# Plum Creek Watershed Data Report

## February 2010

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RIVER SYSTEMS INSTITUTE

TCEQ

TEXAS STATE UNIVERSITY SAN MARCOS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

PREPARED IN COOPERATION WITH THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY AND U.S. ENVIRONMENTAL PROTECTION AGENCY

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This data summary report includes general basin volunteer monitoring activity, general water quality descriptive statistics, tables and graphs, and comparisons to stream standards as related to "aquatic life use" criteria.

In alignment with Texas Stream Team's core mission, monitors attempt to collect data that can be used in decision-making processes, to promote a healthier and safer environment for people and aquatic inhabitants. While many assume it is the responsibility of Texas Stream Team to serve as the main advocate for volunteer monitor data use, it has become increasingly important for monitors to be accountable for their monitoring information and how it can be infused into the decision-making process, from "backyard" concerns to state or regional issues. To assist with this effort, Texas Stream Team is coordinating with monitoring groups and government agencies to propagate numerous data use options.

Among these options, volunteer monitors can directly participate by communicating their data to various stakeholders. Some options include: participating in the Clean Rivers Program (CRP) Steering Committee Process (see box insert on this page); providing information during "public comment" periods; attending city council and advisory panel meetings; developing relations with local Texas Commission on Environmental Quality and river authority water specialists; and, if necessary, filing complaints with environmental agencies; contacting elected representatives and media; or starting organizing local efforts to address areas of concern.

> The Texas Clean Rivers Act established a way for the citizens of Texas to participate in building the foundation for effective statewide watershed planning activities. Each CRP partner agency has established a steering committee to set priorities within its basin. These committees bring together the diverse interests in each basin and watershed. Steering committee participants include representatives from the public, government, industry, business, agriculture, and environmental groups. The steering committee is designed to allow local concerns to be addressed and regional solutions are recommended. For more information about participating in these steering committee meetings and to contribute your views about water quality, contact the appropriate CRP partner agency for your river basin at: http://www.tceq.state.tx.us/compliance/monitoring/crp/partners.html.

Currently, Texas Stream Team is working with various public and private organizations to facilitate data and information sharing. One component of this process includes interacting with watershed stakeholders at CRP steering committee meetings. A major function of these meetings is to discuss water quality issues and to obtain input from the general public. While participation in this process may not bring about instantaneous results, it is a great place to begin making institutional connections and to learn how to "work" the assessment and protection system that Texas agencies use to keep water resources healthy and sustainable.

In general, Texas Stream Team efforts to use volunteer data may include the following:

1. Assist monitors with data analysis and interpretation
2. Analyze watershed-level or site-by-site data for monitors and partners

3. Screen all data annually for values outside expected ranges
4. Network with monitors and pertinent agencies to communicate data
5. Attend meetings and conferences to communicate data
6. Participate in CRP stakeholder meetings
7. Provide a data viewing forum via the Texas Stream Team Data Viewer
8. Participate in professional coordinated monitoring processes to raise awareness of areas of concern

Information collected by Texas Stream Team volunteers utilizes a TCEQ and EPA approved quality assurance project plan (QAPP) to ensure data are correct and accurately reflects the environmental conditions being monitored. All data are screened for completeness, precision and accuracy where applicable, and scrutinized with data quality objective and data validation techniques. Sample results are intended to be used for education and research, baseline, local decision making, problem identification, and others uses deemed appropriate by the data user. Graphs are compiled and situated to assist the data user in obtaining information from the collected data. Where applicable, "time" is located on the "x" or horizontal axis and is chronologically listed from oldest to most recent sampling. The "y1" or "y2" axes contain the constituent(s) of interest. Note: data collection events may not be evenly distributed over time (through seasons and years); sampling events may occur at different times of the day; sample collection and results documentation may have been completed by different monitors over time at each site; data collected by school groups should undergo additional scrutiny before use; data summary information is subject to change.

## Site Description and Background Summary

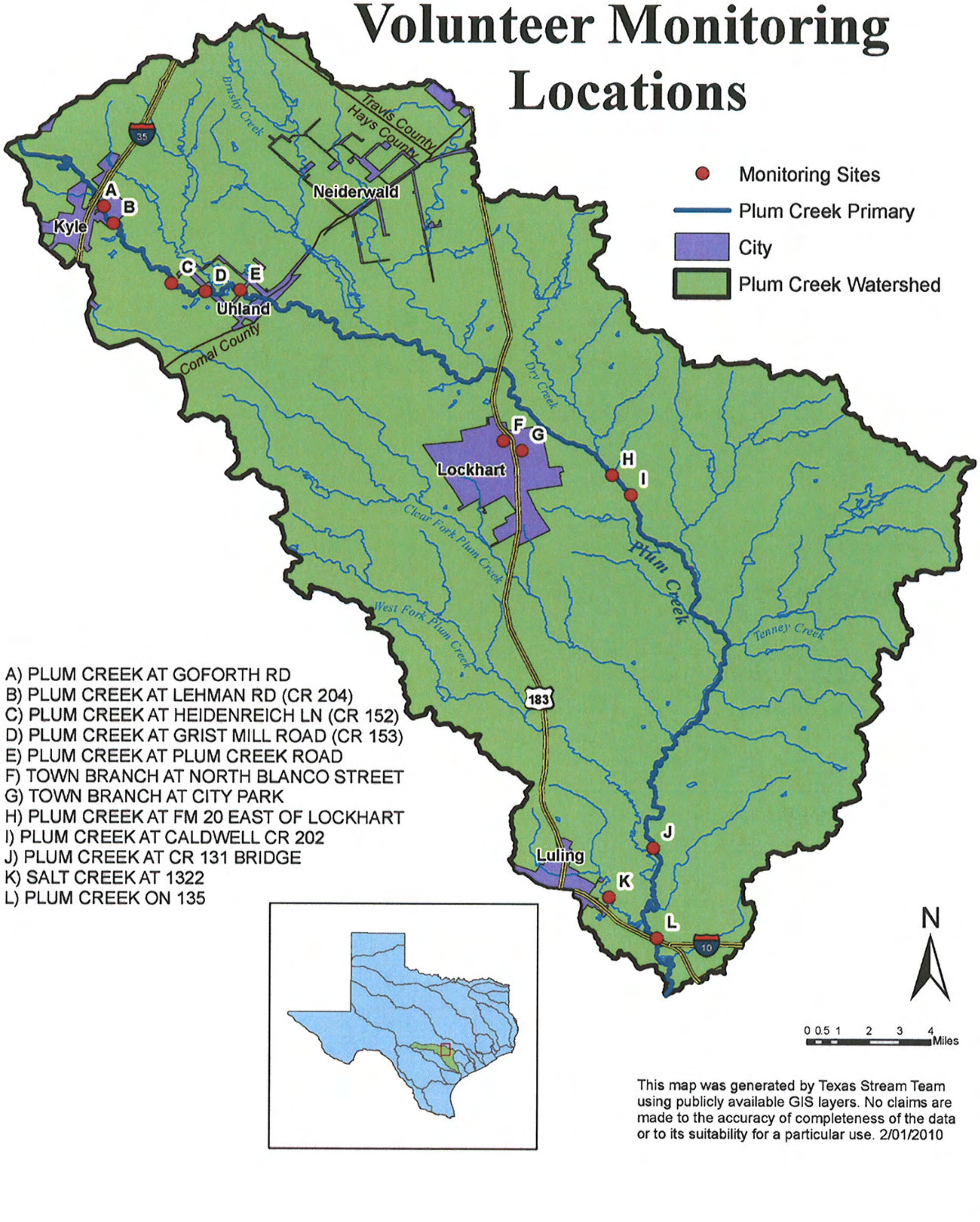
Plum Creek rises in Hays County near FM 2770 north of Kyle, runs south through Caldwell County, passes through Lockhart and Luling, and joins the San Marcos River at the Caldwell-Gonzales County line. The Plum Creek watershed has a drainage area of 397 $mi^2$ (1,028 $km^2$) within the Guadalupe River Basin, which drains South Central Texas from the Hill Country to the Gulf of Mexico. Plum Creek has been designated by the Texas Commission on Environmental Quality (TCEQ) as suitable for aquatic life, contact recreation, general, aquifer protection, and fish consumption uses (TCWP 2010). The aquifer protection domestic water supply designation is applied to water bodies which are capable of recharging the Edwards Aquifer in order to protect the quality of water recharging the aquifer (TCEQ 2000).

