

Perry Lake Water Quality Summary 2005-2014

The US Army Corps of Engineers (USACE) Water Quality Program collects monthly water samples at Perry Lake from the beginning of April through September. These figures present data collected between 2005-2014 from four lake sites (#2,3,6,13) and the outflow (#1) 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.



Perry Lake:

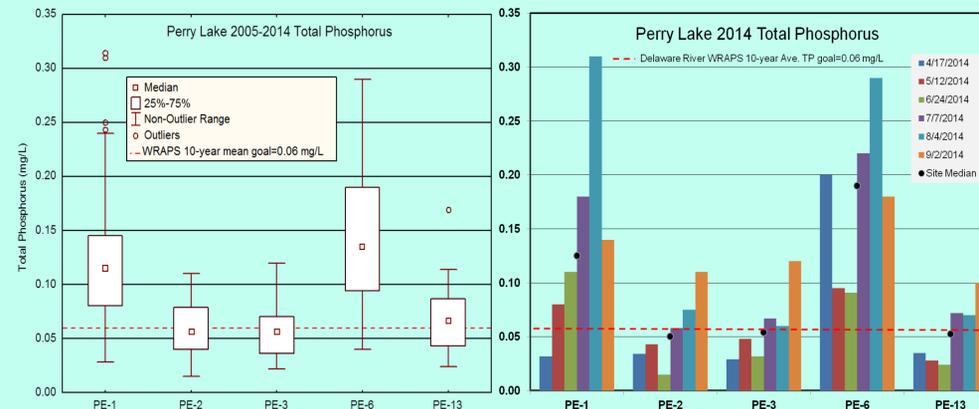
- Built on Delaware River reaching full pool in 1970
- **Watershed** = 1,117 sq miles; 714,880 Acres (A)
- **Capacity:** Flood Control: 515,795 Acre-Feet (AF); 25,347 Surface-Acre (SA)
- **Multipurpose Pool:** 209,513 AF; 11,146 SA; 160 miles of shoreline
- **Avg. annual inflow:** (2005-2014)=395,764 AF; 2014 inflow= 208,617 AF
- **Operating project purposes:** flood control, recreation, water supply, navigation support, water quality, and fish and wildlife habitat
- **Water Quality** at Perry Lake in 2014 was beneficial to operating purposes listed above and measured parameters did not exceed KS State WQ Standards for designated uses. 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.

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 biological productivity. Excess nutrients from urban, agricultural or natural sources increases the natural aging process in lakes. This rapid aging process, called eutrophication, is responsible for changes in plant and aquatic life in lakes and water bodies including algal blooms, low dissolved oxygen that affect fish survival, and taste and odor issues in drinking water. Perry Lake is on the 2014 Ks 303(d) list of impaired waters for accelerated eutrophication. KDHE and EPA are working with water quality partners, landowners and an active Delaware River Watershed Restoration and Protection Strategy (WRAPS) group in the watershed to reduce nutrient and sediment runoff. Slowing the eutrophication process improves water quality and increases the life span of Perry Lake. In 2014, Perry Lake ranked well below USACE Kansas City District lake average for total phosphorus (0.094 mg/L) near district averages for total nitrogen (0.68 mg/L) measured at the site nearest the dam. Both nutrient annual averages were below WRAPS 10-year milestones. Standard error bars in the graph measures below illustrate the variation in sample results from each site in 2014.

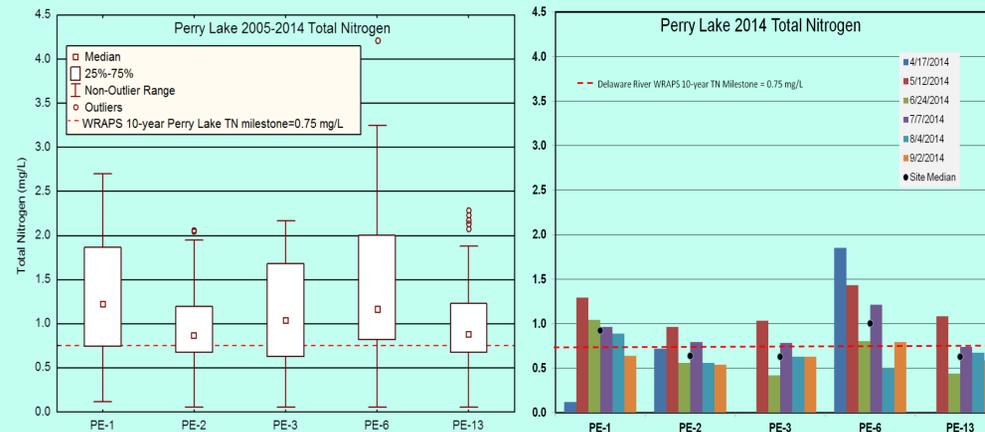
Total Phosphorus

Total phosphorus (TP) median concentrations in 2014 were similar to long-term trends at Perry Lake sites and outflow. TP median concentrations from 2005-2014 lake samples were similar to EPA approved 10-year goals set by Delaware R. WRAPS, except at sites PE1 and PE6 where results were 2 to 3 times higher. Phosphorus released by bottom sediments are apparent at lake sites in 2014 as TP levels increase as summer progresses unrelated to runoff events or inflows. Mixing from nutrient rich bottom sediments and re-suspension of TP by fish, wind, and bacteria result in significant internal loading of phosphorus in the shallow water during the summer months at Perry Lake and Delaware River.



