

# A Brief Explanation of Water Quality Parameters Presented on this Site

The data shown on this site represent some of the key water quality parameters that Delaware Department of Natural Resources and Environmental Control (DNREC) regularly collects at more than 140 monitoring sites on a monthly or bimonthly basis. The monitoring is conducted to evaluate water quality conditions of Delaware's surface waters, to identify any potential problems, and to evaluate the success of management actions.

The following is a brief description of water quality parameters presented on this site.

## Dissolved Oxygen

The amount of oxygen dissolved in surface waters is one of the most important measures of habitat and water quality. This is because without oxygen, all of the living resources familiar to us perish. Dissolved oxygen (DO) is measured as a concentration (mg/l – milligrams per liter). When DO concentration drops below 5.0 or 5.5 mg/l, many sensitive organisms such as fish, become stressed, especially if exposed to these low DO conditions for a long period of time. On the other hand, bottom-dwelling organisms such as worms are usually more tolerant, and some species can survive at levels down to 1 mg/l in some cases.

The concentration of DO is affected by several factors. Temperature affects the concentration since warmer water cannot dissolve as much oxygen as colder water. In addition to temperature, the amount of algae in the water can also impact DO levels. Supersaturation (over 100% DO saturation) can occur when there is a large algal bloom. During the daylight, when the algae are photosynthesizing, they can produce oxygen so rapidly that it is not able to escape into the atmosphere, thus leading to short-term saturation levels of greater than 100%. In most cases, the DO graphs from the continuous monitoring stations show daily variations, with peaks in late afternoon and minimums at dawn. These peaks are due to the production of oxygen by algae (measured by chlorophyll) during the daytime and the consumption of oxygen at night by algae and other organisms in the water and bottom sediments. These daily swings can be quite large when there are algae blooms fueled by nutrient pollution, and they often result in fish kills when oxygen levels drop to around 1 mg/l or less.

## State of Delaware's Standard for Dissolved Oxygen in Surface Waters

State of Delaware Surface Water Quality Standards, as amended, July 11, 2004, specifies the following levels for dissolved oxygen for the waters of the State:

### a) For Fresh Waters

- a. Daily average shall not be less than 5.5 milligram per liter.
- b. Instantaneous minimum shall not be less than 4.0 mg/L

### b) For Marine Waters (where average salinity is higher than 5 part per thousand)

- a. Daily average shall not be less than 5.0 mg/L.
- b. Instantaneous Minimum shall not be less than 4.0 mg/L

**c) For Cold Water Fisheries (Put and Take)**

- a. Daily average shall not be less than 6.5 mg/L during the applicable period.
- b. Instantaneous Minimum shall not be less than 5.0 mg/L during the applicable period.

**d) For the Nanticoke River from the upstream-most limits of the City of Seaford to the Maryland State Line and Broad Creek from the upstream-most limits of the Town of Laurel to the confluence with the Nanticoke River**

- a. At water temperatures greater than 84 degrees Fahrenheit, instantaneous minimum shall not be less than 4.3 mg/L
- b. For the period February 1- May 31:
  - i. 7-Day mean shall not be less than 6.0 mg/L
  - ii. Instantaneous minimum shall not be less than 5.0 mg/L
- c. For June 1- January 31:
  - i. 30 Day mean shall not be less than 5.5 mg/L
  - ii. 7-Day mean shall not be less than 4.0 mg/L
  - iii. Instantaneous minimum shall not be less than 3.2 mg/L

## **Salinity**

The concentration of salt, or salinity, is a function of the mixing of freshwater with ocean waters, which has higher salinity. In any given location, salinity can vary greatly depending upon river flow, being low during high flows and high during low flows and droughts. Most of the living resources are adapted to these swings in salinity, but extreme floods or droughts can lead to stressful conditions. Extended periods of high salinity can also force fish that prefer lower salinities, such as yellow perch, out of the river mainstems and up into headwater creeks.

## **Temperature**

Temperature, like salinity, undergoes wide variations seasonally, although it is much less variable and much more predictable than any other water quality parameter displayed here. This can be seen by looking at the historical range for the long-term stations for any given month. This relative stability is due to the heat retaining properties of water, which make it much more resistant to temperature changes than our atmosphere.

## **Nutrients – Nitrogen (N) and Phosphorus (P)**

Nutrients, nitrogen and phosphorus, are essential elements for both plants and animals. However, their presence in excessive amounts cause undesirable conditions. Symptoms of nutrient overenrichment include excessive algal bloom, large daily swings in dissolved oxygen levels, loss of Submerged Aquatic Vegetation (SAV), and fish kills.

## **State of Delaware's Standard for Nitrogen and Phosphorous in Surface Waters**

State of Delaware Surface Water Quality Standards, as amended, July 11, 2004, specifies the following levels for dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorus (DIP) for tidal waters of Delaware Inland Bays:

- For tidal portions of the stream basins of Indian River, Rehoboth Bay, and Little Assawoman Bay, nutrients control needed to attain submerged aquatic vegetation growth season (approximately March 1 to October 31). Therefore, average levels for dissolved inorganic nitrogen should not exceed 0.14 mg/L as N, and average levels of dissolved inorganic phosphorus should not exceed 0.01 mg/L as P.

For all other waters of the State, DNREC considers levels higher than 3.0 mg/l total nitrogen and 0.2 mg/l total phosphorus to be excessive, which could require corrective management actions.

## **pH**

pH, in simple terms, is a chemical measure of whether or not something is an acid or a base. It is measured on a log scale of 0 to 14, with each unit representing a ten-fold change. A pH of 7 is considered neutral and a range of 5.5 to 8.5 is usually tolerated by most aquatic organisms. Lower pHs are sometimes seen in fresher waters due to acid precipitation or even naturally-occurring organic acids, which can be found in areas with extensive marshes. High pHs can occur during algae blooms due to chemical reactions associated with photosynthesis. Moderate to higher salinities usually "buffer" pH in the 7 to 8 range, so most of the more extreme values are generally found in low salinity waters.

## **State of Delaware's Standard for pH in Surface Waters**

State of Delaware Surface Water Quality Standards, as amended, July 11, 2004, specifies the following values for minimum and maximum levels of pH in surface waters of the State:

- pH, measured in standard units, in all waters of the state shall be between 6.5 and 8.5 unless outside this range due solely to natural conditions. Where within this range, maximum human-induced change from background shall be 0.5 Standard Units; pH which results from human-induced change must remain within this range.
- Where pH is below 6.5 or above 8.5 due solely to natural conditions, it shall not be lowered (where below 6.5) or raised (where above 8.5) more than 0.3 Standard Units due to human-induced changes.

## Enterococcus Bacteria

Enterococcus bacteria are indicator bacteria associated with warm blooded animals. Their presence in surface waters in excessive amount increases the risk of gastrointestinal illness for people who conduct swimming and other water contact activities in marine and fresh waters.

### State of Delaware's Standard for Enterococcus Bacteria in Surface Waters

State of Delaware Surface Water Quality Standards, as amended, July 11, 2004, specifies the following levels for enterococcus bacteria in surface waters of the State:

Waterbody Type	Single-Sample Value (Enterococcus Colonies/100ml)	Geometric Mean (Enterococcus Colonies/100ml)
Primary Contact Recreation Fresh Waters	185	100
Primary Contact Recreation Marine Waters	104	35
Secondary Contact Recreation Fresh Waters	925	500
Secondary Contact Recreation Marine Waters	520	175