The southeastern portion of the Plum Creek in Caldwell County contains primarily deep, non calcareous, sandy soils over clays and sandy clay loams. Surface water plays a major role in the watershed and is sufficient for agricultural use in most areas. However, surface water is susceptible to being heavily silted during runoff events and may become severely limited in periods of drought. A significant portion of the water supply in the Plum Creek watershed comes from surface water, including reliance on the San Marcos River being pumped from lower portions of Caldwell County near Luling. The city of Luling also depends on this supply of surface water, as do many other cities in the watershed. The city of Lockhart currently receives 80% of its water from the San Marcos River (PCWP 2010).

Plum Creek is currently considered impaired by the TCEQ due the high levels of bacteria from the confluence with the San Marcos River to approximately 2.5 miles upstream of the confluence with Clear Fork Plum Creek and from approximately 0.5 miles upstream of SH 21 to the upper end of the creek (TCEQ 2008a). The levels of nutrients in Plum Creek have raised concerns by the TCEQ for water quality. There are elevated levels of nitrate in the entire segment. There are elevated levels of orthophosphorus or total phosphorus from approximately 2.5 miles upstream of the confluence with Clear Fork Plum Creek to approximately 0.5 miles upstream of SH21, and there is depressed dissolved oxygen and elevated total phosphorus from approximately 0.5 miles upstream of SH 21 to the upper end of Plum Creek (TCEQ 2008b).

The Plum Creek Watershed Partnership has developed a Watershed Protection Plan to promote a sustainable, proactive approach to cleaning up and protecting Plum Creek. The watershed planning process led to key recommendations including public outreach campaigns and a variety of management practices. A result of focused local effort throughout the watershed, implementation is underway to address water quality issues, including E. *coli* bacteria and nutrient levels. Visit http://pcwp.tamu.edu/ find out how to become more involved.

# Plum Creek Watershed Volunteer Monitoring Locations



## Data Summary

| Parameter | Observed Range | Standard[1] | # Exceedence | % Exceedance |
|---|---|---|---|---|
| **Water Temperature** | 8-28 °C | 32 °C | 0/45 | 0 |
| **Dissolved Oxygen** | 3.7-11 mg/L | 3 mg/L | 0/45 | 0 |
| **Specific Conductivity** | 20[2]-1,140 µS/cm | 1,672 µS/cm | 0/45 | 0 |
| **pH** | 6.8-8.5 | 6.5-9 | 0/45 | 0 |

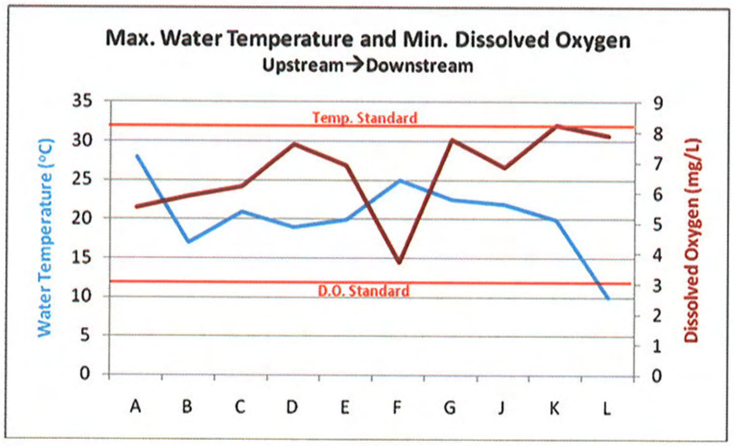
### Water Temperature

Fish are cold-blooded and therefore depend on the temperature of water to be able to carry out processes such as metabolism and reproduction. Extreme high or low temperatures can threaten their survival, particularly if the temperature changes abruptly. Sources of warm water include powers plants' effluent after it has been used for cooling or hydroelectric dams which release warmer or cooler water (depending on the time of year) near the point of release. Temperature also causes dissolved oxygen to decrease as it gets warmer and vice versa. In this data set, mean water temperature readings ranged from 9.25°C to 19°C. The maximum reading of 28°C was taken at Plum Creek at Goforth Road (CR-157) on August 7, 2009. The minimum of 8°C was taken at Town Branch at N. Blanco St. on January 31, 2009.