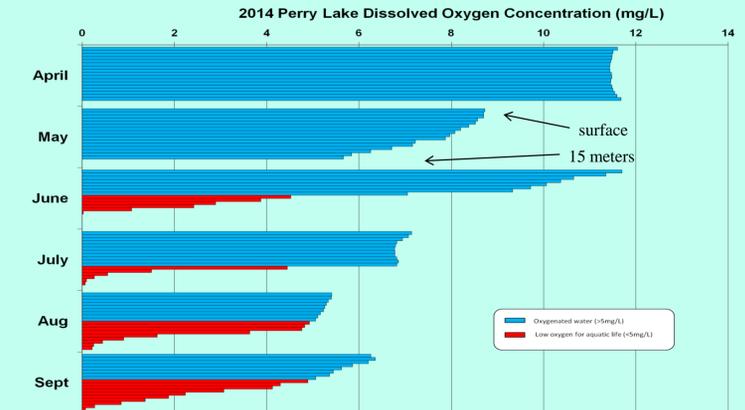
Total Nitrogen

In 2014, median total nitrogen concentrations were slightly lower than 10-year milestones set by Delaware River WRAPS. Below average inflows and moderate rain events lead to reduced nutrient loading from the watershed. Median TN concentrations were below 10 year medians at all sites and 2014 TN maxima at each site did not exceed the 75% quartile of the 10-year data set. TN concentrations can be highly variable between sites and years and most related to stream discharge and watershed factors (i.e. soils and farming practices).



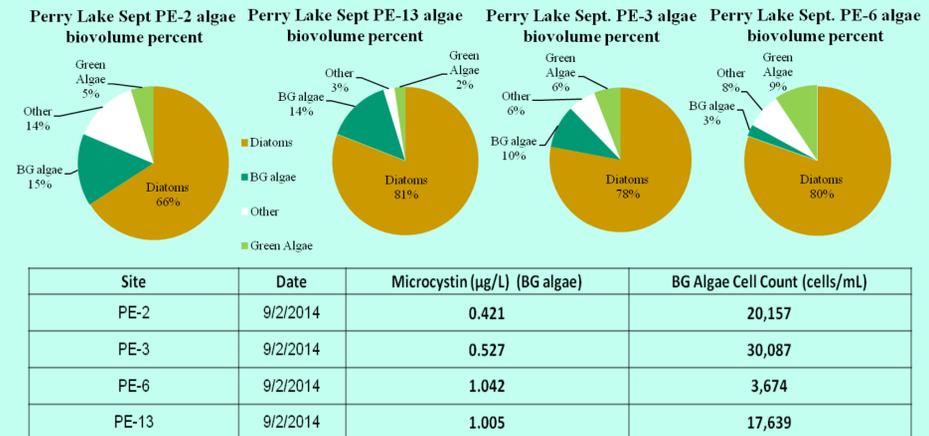
Dissolved Oxygen

Dissolved oxygen is a key factor in aquatic species location, growth, and ultimately survival in lakes. The figure below illustrates dissolved oxygen measured in the water column in one-meter intervals (e.g. each row in each month represents one meter of depth) from April through September. Perry Lake stratifies for a short period of the summer, but adequate (5 mg/L) dissolved oxygen is available. In 2014, at least the top 8 meters of the lake were well oxygenated for fish and aquatic life throughout the summer.



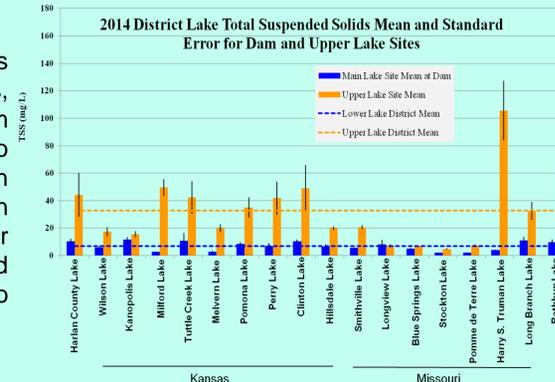
Algae

Algae and green plants are the base of the food chain in a lake and convert nutrients and CO₂ through photosynthesis into biomass for all aquatic life. In 2014 USACE samples, blue-green algae species composed 15% or less of the algae community as shown by biovolume measurement. During July-Sept samples, blue green algae cell counts at Perry Lake peaked at 30,087 cells/mL which is well below the KDHE Public Health Watch level of 80,000 cells/mL. Algal toxin Microcystin was detected in September samples (see table) at low levels (≤1 ug/L) and not at quantifiable levels in August. KDHE Public Health Watch criteria for microcystin is 4 ug/L.



Total Suspended Solids

Total Suspended Solids (TSS) is descriptive of erosion in river basins, sedimentation or filling rates of downstream reservoirs, and is also closely linked to nutrient and contaminant transport through river systems. Perry Lake TSS values in the upper lake were above average for District lakes. However, 84% of TSS settled out as water moved from the upper lake to the dam.



Water Quality Concerns:

- Eutrophication
- Sediment inputs
- Herbicides
- Algae Blooms

