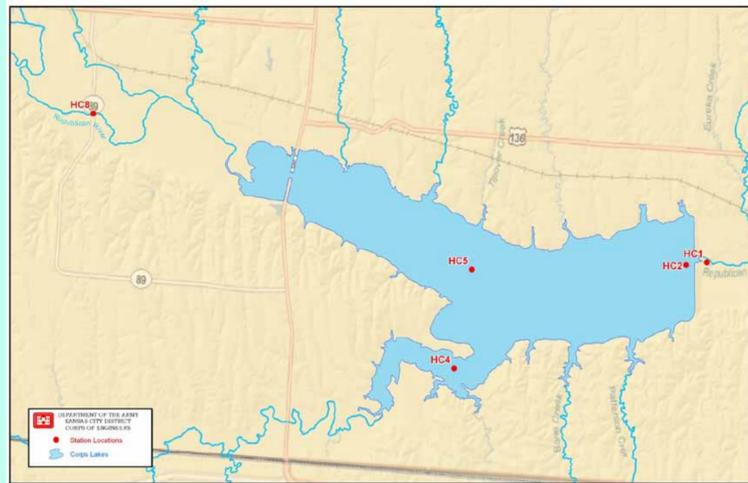


# Harlan County Lake Water Quality Data

## 2001-2011

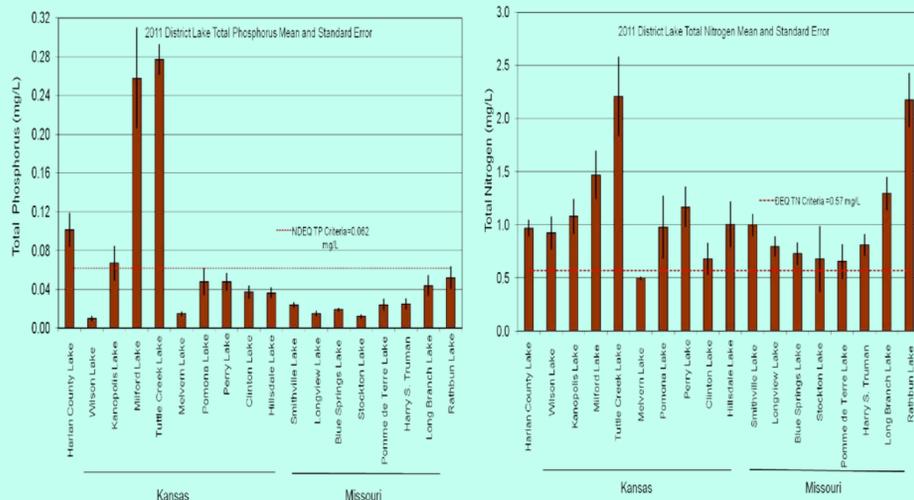


### Harlan County Lake

- Built on Republican River at RM 232 reaching full pool in 1951.
- Watershed = 7,169 square miles/ 4,588,160 Surface Acres (SA)
- Capacity:
  - Flood Control: 500,000 Acre-feet (AF) / 23,431 SA
  - Multipurpose: 150,000 AF / 13,305 SA / 54 miles of shoreline
  - Avg. annual inflow (1980-2011) = 155,800 AF: 2011 inflow=174,500 AF
- Operating project purposes: flood control, irrigation, recreation, fish and wildlife

### Nutrient Enrichment

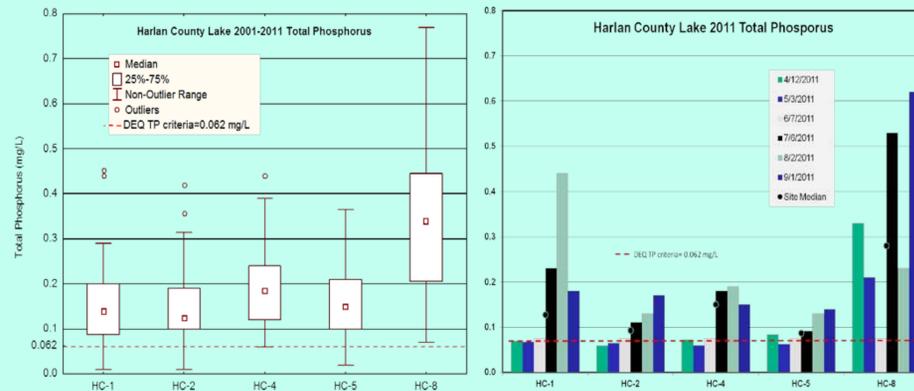
Nutrients (i.e. phosphorus and nitrogen) are essential for aquatic life and are the primary factor driving fish and aquatic plant growth rates and productivity. Excess nutrients from urban, agricultural or natural sources increases the natural aging or eutrophication process in lakes. This can alter plant and aquatic life in lakes and water bodies, cause algal blooms, create low dissolved oxygen affecting fish survival, and lead to taste and odor issues in drinking water. Harlan County Lake is listed in the 2010 Nebraska 303(d) list of impaired waters due to excessive total phosphorus and total nitrogen concentrations. Nebraska Department of Environmental Quality (DEQ) and U.S. Environmental Protection Agency are working with water quality partners to reduce nutrient inflow into Harlan County Lake in efforts to improve water quality. In 2011, Harlan County Lake ranked near average among District Lakes for average total phosphorus and total nitrogen measured at the site nearest the dam. Both nutrient measures exceeded nutrient criteria set by DEQ in efforts to reduce impairments to Harlan County Lake. Standard error bars in the graphs below illustrate the variation in sample results from each site in 2011.