### Dissolved Oxygen

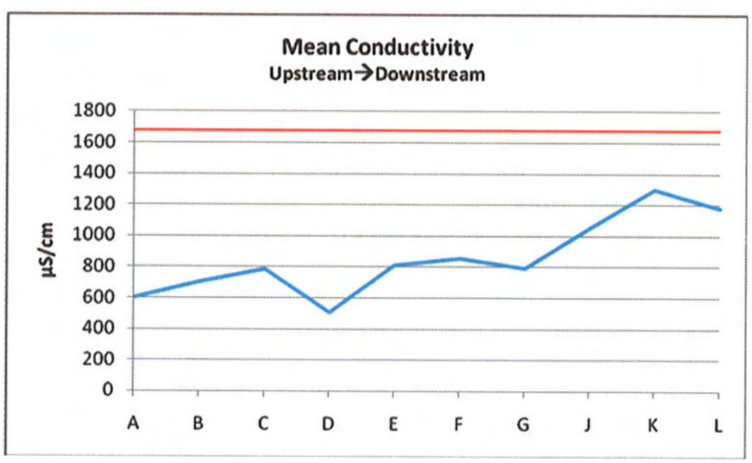
Oxygen is necessary for the survival of most organisms. Too little oxygen will lead to asphyxiation of aquatic organisms. Too much oxygen (supersaturation) can cause bubbles to develop in cardiovascular systems and can be fatal. Dissolved oxygen (DO) levels below 2 mg/L can lead to asphyxiation, and levels above 20 mg/L will lead to supersaturation. The most suitable conditions for aquatic life are above 5 mg/L. Low dissolved oxygen levels typically result from an abundance of nutrients starving subsurface vegetation of sunlight, and therefore limiting the amount of dissolved oxygen due to limited photosynthesis. This process is enhanced when the subsurface vegetation dies and consumes oxygen when decomposing. Low DO levels may also result from high groundwater inflows as groundwater is typically low in dissolved oxygen due to minimal aeration or high temperatures which reduce oxygen solubility. In this data set, mean DO values ranged from 5.9 to 8.9 mg/L. The maximum value of 11.0 mg/L was observed at Plum Creek at Lehman Rd (CR-204) on February 10, 2007, and the minimum value of 3.7 mg/L was observed at Town Branch @ N. Blanco St. on August 23, 2008.

[1] Taken from the Texas 2000 Water Quality Standards: http://www.epa.gov/waterscience/standards/wqslibrary/tx/tx-wqs.pdf.
[2] This value is probably a mistake, but it is assumed to be correct since there is no way to check.



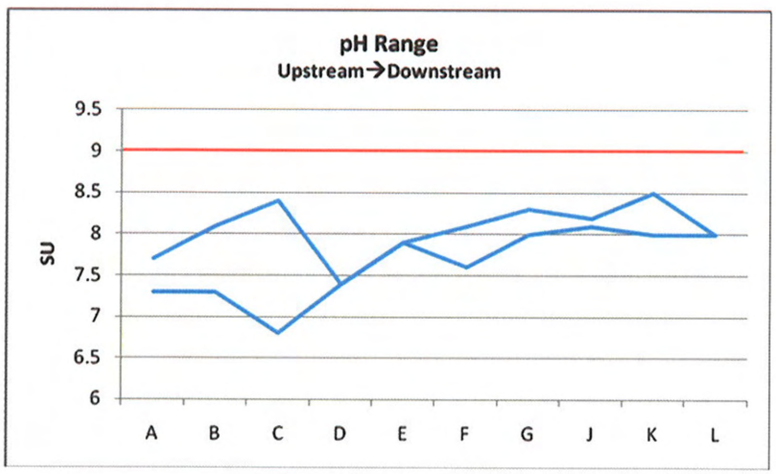

## Specific Conductivity

Specific conductivity (SC) is a measure of the ability of a body of water to conduct electricity. A body of water is more conductive if it has more Total Dissolved Solids (TDS) such as nutrients and salts, which indicate poor water quality if they are abundant. High concentrations of nutrients can lead to excessive surface vegetation growth and can starve subsurface vegetation of sunlight, therefore limiting the amount of dissolved oxygen in a water body due to limited photosynthesis. This process is enhanced when the subsurface vegetation dies and consumes oxygen when decomposing. High concentrations of salt can inhibit water absorption and limit root growth for vegetation, lead to an abundance of more drought tolerant plants, and cause dehydration of fish and amphibians. Sources of TDS include agricultural runoff, domestic runoff, or discharges from wastewater treatment plants. It is important to note that the TCEQ Water Quality Standard for Conductivity pertains to an annual average, so data sets with less than a year of sampling dates or with irregular intervals are not representative of a real potential for impairment. In this data set, mean SC values ranged from 510 to 1300 μS/cm. The maximum value of 1,440 μS/cm was observed at Salt Creek at 1322 on December 2, 2007, and the minimum value of 450 μS/cm was observed at Plum Creek at Lehman Rd (CR-204) on April 14, 2007.



