EXPLANATION OF LAKE WATER QUALITY MONITORING REPORT

This report contains summaries for variables most often used to measure the water quality of lakes and ponds in Maine. These variables are relatively inexpensive to measure, and are easily monitored by volunteers in the Volunteer Lake Monitoring Program and staff of the Department of Environmental Protection. Minimum and Maximum values are from entire DEP dataset.

SECCHI DISK TRANSPARENCY AND GRAPHS: Secchi Disk Transparency (SDT) is a measure of the water clarity, or transparency, of the lake. All Secchi disk readings are in meters [1 meter (m) = 3.28 feet]. Factors, which reduce clarity, are algae, zooplankton, water color and silt. Since algae are generally the most abundant, measuring transparency indirectly measures the algal productivity. SDT readings can be used to track changes in water quality over time. Transparency values in Maine vary from 0.2m (8 inches) to 21.27m (70 ft), with the overall average being 4.83m (15.8 ft). Unless a lake is highly colored (see explanation of color below) or some other factor is interfering, a transparency of less than 2m (6.6 ft) indicates a water quality problem that has resulted in an algal bloom. In Maine, the mean (average) SDT readings are related to algal productivity using the following guidelines: Productive=4m (13 ft) or less; Moderately productive =4.1-7.9m (13-26.5 ft); Unproductive=8m (26.5 ft) or greater.

Usually two transparency graphs are displayed in the report. The first graph is provided if data were collected the previous year and illustrates the seasonal variation that can occur during the monitored months. The second graph represents the average SDT readings for each year data is available. The bars or tick marks on this graph represent the minimum and maximum Secchi disk readings for that year. This graph allows tracking of water quality over many years.

MIN. = minimum or lowest Secchi disk depth recorded for that year. The summary line would have the lowest Secchi disk reading ever recorded for that lake. MEAN = Average of monthly averages of Secchi disk reading for that year. The summary line would show the average for all years datasets have been taken. MAX. =Maximum or deepest Secchi disk reading taken for that year. The summary line would be the deepest reading ever recorded for this lake. N = number of months readings were taken that year. Summary N = number of years of data.

SUMMARY OF CHEMICAL AND TROPHIC STATE PARAMETERS:

COLOR: The amount of "color" in a lake refers to the concentration of natural dissolved organic acids such as tannins and lignin's, which give the water a tea color. Color is measured by comparing a sample of the lake water to Standard Platinum Units (SPU). Colored lakes (>30 SPU) can have reduced transparency readings and increased phosphorus values. This does not mean the lakes are more productive, the color simply interferes with the test so better results can not be achieved. Chlorophyll a (Chla) is the best indicator of productivity in colored lakes and should be used if possible. Color varies from 1 to 630, with the average in Maine being 28 SPU.

pH: The pH of a lake reflects how acidic or basic the water is and helps determine which plant and animal species are present. The measure of the acidity of water is based on a scale of 1-14, with 7 being neutral. aAcid waters are below 7; alkaline waters are above 7. Epilimnetic pH varies, from 4.23 to 9.70, the average being 6.81. A one unit change in pH represents a 10 fold change in acidity or alkalinity.

ALKALINITY: Alkalinity is a measure of the capacity of water to neutralize acids and is also known as the buffering capacity. It is due primarily to the presence of naturally available bicarbonate, carbonate, and hydroxide ions, with bicarbonate being the major form. Epilimnetic alkalinity in Maine varies from -1.5 milligram per liter (mg/l) to 190.0 mg/l, with the average being 12.0 mg

CONDUCTIVITY: Conductivity is a measure of the ability of water to carry an electrical current and is directly related to the dissolved ions (charged particles) present in water. Epilimnetic conductivity varies from 2 μmhos/cm to 7900 μs/cm, with the

average being 46 µs/cm. Fishery biologists use conductivity values to calculate fish yield estimates. Conductivity will increase if there is an increase of pollutants entering the lake or pond.