The US Army Corps of Engineers (COE) Water Quality Program collects monthly water samples (April – September) at Harlan County Lake. These figures present data collected between 2001-2011 from up to 5 sites. The sites include inflow (#8), three lake sites (#2,4,5), 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 through the lake and outflow focusing on eutrophication, nutrients, sediment, herbicides, metals, and contaminants.

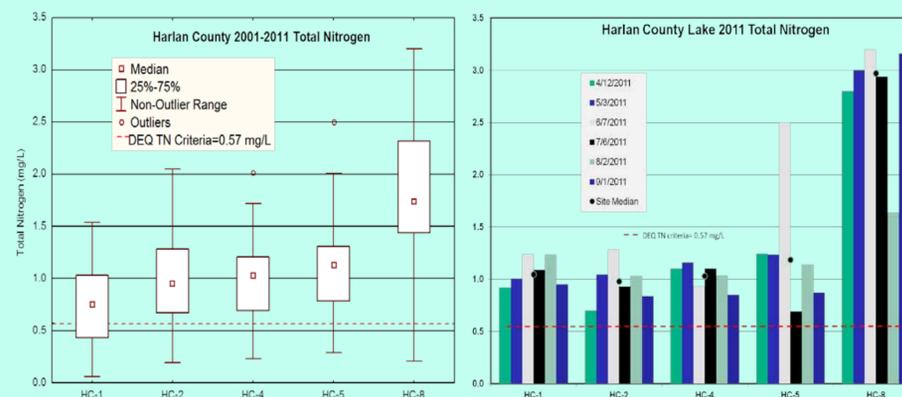
### Total Phosphorus

Physical conditions and excessive nutrients in Harlan County Lake have led to toxic blue-green algae blooms including an event in 2007 which resulted in a health warning from DEQ and closure of swimming beaches. Median total phosphorus concentrations were in the hypereutrophic range (0.096 mg/L or greater) 2001 to 2011 with the highest levels in 2007 (Median=0.33 mg/L). Median phosphorus concentrations in 2011 were slightly lower than 2001-2011 trends, but exceeded DEQ TP criteria at all sites. Median total phosphorus concentrations in the Republican R. inflow (HC8) were 1-3 times higher than lake sites. High levels of TP from upper lake sites are typically bound to suspended sediment particles which is processed through biological attenuation and settled out as the water moves through the lake to the dam, as demonstrated by the decline in TP from HC 8 to HC 2. Total phosphorus concentrations at lake sites increased in late summer as internal phosphorus loading(i.e. released from bottom sediments from various mechanisms) impacted water quality.



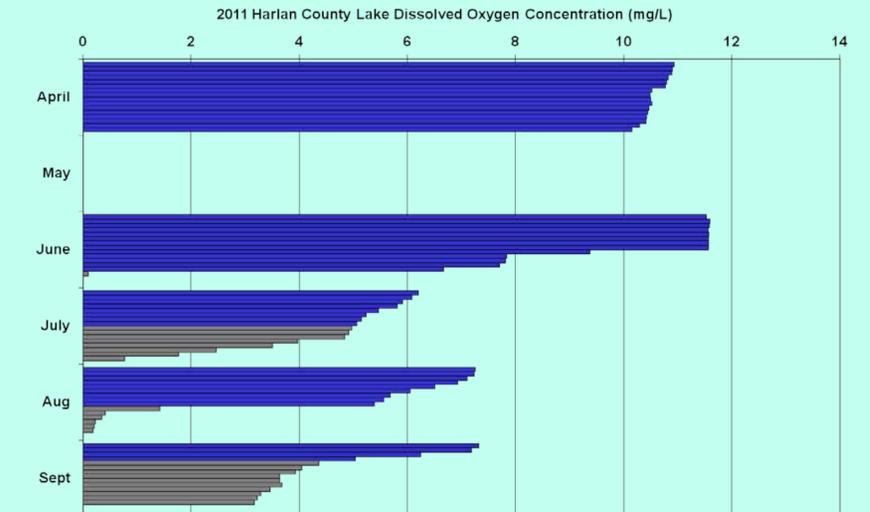
### Total Nitrogen

Total nitrogen concentrations were higher than DEQ TN criteria at all sites from 2001 to 2011. Total nitrogen concentrations were correlated to total phosphorus concentrations at Harlan County Lake demonstrating similar trends related to site location in the lake system, but total lake nitrogen concentrations did not have seasonal trends as observed with total phosphorus



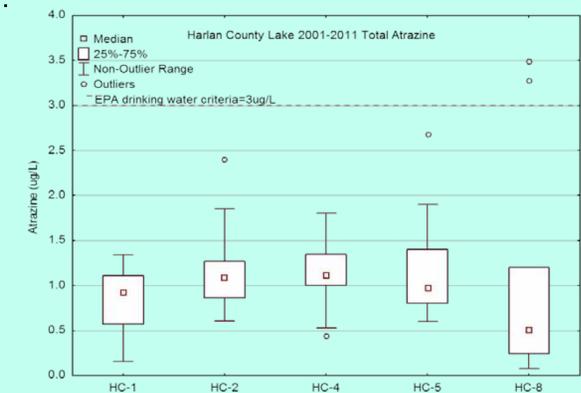
### Dissolved Oxygen

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 in one-meter intervals (e.g. each row in each month represents one meter of depth) from April through September. Harlan County 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, Harlan County Lake was oxygenated in the top 4 meters during the worst conditions in September.



### Atrazine

Atrazine is a widely used and frequently detected herbicide throughout the Midwest. Measured concentrations occasionally exceed EPA water quality criteria (3 ug/L) during spring sampling, which coincides with application and runoff. Long-term trends show lake atrazine concentrations are low with two samples exceeding EPA criteria measured from the Republican River site (HC8) from 2001-2011.



### Water Quality Concerns:

- Eutrophication
- Nutrients
- Herbicides