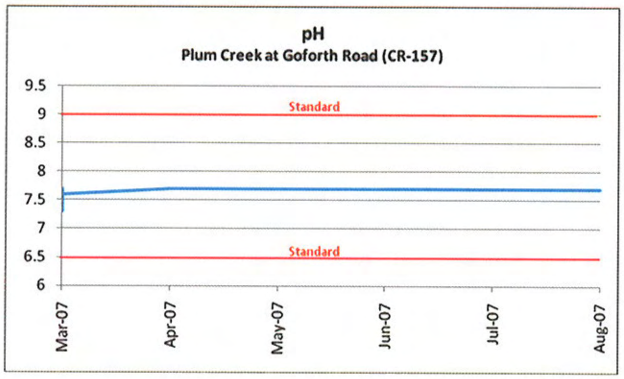
## pH

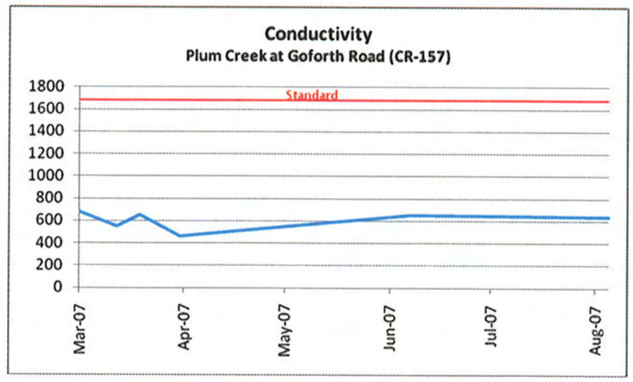
pH is a measure of acidity and alkalinity. The scale measures the concentration of hydrogen ions on a range of 0 to 14 and is reported in standard units (su). The range is logarithmic. Therefore, every 1 unit change means the acidity increased or decreased 10-fold. Sources of low pH (acidic) can include acid rain and runoff from acid-laden soils. Acid-rain is mostly caused by coal power plants with minimal contributions from the burning of other fossil fuels and other processes such as volcanic emissions. Soil-acidity can be caused by excessive rainfall leaching alkaline materials out of soils, acidic parent material, crop decomposition creating hydrogen ions, or high-yielding fields which have drained the soil of all alkalinity. Sources of high pH include geologic composition as in the case of limestone increasing alkalinity and the dissolving of carbon dioxide in water as well. Carbon dioxide is water soluble, and as it dissolves it forms carbonic acid, an alkaline molecule. In this dataset, mean pH values stay within a range of 6.8 to 8.5 su. The maximum value of 8.5 su was observed at Salt Creek at 1322 on December 2, 2007, and the minimum value of 6.8 su was observed at Plum Creek at Heidenreich Ln (CR-152) on December 17, 2006.

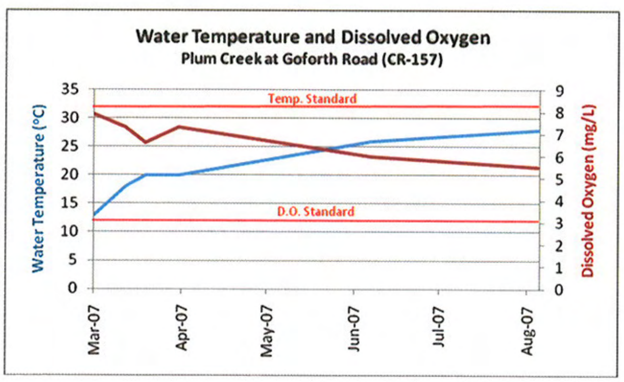


# Site-by-Site Analysis

| Plum Creek at Goforth Road (CR-157) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **N** | **% Complete** | **Min** | **Mean** | **Max** | **Std. Dev** |
| Sample Time | 6 | 100 | 9:00 | 10:23 | 12:30 | 0.1 |
| Total Depth (m) | 6 | 100 | 0.07 | 0.21 | 0.3 | 0.08 |
| Specific Conductivity (µS/cm) | 6 | 100 | 460 | 605 | 680 | 83.6 |
| DO (mg/L) | 6 | 100 | 5.5 | 6.8 | 7.9 | 0.9 |
| pH (su) | 6 | 100 | 7.3 | 7.62 | 7.7 | 0.2 |
| Air Temperature (°C) | 6 | 100 | 13 | 21 | 27 | 5.2 |
| Water Temperature (°C) | 6 | 100 | 13 | 20.83 | 28 | 5.5 |
| Secchi Depth (m) | 6 | 100 | 0.07 | 0.21 | 0.3 | 0.1 |

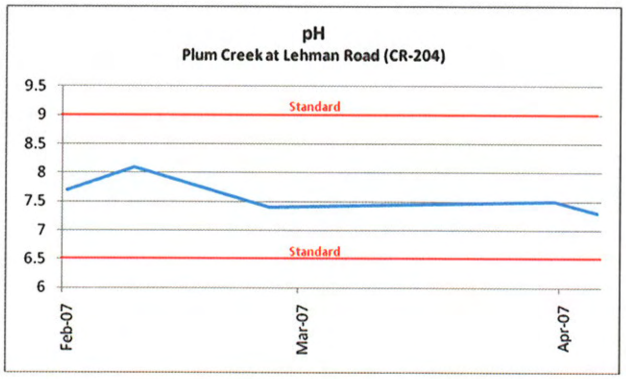


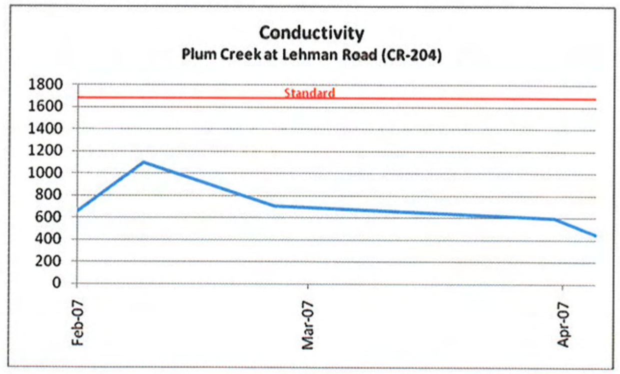



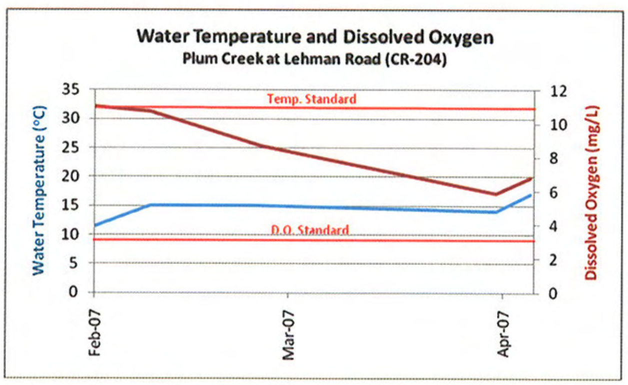




Data collected by Tara Noah and Monica Gomez

| Plum Creek at Lehman Rd (CR-204) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **N** | **% Complete** | **Min** | **Mean** | **Max** | **Std Dev** |
| Sample Time | 5 | 100 | 9:15 | 13:21 | 17:30 | 0.14 |
| Total Depth (m) | 5 | 100 | 0.25 | 0.56 | 1.1 | 0.33 |
| Specific Conductivity (µS/cm) | 5 | 100 | 450 | 704 | 1100 | 241.93 |
| DO (mg/L) | 5 | 100 | 5.9 | 8.6 | 11 | 2.29 |
| pH (su) | 5 | 100 | 7.3 | 7.6 | 8.1 | 0.32 |
| Air Temperature (°C) | 5 | 100 | 9 | 14.3 | 21 | 4.32 |
| Water Temperature (°C) | 5 | 100 | 11.5 | 14.5 | 17 | 2.00 |
| Secchi Depth (m) | 5 | 100 | 0.25 | 0.56 | 1.1 | 0.33 |

