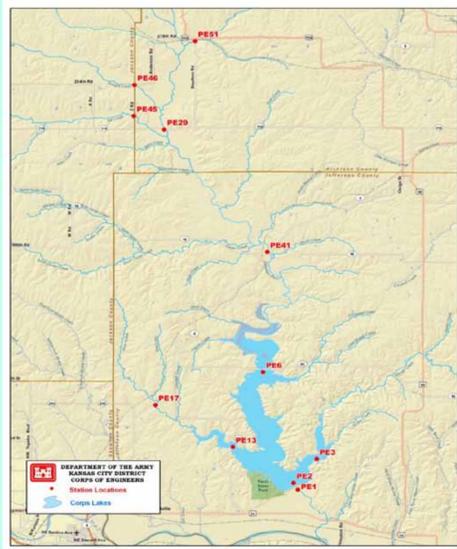


# Perry Lake Water Quality Data 2001-2011



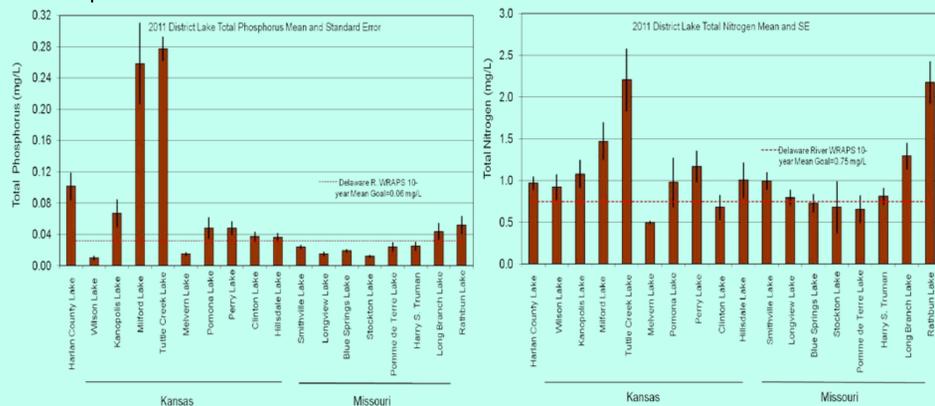
The US Army Corps of Engineers (COE) Water Quality Program collects monthly water samples (April – September) at Perry Lake. These graphs present data collected between 2001-2011 from up to 12 sites. The sites include inflows (#29, 17, 41, 45, 46, and 51), four lake sites (#2, 3, 6, and 13), and the outflow (#1). Thirty-four chemical, physical and biological parameters are measured to evaluate water quality. COE use this data to describe conditions and changes from the inflows, 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: 209,513 AF / 11,146 SA / 160 miles of shoreline
  - Avg. annual inflow = 431,500 AF, 2011 inflow=338,000 AF
- Operating project purposes: flood control, recreation, water supply, navigation support, water quality, and fish and wildlife habitat

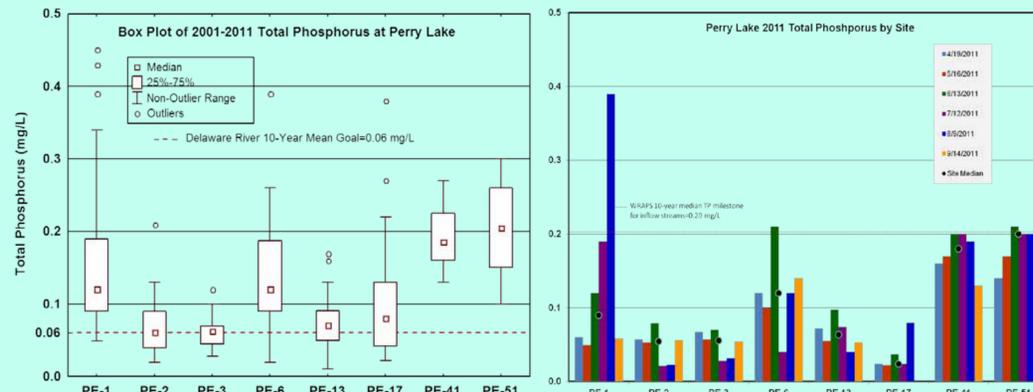
## Nutrient enrichment

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 urban, 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, create low dissolved oxygen that affect fish survival, and lead to taste and odor issues in drinking water. Perry Lake has been listed as “impaired” on the 2010 Kansas 303(d) list due to accelerated eutrophication. This impairment is usually quantified by measuring multiple variables including chlorophyll concentrations from algae, water visibility, and/or total phosphorus. KDHE and EPA are working with water quality partners, landowners and an active Delaware River Watershed Restoration and Protection Strategy (WRAPS) group. Together they provide recommended best management practices for target areas in the watershed to meet long term goals for Perry Lake. Working in the watershed to reduce nutrient and sediment runoff will slow the eutrophication process improving water quality and increasing the life span of Perry Lake. In 2011, Perry Lake ranked near District averages for total phosphorus (0.06 mg/L) and total nitrogen (1.0 mg/L) measured at the site nearest the dam. Standard error bars in the graphs below illustrate the variation in sample results from each site in 2011.



