Dissolved Oxygen

DO varies over a 24-hour period, with lowest levels expected just before sunrise, when plants and animals have been respiring, but photosynthesis has not been occurring. This flux over a 24-hour period is called diurnal variation. Large fluctuations in diurnal DO levels (e.g., 8-10 mg/L and supersaturated conditions at times) generally indicate increased photosynthesis and respiration due to elevated levels of plant and/or algal growth. Streams having levels of dissolved oxygen at greater than 100% saturation (i.e. supersaturation) do so during the day when the rate of oxygen production via photosynthesis exceeds the rate of diffusion of dissolved oxygen from water to air. Levels of DO saturation typically range from 80-120%, although highly productive streams can experience levels upwards of 140-150% during the middle of the day.

Dissolved oxygen levels are important in determining various communities of aquatic life. There are defined DO minimums set for each type of classification. The minimums are designed to allow the aquatic organisms defined in the classification to survive in those waters. The table below shows the minimum DO allowed in waters classified in certain ways by Wisconsin state law.

Stream classification	Minimum dissolved oxygen allowed
Trout waters	6 mg/l (out of spawning season) and 7 mg/L (during spring/fall spawning season)
Fish or aquatic life-designated waters	5 mg/L
Limited forage fish waters	3 mg/L
Limited aquatic life waters	1 mg/L

Dissolved Oxygen and Temperature -- a Special Link

Dissolved oxygen content in streams is linked with temperature requirements of aquatic life. Colder water generally holds more oxygen and warmer water holds less oxygen.

Transparency

Water transparency is a measure of water clarity made with a transparency tube. Transparency measurements are affected by both the presence of suspended particles, such as soil particles and microscopic organisms, and by water color, which is caused by certain dissolved substances. Transparency is an easily made measurement that can be correlated with turbidity, although the two measurements are not directly comparable.

Turbidity, a more difficult measurement that is often made in a lab, is a measure of water clarity or "cloudiness" caused primarily by the presence of suspended particulate matter. It is an optical measurement of the amount of light scattering caused by fine organic or inorganic particles and, to a lesser extent, dissolved substances. More suspended particles cause greater turbidity resulting in less light penetration through the water. This hinders photosynthesis, necessary for healthy aquatic plant growth and production of dissolved oxygen. With increased turbidity, water becomes warmer because the suspended particles absorb heat. Since warmer water holds less dissolved oxygen than cold water, oxygen levels are affected by turbidity. Extremely high levels of turbidity may also impair aquatic organism survival by blocking gas exchange in membranes used for respiration, interfering with filter feeding mussels, or by restricting predation by sight-feeding fish. In general, turbidity increases with increasing river flow due to erosional processes and bad sediment resuspension. Since transparency is a surrogate measurement of turbidity and the two measurements are correlated, the table to the right can be used to convert transparency values to approximate turbidity values. The figure below can be used to further understand how the resultant turbidity values and exposure times impact fish.



* Nephelometric Turbidity Units (NTU) are units of particle dispersion (suspended particles) providing a measure of turbidity using a *nephelometer*.

Transparency (cm)	Turbidity (NTUs)
<6.4	>240
6.4 to 7.0	240
7.1 to 8.2	185
8.3 to 9.5	150
9.6 to 10.8	120
10.9 to 12.0	100
12.1 to 14.0	90
14.1 to 16.5	65
16.6 to 19.1	50
19.2 to 21.6	40
21.7 to 24.1	35
24.2 to 26.7	30
26.8 to 29.2	27
29.3 to 31.8	24
31.9 to 34.3	21
34.4 to 36.8	19
36.9 to 39.4	17
39.5 to 41.9	15
42.0 to 44.5	14
44.6 to 47.0	13
47.1 to 49.5	12
49.6 to 52.1	11
52.2 to 54.6	10
>54.7	<10

Water Temperature

Water temperature influences the growth and distribution of aquatic organisms and is an important factor regulating chemical and biochemical reactions in aquatic animals and plants. Surface water temperature is strongly influenced by solar radiation, local climate and groundwater inflows.

Wisconsin uses water temperature in the designation of fish and aquatic life uses for surface waters. Use designations are utilized to classify waters into categories so management decisions can be made to protect the quality of those water resources.