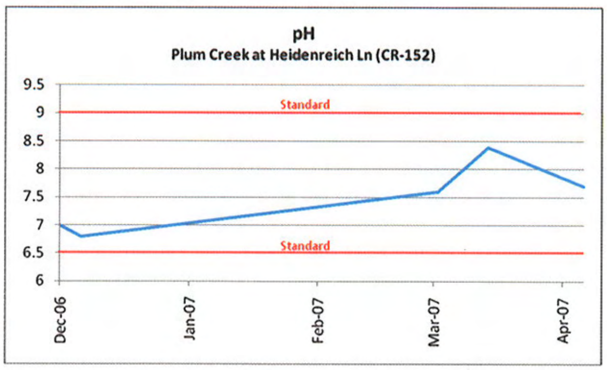


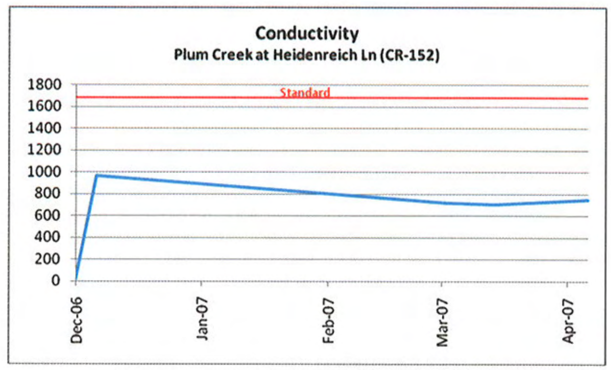



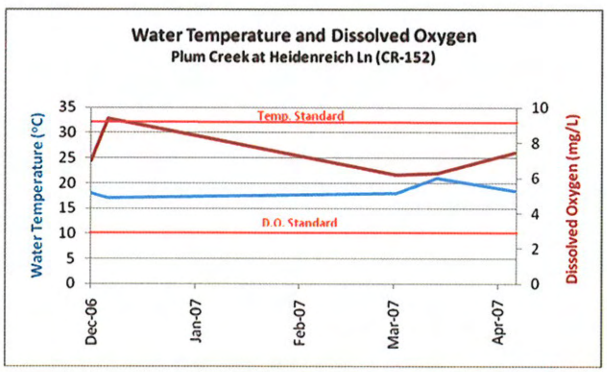




Data collected by Melissa Ponce, Carolyn Renfro, Elizabeth Stockhorst and Karinda Cowan

| Plum Creek at Heidenreich Ln (CR-152) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **N** | **% Complete** | **Min** | **Mean** | **Max** | **Std Dev** |
| Sample Time | 5 | 100 | 8:00 | 9:47 | 15:15 | 0.1 |
| Total Depth (m) | 5 | 100 | 0.07 | 0.608 | 1 | 0.28 |
| Specific Conductivity (µS/cm) | 5 | 100 | 20 | 787.5 | 970 | 122.8 |
| DO (mg/L) | 5 | 100 | 6.2 | 7.3 | 9.4 | 1.3 |
| pH (su) | 5 | 100 | 6.8 | 7.5 | 8.4 | 0.6 |
| Air Temperature (°C) | 5 | 100 | 18 | 36.62 | 65 | 23.7 |
| Water Temperature (°C) | 5 | 100 | 17 | 18.5 | 21 | 1.5 |
| Secchi Depth (m) | 5 | 100 | 0.1 | 0.298 | 0.44 | 0.1 |



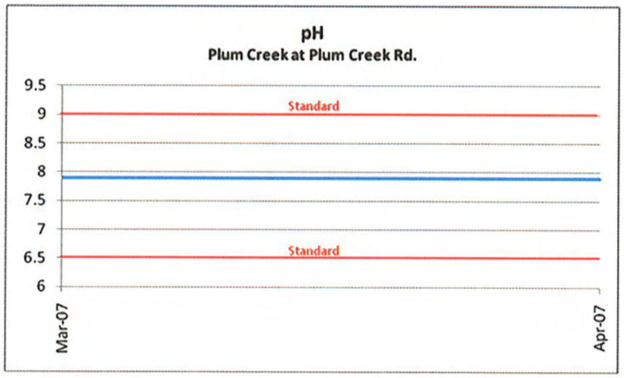

Data collected by Rikki Spear, Angela Gallardo, Danell Lunz and Mary Magana

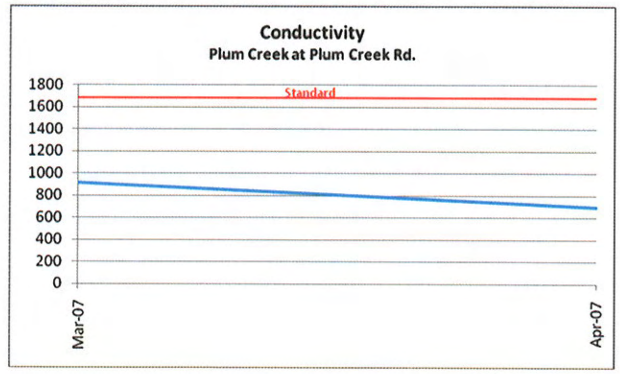
| Plum Creek at Grist Mill Road | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **N** | **% Complete** | **Min** | **Mean** | **Max** | **Std Dev** |
| Sample Time | 2 | 100 | 8:00 | 9:12 | 10:25 | 0.07 |
| Total Depth (m) | 2 | 100 | 0.13 | 0.127 | 0.13 | 0 |
| Specific Conductivity (μS/cm) | 2 | 100 | 510 | 510 | 510 | 0 |
| DO (mg/L) | 2 | 100 | 7.6 | 7.6 | 7.6 | 0 |
| pH (su) | 2 | 100 | 7.4 | 7.4 | 7.4 | 0 |
| Air Temperature (°C) | 2 | 100 | 17 | 17.5 | 18 | 0.71 |
| Water Temperature (°C) | 2 | 100 | 19 | 19 | 19 | 0 |
| Secchi Depth (m) | 2 | 100 | 0.13 | 0.13 | 0.13 | 0 |