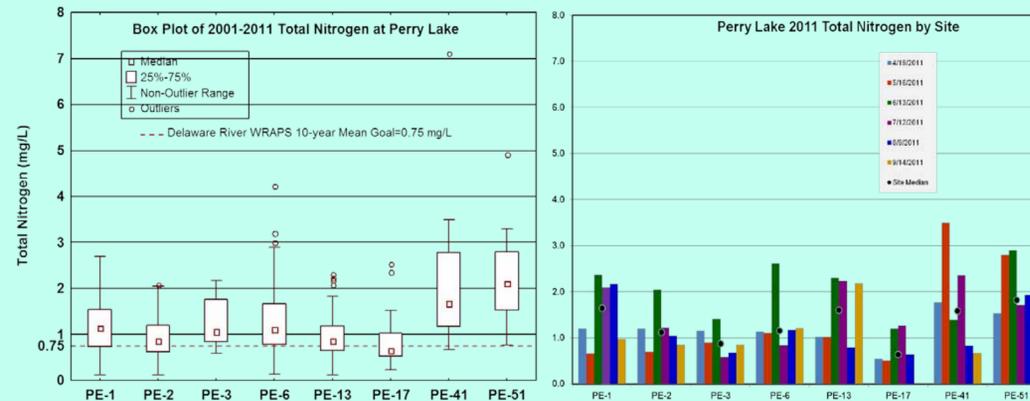
## Total Phosphorus

Excessive nutrients in Perry Lake led to a significant blue-green algae bloom in July, 2011. Lake phosphorus concentrations decreased from this peak in July through September. Phosphorus availability was the primary factor associated with blue green algae in Perry Lake during summer months. Inflow sites in 2011 had phosphorus levels which were similar to long term trends. Large inflow streams including the Delaware River (PE 41) and those downstream from row crop agriculture including L. Grasshopper Creek (PE 51) were the largest phosphorus contributors. Perry Lake median TP concentrations exceeded WRAPS 10-year milestone for the lake (0.06 mg/L) at two sites and inflow median TP measurements exceeded WRAPS 10-year inflow milestones (0.2 mg/L) at one site.



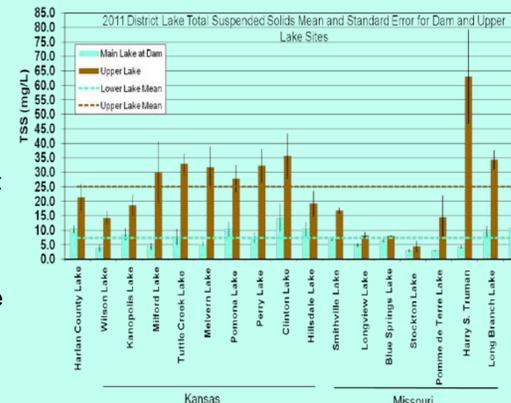
## Total Nitrogen

In 2011, median total nitrogen concentrations were highly variable. Lake sites exceeded WRAPS 10-year goals of 0.75 mg/L. Inflows had the lowest total nitrogen at Rock Creek (PE 17) while the highest concentrations were measured from L. Grasshopper Creek (PE 51) and Delaware River (PE 41). Total nitrogen concentrations are highly variable between sites and years and most related to stream discharge and watershed factors (i.e. soils and farming practices).



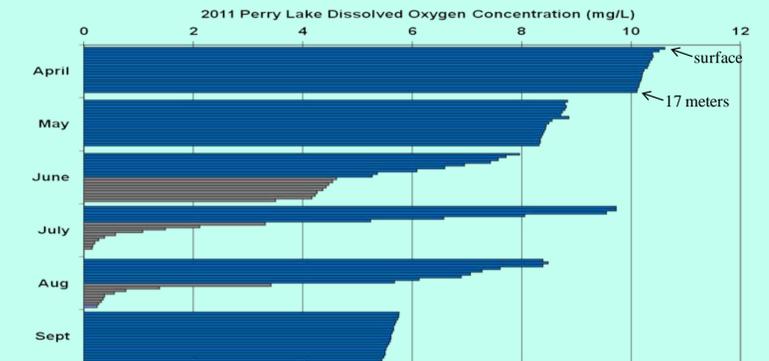
## Total Suspended Solids

Total Suspended Solids (TSS) is a good index used to describe 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 slightly above average for District lakes with 77% of TSS settled out as water moved from the upper lake to the dam.



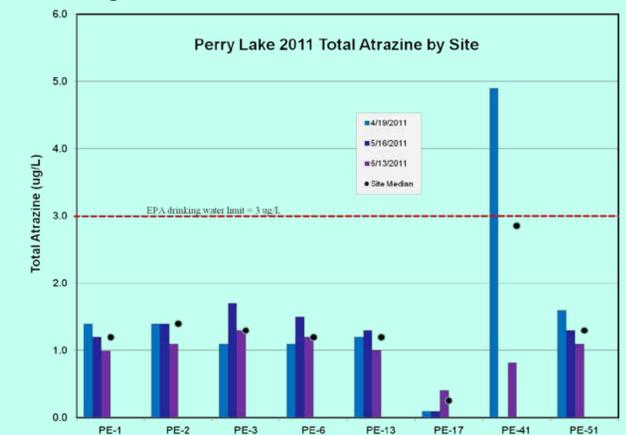
## Dissolved Oxygen

Dissolved oxygen is a key factor in aquatic species location, growth, and ultimately survival in lakes. The figure below shows 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 typically available. In 2011, the top 6 meters of the lake was well oxygenated for fish and aquatic life throughout the summer.



## Atrazine

Atrazine is a widely used and frequently detected herbicide throughout the Midwest. Measured concentrations occasionally exceed drinking water standards (3 ug/L) during spring sampling, which coincides with agricultural chemical application and increased runoff. Long term trends show noticeable improvements in atrazine management in the watershed. In 2011, the median AT concentration at all sites were below the 3 ug/L EPA limits.



## Water Quality Concerns:

- Eutrophication
- Nutrients
- Herbicides
- Sediment inputs