Thermal regime	Maximum instantaneous temperature	Maximum daily mean temperature
Cold water stream	<25 °C (77 °F)	< 22 °C (72 °F)
Cool water stream	25-28 °C	22-24 °C
Warm water stream	>28 °C (82 °F)	> 24 °C (75 °F)

These use designations or classes of streams support different types of fish species. The best quality coldwater streams have relatively few species of fish as compared to warm water streams. Salmonids such as brook trout dominate the fish populations in the best quality coldwater streams, while brown trout, an exotic salmonid species, dominate coldwater streams that have slightly less pristine water quality. Bass, darter and sucker species are more prevalent in warmwater streams than in coldwater streams (see figure 3 on following page).



Generic Project Monitoring Graphs and Charts Report

Scott and Maya Dizack, Pewaukee Area Monitors Craig Helker, Wisconsin DNR KATHRYN VAN GHEEM, Clean Lakes Alliance SER_06_CMP12 CBSM of Unnamed Tributary (Prairie Stream) to Lake Michigan, 10033' Reporting Period: 01/01/2011 to 11/19/2014

This report includes data for Prairie Stream at Lake Michigan which is referred to as Station ID 10033792, and includes all data entered into the WDNR database (SWIMS). This station has been monitored between the dates of 01/01/2011 and 11/19/2014.

The following pages summarize the results of monitoring on Prairie Stream at Lake Michigan, 10033792.

Dissolved Oxygen (Instantaneous) at Prairie Stream at Lake Michigan, 10033792

Instantaneous dissolved oxygen was gathered at this station 23 times during the period of monitoring, from 07/23/11 to 09/13/14. Dissolved oxygen values are displayed in the Graph 1 below and reflect the following values:

Minimum: 1.61 mg/l Maximum: 12.45 mg/l Mean: 5.50 mg/l Median: 4.81 mg/l





Dissolved Oxygen, Percent Saturation (Instantaneous) at Prairie Stream at Lake Michigan, 10033792

Instantaneous dissolved oxygen percent saturation was gathered at this station 23 times during the period of monitoring, from 07/23/11 to 09/13/14. Dissolved oxygen percent saturation values are displayed in the Graph 2 below and reflect the following values:

Minimum: 17.1 % Saturation Maximum: 114.03 % Saturation Mean: 56.24 % Saturation Median: 52.6 % Saturation



pH (Instantaneous) at Prairie Stream at Lake Michigan, 10033792

Instantaneous pH was gathered at this station 25 times during the period of monitoring, from 07/09/11 to 09/13/14. pH values are displayed in the Graph 3 below and reflect the following values:



Average Transparency (Instantaneous) at Prairie Stream at Lake Michigan, 10033792

Instantaneous transparency was gathered at this station 23 times during the period of monitoring, from 07/09/11 to 09/13/14. Transparency values are displayed in the Graph 4 below and reflect the following values:



Date of Transparency Reading

Water Temperature (Instantaneous) at Prairie Stream at Lake Michigan, 10033792

Instantaneous water temperature was gathered at this station 24 times during the period of monitoring, from 07/09/11 to 09/13/14. Water temperature values are displayed in the Graph 5 below and reflect the following values:



Date of Temperature Reading

Phosphorus (Instantaneous) at Prairie Stream at Lake Michigan, 10033792

Instantaneous phosphorus was gathered at this station 13 times during the period of monitoring, from 07/09/11 to 09/13/14. Phosphorus values are displayed in the graph below and reflect the following values:



Generic Project Monitoring Graphs and Charts Report

Unnamed Scott and Maya Dizack, Pewaukee Area Monitors Craig Helker, Wisconsin DNR KATHRYN VAN GHEEM, Clean Lakes Alliance SER_06_CMP12 CBSM of Unnamed Tributary (Prairie Stream) to Lake Michigan, 10033' Reporting Period: 01/01/2011 to 11/19/2014

This report includes data for Prairie Stream North which is referred to as Station ID 10033791, and includes all data entered into the WDNR database (SWIMS). This station has been monitored between the dates of 01/01/2011 and 11/19/2014.

The following pages summarize the results of monitoring on Prairie Stream North , 10033791.