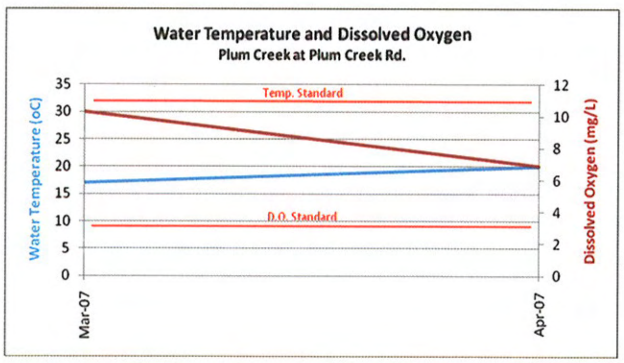
Data collected by Kelly Kyle, and Jacob Barret

Graphs were omitted for this site because there are only two sampling dates, and they are two days apart.

| Plum Creek at Plum Creek Road | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | N | % Complete | Min | Mean | Max | Std Dev |
| Sample Time | 2 | 100 | 14:00 | 14:46 | 15:32 | 0.05 |
| Total Depth (m) | 2 | 100 | 0.3 | 0.4 | 0.5 | 0.14 |
| Specific Conductivity (µS/cm) | 2 | 100 | 700 | 810 | 920 | 155.56 |
| DO (mg/L) | 2 | 100 | 6.9 | 8.6 | 10.3 | 2.40 |
| pH (su) | 2 | 100 | 7.9 | 7.9 | 7.9 | 0.00 |
| Air Temperature (°C) | 2 | 100 | 22 | 25.25 | 28.5 | 4.60 |
| Water Temperature (°C) | 2 | 100 | 17 | 18.5 | 20 | 2.12 |
| Secchi Depth (m) | 2 | 100 | 0.25 | 0.275 | 0.3 | 0.04 |

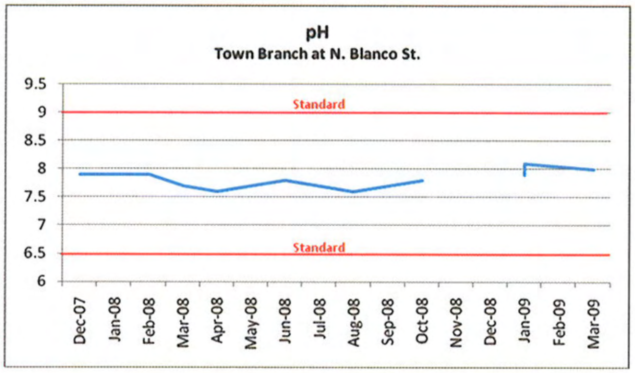


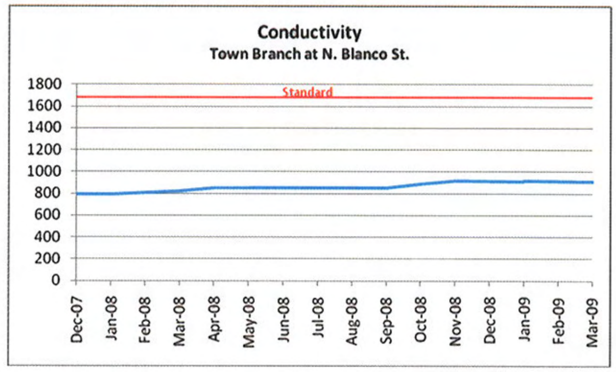



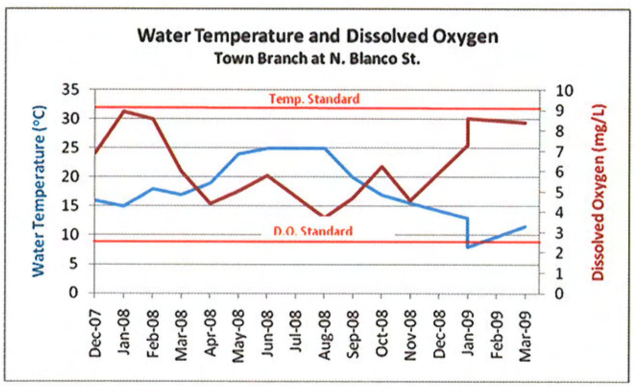




Data collected by Steve Goodman

| Town Branch @ N. Blanco St. | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **N** | **% Complete** | **Min** | **Mean** | **Max** | **Std Dev** |
| Sample Time | 14 | 100 | 8:30 | 9:19 | 10:15 | 0.03 |
| Total Depth (m) | 14 | 100 | 0.15 | 0.16 | 0.205 | 0.02 |
| Specific Conductivity (µS/cm) | 14 | 100 | 790 | 857.86 | 920 | 45.94 |
| DO (mg/L) | 14 | 100 | 3.7 | 6.36 | 8.95 | 1.78 |
| pH (su) | 13 | 93 | 7.6 | 7.82 | 8.1 | 0.15 |
| Air Temperature (°C) | 14 | 100 | 5 | 18.64 | 32 | 7.82 |
| Water Temperature (°C) | 14 | 100 | 8 | 17.43 | 25 | 4.98 |
| Secchi Depth (m) | 8 | 57 | 0.15 | 0.16 | 0.205 | 0.02 |

