3 ug/L) during spring sampling, which coincides with application and runoff. Median concentrations were less than 3ug/L and exceedance from all sites was 12 percent during the 5-year study period.



Fecal Bacteria

E. Coli is sampled and reported from seven Corps owned swim beaches on Truman Lake protective of whole body contact recreation during the summer recreation season. Large numbers of geese and wildlife can occupy Corps swim beaches leading to e. coli counts exceeding EPA Standards when sampling coincides with high water levels or recent rain events. In 2011, none of the Truman Lake beach samples exceeded water quality standards (235 CFU/100ml). Beaches at Truman Lake are infrequently closed due to e. coli populations, but have not been linked to chronic problems or poor water quality in the watershed.



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