TOTAL PHOSPHORUS MEANS (ppb): Total Phosphorus (TP) is one of the major nutrients needed for plant growth. It is generally present in small amounts and limits the plant growth in lakes. It is measured in parts per billion (ppb). As phosphorus increases, the amount of algae also increases. Epilimnetic TP varies from 1 ppb to 426 ppb with the average being 12 ppb. EPI Core = Epilimnetic core sample (mixed sample from epilimnion) was taken; Surf Grab = Surface grab sample taken; Bot. Grab = Bottom grab sample taken (1 m above bottom of lake), PRO. Grab = Profile grab samples taken and averaged.

CHLOROPHYLL A (ppb): CHLOROPHYLL A (Chl<u>a</u>) is a measurement of the green pigment found in all plants including microscopic plants such as algae. It is used as an estimate of algal biomass, the higher the Chl<u>a</u> number the higher the amount of algae in the lake. Epilimnetic Chl<u>a</u>, varies from 0.10 ppb to 238 ppb, with the average 5.3 ppb. MIN. = minimum or lowest Chl<u>a</u> depth recorded for that year. Summary would have the lowest Chl<u>a</u> reading ever recorded for that lake. MEAN = Average Chl<u>a</u> reading for that year. Summary would be average for all years data has been taken. MAX. = Maximum or highest Chl<u>a</u> reading taken for that year. Summary would be the highest reading ever recorded for this lake.

TROPHIC STATE INDICES: The Trophic State Index (TSI) is a scale which ranks lakes from 0 to 100+ with 0 supporting very little algae and 100+ being very productive. TSI can be calculated from the Secchi disk, Chl<u>a</u> or total phosphorus results. TSI for a year is only calculated when there are at least five months of data. Lakes with TSI values greater than 60 may support blooms (less than 2m SDT). Lakes with TSI values over 100 indicate extreme productivity and annual algal blooms. TSI values can be used to compare lakes and track water quality trends within a lake. Lakes with color over 30 SPU will only have a valid TSI if the value is calculated from Chl<u>a</u>. The range of TSI is from 5-136 with an average of 45. EPI PHOS = Epilimnetic Phosphorus samples taken to determine the TSI; C = core G = grab samples taken; SEC = TSI value calculated using the mean Secchi disk (water color < 30 SPU to ensure valid TSI); CHL = TSI calculated using the mean Chl<u>a</u>.

LATE SUMMER TEMPERATURE / DISSOLVED OXYGEN PROFILES: Dissolved Oxygen (D.O.) is the measure of the amount of oxygen dissolved in the water. All living organisms, except for certain types of bacteria, need oxygen to survive. Organisms living in the water have the ability to use the oxygen dissolved in the water to breathe. Too little oxygen severely reduces the diversity and population of aquatic communities. Therefore the amount of D.O. in the water is very important to aquatic life. Low oxygen can directly kill or stress organisms such that they will not be able to successfully reproduce or grow. Water with less than 1 part per million (ppm) of oxygen is considered anoxic (no oxygen present); less than 5 ppm of oxygen is generally considered so stressful that most coldwater fish will avoid these areas. Anoxic conditions can also promote TP release from sediments.

Temperature is the measure of heat in the water and can affect the waters chemistry and biology. For example, the amount of oxygen water can hold is directly related to the temperature of the water. The higher the temperature the less oxygen the water can hold. Oxygen will naturally decline during the summer months as water temperatures rise. Lakes deeper than 25-30 feet can also stratify, with warm water riding over cooler deep water, restricting circulation in the lake. This can contribute to oxygen loss in the lower waters. Temperature can also determine the kinds of plants and animals found in the lake or pond. Certain species of fish, insects and algae will predominate during the cooler temperatures of the spring and fall, yet disappear during the warmer temperatures of summer. For instance, salmonids generally prefer temperatures below $18^{O}C$ ($65^{O}F$) but can tolerate slightly higher temperatures for short periods of time. However, constant exposure to temperatures of greater than $18^{O}C$ ($65^{O}F$) may result in some fish being more susceptible to disease or not being able to reproduce as well. Conversely, other more tolerant species will predominate during the more stressful summer months. The late summer temperature and dissolved oxygen profiles in data report represent the lake's most stressed open water period. m = Depth data was recorded, in meters; ^{O}C = Temperature in degrees Celsius; Date is sampling date; ppm = Dissolved oxygen reading in parts per million (ppm).