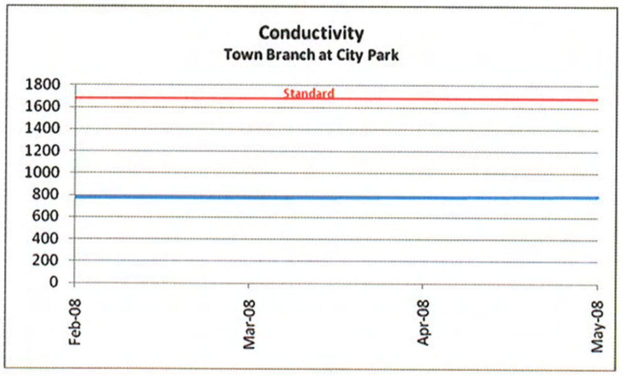


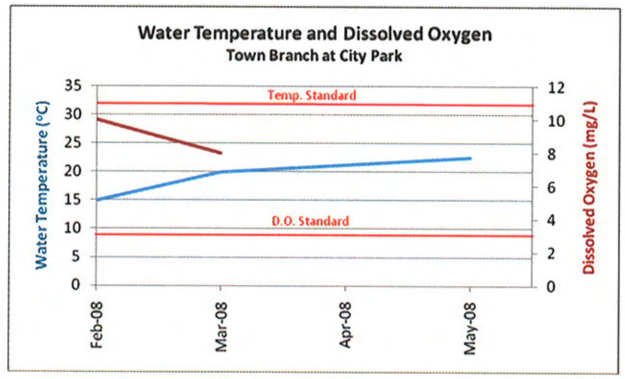



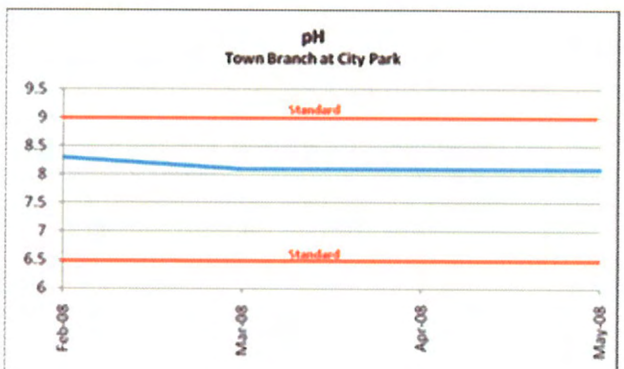




Data collected by Mary Magana

| Town Branch at City Park | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | N | % Complete | Min | Mean | Max | Std Dev |
| Sample Time | 4 | 100 | 10:07 | 10:15 | 10:25 | 0.01 |
| Total Depth (m) | 4 | 100 | 0.23 | 0.355 | 0.5 | 0.11 |
| Specific Conductivity (µS/cm) | 4 | 100 | 780 | 790 | 810 | 14.14 |
| DO (mg/L) | 3 | 75 | 7.75 | 8.6 | 10 | 1.23 |
| pH (su) | 4 | 100 | 8 | 8.125 | 8.3 | 0.13 |
| Air Temperature (°C) | 4 | 100 | 11 | 19 | 25 | 6.49 |
| Water Temperature (°C) | 4 | 100 | 15 | 18.25 | 22.5 | 3.62 |
| Secchi Depth (m) | 4 | 100 | 0.23 | 0.808 | 1 | 0.39 |

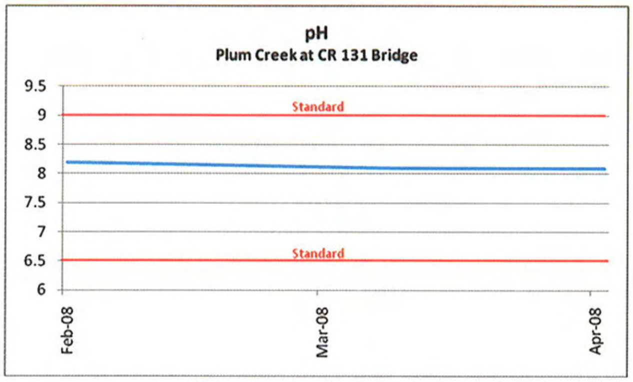


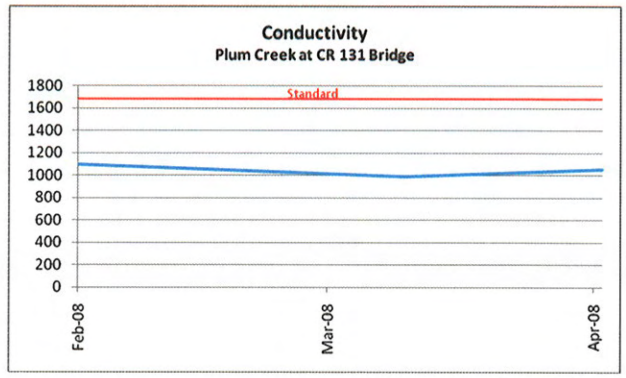



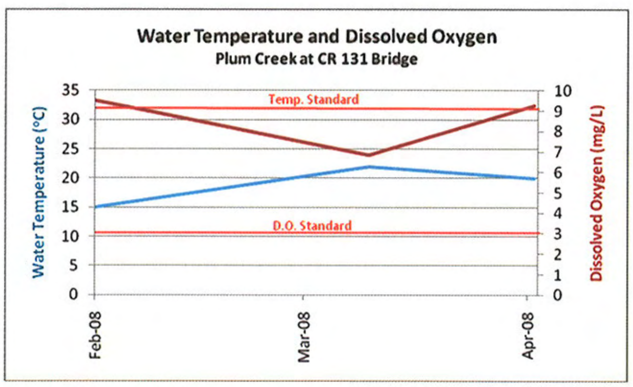




Data collected by Jennifer Lickert

| Plum Creek at CR 131 Bridge | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | N | % Complete | Min | Mean | Max | Std Dev |
| Sample Time | 3 | 100 | 14:00 | 14:56 | 16:15 | 0.05 |
| Total Depth (m) | 3 | 100 | 0.5 | 0.5 | 0.5 | 0.00 |
| Specific Conductivity (µS/cm) | 3 | 100 | 990 | 1050 | 1100 | 55.68 |
| DO (mg/L) | 3 | 100 | 6.85 | 8.5 | 9.5 | 1.46 |
| pH (su) | 3 | 100 | 8.1 | 8.133 | 8.2 | 0.06 |
| Air Temperature (°C) | 3 | 100 | 20 | 27 | 31 | 6.08 |
| Water Temperature (°C) | 3 | 100 | 15 | 19 | 22 | 3.61 |
| Secchi Depth (m) | 3 | 100 | 0.5 | 0.5 | 0.5 | 0.00 |