Dissolved Oxygen (Instantaneous) at Prairie Stream North , 10033791

Instantaneous dissolved oxygen was gathered at this station 15 times during the period of monitoring, from 04/21/11 to 09/13/14. Dissolved oxygen values are displayed in the Graph 1 below and reflect the following values:

Minimum: 2.14 mg/l Maximum: 12.41 mg/l Mean: 6.03 mg/l Median: 5.8 mg/l





Dissolved Oxygen, Percent Saturation (Instantaneous) at Prairie Stream North , 10033791

Instantaneous dissolved oxygen percent saturation was gathered at this station 15 times during the period of monitoring, from 04/21/11 to 09/13/14. Dissolved oxygen percent saturation values are displayed in the Graph 2 below and reflect the following values:

Minimum: 23.5 % Saturation Maximum: 121.8 % Saturation Mean: 66.61 % Saturation Median: 63 % Saturation



pH (Instantaneous) at Prairie Stream North , 10033791

Instantaneous pH was gathered at this station 17 times during the period of monitoring, from 04/21/11 to 09/13/14. pH values are displayed in the Graph 3 below and reflect the following values:



Date of pH Reading

Average Transparency (Instantaneous) at Prairie Stream North , 10033791

Instantaneous transparency was gathered at this station 15 times during the period of monitoring, from 04/21/11 to 09/13/14. Transparency values are displayed in the Graph 4 below and reflect the following values:



Water Temperature (Instantaneous) at Prairie Stream North , 10033791

Instantaneous water temperature was gathered at this station 17 times during the period of monitoring, from 04/21/11 to 09/13/14. Water temperature values are displayed in the Graph 5 below and reflect the following values:



Date of Temperature Reading

Phosphorus (Instantaneous) at Prairie Stream North , 10033791

Instantaneous phosphorus was gathered at this station 13 times during the period of monitoring, from 07/09/11 to 09/13/14. Phosphorus values are displayed in the graph below and reflect the following values:



Generic Project Monitoring Graphs and Charts Report

Scott and Maya Dizack, Pewaukee Area Monitors Craig Helker, Wisconsin DNR KATHRYN VAN GHEEM, Clean Lakes Alliance SER_06_CMP12 CBSM of Unnamed Tributary (Prairie Stream) to Lake Michigan, 10033' Reporting Period: 01/01/2011 to 11/19/2014

This report includes data for Prairie Stream South which is referred to as Station ID 10033793, and includes all data entered into the WDNR database (SWIMS). This station has been monitored between the dates of 01/01/2011 and 11/19/2014.

The following pages summarize the results of monitoring on Prairie Stream South, 10033793.

Dissolved Oxygen (Instantaneous) at Prairie Stream South, 10033793

Instantaneous dissolved oxygen was gathered at this station 22 times during the period of monitoring, from 07/23/11 to 09/13/14. Dissolved oxygen values are displayed in the Graph 1 below and reflect the following values:

Minimum: 5.15 mg/l Maximum: 10.41 mg/l Mean: 7.80 mg/l Median: 7.705 mg/l





Dissolved Oxygen, Percent Saturation (Instantaneous) at Prairie Stream South, 10033793

Instantaneous dissolved oxygen percent saturation was gathered at this station 22 times during the period of monitoring, from 07/23/11 to 09/13/14. Dissolved oxygen percent saturation values are displayed in the Graph 2 below and reflect the following values:

Minimum: 50.7 % Saturation Maximum: 119 % Saturation Mean: 88.48 % Saturation Median: 89.8 % Saturation



pH (Instantaneous) at Prairie Stream South, 10033793

Instantaneous pH was gathered at this station 24 times during the period of monitoring, from 07/09/11 to 09/13/14. pH values are displayed in the Graph 3 below and reflect the following values:



Date of pH Reading

Average Transparency (Instantaneous) at Prairie Stream South, 10033793

Instantaneous transparency was gathered at this station 22 times during the period of monitoring, from 07/09/11 to 09/13/14. Transparency values are displayed in the Graph 4 below and reflect the following values:



Water Temperature (Instantaneous) at Prairie Stream South, 10033793

Instantaneous water temperature was gathered at this station 23 times during the period of monitoring, from 07/09/11 to 09/13/14. Water temperature values are displayed in the Graph 5 below and reflect the following values:



Date of Temperature Reading

Phosphorus (Instantaneous) at Prairie Stream South, 10033793

Instantaneous phosphorus was gathered at this station 13 times during the period of monitoring, from 07/09/11 to 09/13/14. Phosphorus values are displayed in the graph below and reflect the following values:



Minimum: .033 mg/L Maximum: 4.2 mg/L Mean: .44 mg/L Median: .097 mg/L