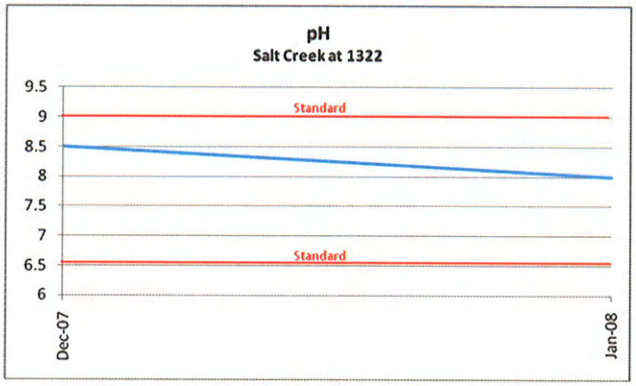


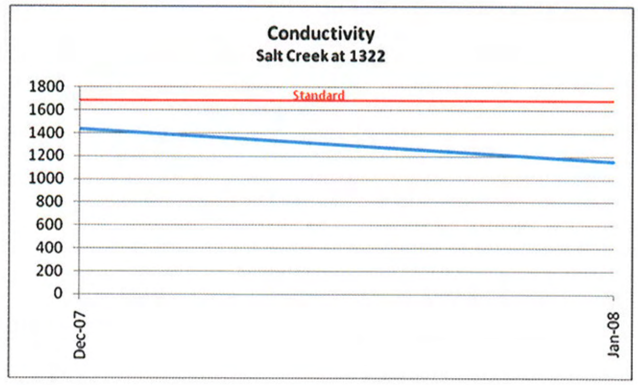



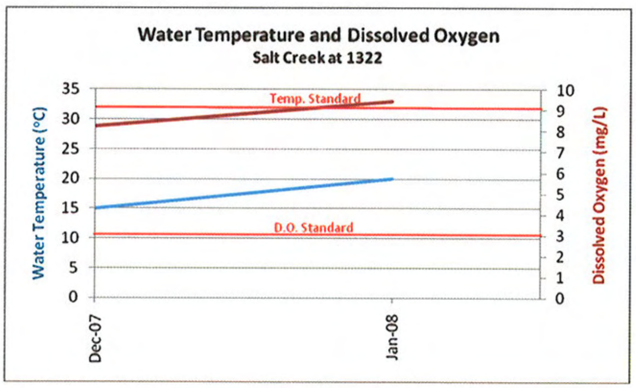




Data collected by Heather Ann Brown

| Salt Creek at 1322 | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **N** | **% Complete** | **Min** | **Mean** | **Max** | **Std Dev** |
| Sample Time | 2 | 100 | 11:30 | 11:55 | 12:20 | 0.02 |
| Total Depth (m) | 2 | 100 | 0.35 | 0.35 | 0.35 | 0 |
| Specific Conductivity (µS/cm) | 2 | 100 | 1160 | 1300 | 1440 | 197.9 |
| DO (mg/L) | 2 | 100 | 8.25 | 8.9 | 9.45 | 0.85 |
| pH (su) | 2 | 100 | 8 | 8.25 | 8.5 | 0.35 |
| Air Temperature (°C) | 2 | 100 | 17 | 20 | 23 | 4.24 |
| Water Temperature (°C) | 2 | 100 | 9 | 14.5 | 20 | 7.78 |
| Secchi Depth (m) | 2 | 100 | 0.35 | 0.35 | 0.35 | 0 |

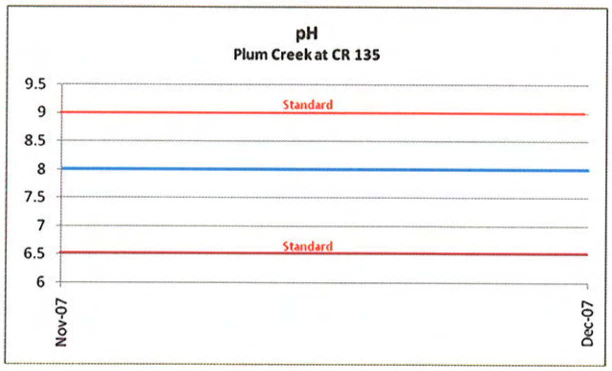


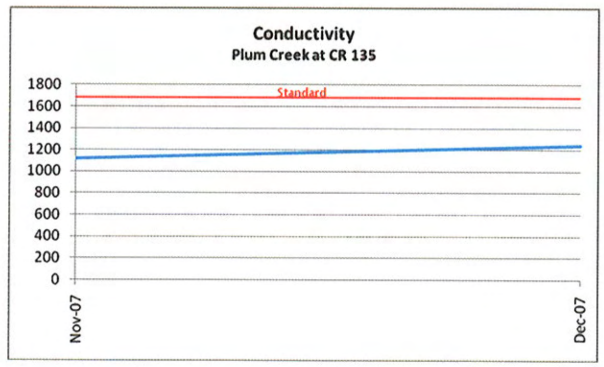



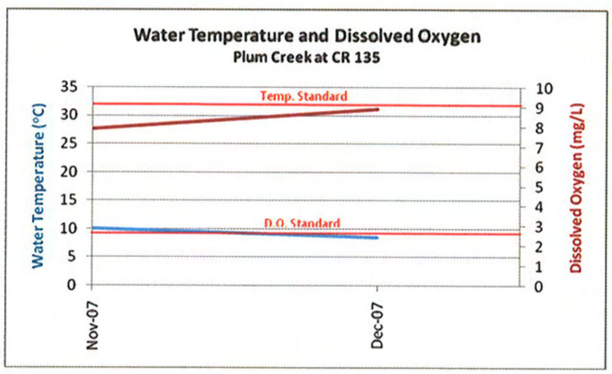




Data collected by Nicole Welch

| Plum Creek at CR 135 | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **N** | **% Complete** | **Min** | **Mean** | **Max** | **Std Dev** |
| Sample Time | 2 | 100 | 8:37 | 8:51 | 9:05 | 0.01 |
| Total Depth (m) | 2 | 100 | 0.5 | 0.5 | 0.5 | 0 |
| Specific Conductivity (µS/cm) | 2 | 100 | 1120 | 1180 | 1240 | 84.85 |
| DO (mg/L) | 2 | 100 | 7.9 | 8.4 | 8.9 | 0.71 |
| pH (su) | 2 | 100 | 8 | 8 | 8 | 0 |
| Air Temperature (°C) | 2 | 100 | 9 | 11 | 13 | 2.83 |
| Water Temperature (°C) | 2 | 100 | 8.5 | 9.25 | 10 | 1.06 |
| Secchi Depth (m) | 2 | 100 | 0.5 | 0.5 | 0.5 | 0 |




Data collected by Cristina Chonka

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