Canadian River Watershed Data Report

April 7, 2010

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

The preparation of this report was financed through grants from the Texas Commission on Environmental Quality and the U.S. Environmental Protection Agency

The Canadian River rises in the Sangre de Cristo Mountains in southern Las Animas County, Colorado and flows south and southeastward for roughly 760 miles into the Arkansas River, twenty miles east of Canadian, Oklahoma. 190 of these miles are within Texas, specifically within in Oldham, Potter, Hutchinson, and Roberts counties.[i] The Texas portion of the watershed drains 12,700 mi^2 (39,893 km^2). In Texas, the economy of the watershed is based on agriculture, agribusiness, oil and gas production, and varied manufacturing activities. The climate is semi-arid. Trees are only found along the edges of streams and reservoirs. Salt cedars are the most dominant.[ii] The river moves through the High Plains and the Rolling Plains. It is wide, shallow, and sandy-bottomed with seasonal fluctuations in stream flow. Land use in the Texas portion is predominantly irrigated, dry land farming, and cattle ranching. The largest urban area is Amarillo. Other relatively large cities include Pampa, Borger and Dumas.[iii]

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 coordinates 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; 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.

Water Quality Parameters

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. Sources of warm water include powers plants' effluent after it has been used for cooling or hydroelectric plants which release warmer or cooler water (depending on the time of year) near the point of release. On a yearly scale, the amount of dissolved oxygen in the water decreases as temperatures increase, and vice versa, because warmer, less dense water can hold less oxygen molecules than cooler, more dense water. However, on a daily scale, the amount of dissolved oxygen in the water increases as temperatures increase, and vice versa, because of photosynthesis adding oxygen to the water body. Water temperature variations are most detrimental when they occur rapidly, leaving the biotic community no time to adjust. However, volunteer monitoring occurs at a particular time, so these variations are not covered in this report.

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, which could be fatal. Dissolved oxygen (DO) levels below 2 milligrams per liter (mg/L) can lead to asphyxiation, and levels above 20 mg/L can lead to supersaturation. The most suitable aquatic environment exhibits levels above 5 mg/L. High concentrations of nutrients can lead to excessive surface vegetation growth, which may starve subsurface vegetation of sunlight, and therefore limit 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. Low dissolved oxygen 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. Supersaturation typically only occurs underneath waterfalls or dams with water flowing over the top.

Specific Conductivity

Specific conductivity is a measure of the ability of a body of water to conduct electricity. It is measured in microSiemens per centimeter (µS/cm). A body of water is more conductive if it has more dissolved materials such as nutrients and salts, which indicate poor water quality if they are abundant. Nitrates and phosphates are specific nutrients for which tests are sometimes conducted. High concentrations of nutrients lower dissolved oxygen, the process of which was described in the previous section. 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 total dissolved solids (TDS) can include agricultural runoff, domestic runoff, or discharges from wastewater treatment plants.

pH

pH is a measure of acidity or 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 (alkaline) include geologic composition as in the case of limestone increasing alkalinity and the dissolving of carbon dioxide in water. Carbon dioxide is water soluble, and as it dissolves it forms carbonic acid, an alkaline molecule. The most suitable range for healthy organisms is 6.5-9.

Secchi Depth and Total Depth

The Secchi Disk is used to determine the clarity of the water, a condition known as turbidity. The disk shown on the right is lowered into the water until it is no longer visible, and the depth is recorded. Highly turbid waters pose a risk to wildlife by clogging the gills of fish, reducing visibility, and carrying contaminants. Reduced visibility can harm predatory fish or birds that depend on good visibility to find their prey. Contaminants are most commonly transported in sediment rather than in the water. Average Secchi Depth readings below Total Depth readings indicate highly turbid water. Readings that are equal to total depth indicate clear water. Low total depth observations have a potential to concentrate contaminants.


Secchi Disk

Data Analysis

Volunteer water quality monitoring data in the Canadian River Watershed is available for Medi-Park Lake, Martin Lake, and Thompson Park Lake. None of these are large enough to be regulated by the TCEQ. However, standards are shown as a reference point. The water temperature standard shown is the highest standard for the regulated water bodies in the Canadian River Watershed. This is a maximum level aquatic life can handle. The dissolved oxygen standard is the lowest. This is the minimum level aquatic life can handle. The pH range shown is the same for every water body in the watershed. The conductivity standards vary too much in the watershed to be an accurate representation of these particular water bodies.

Medi-Park Lake

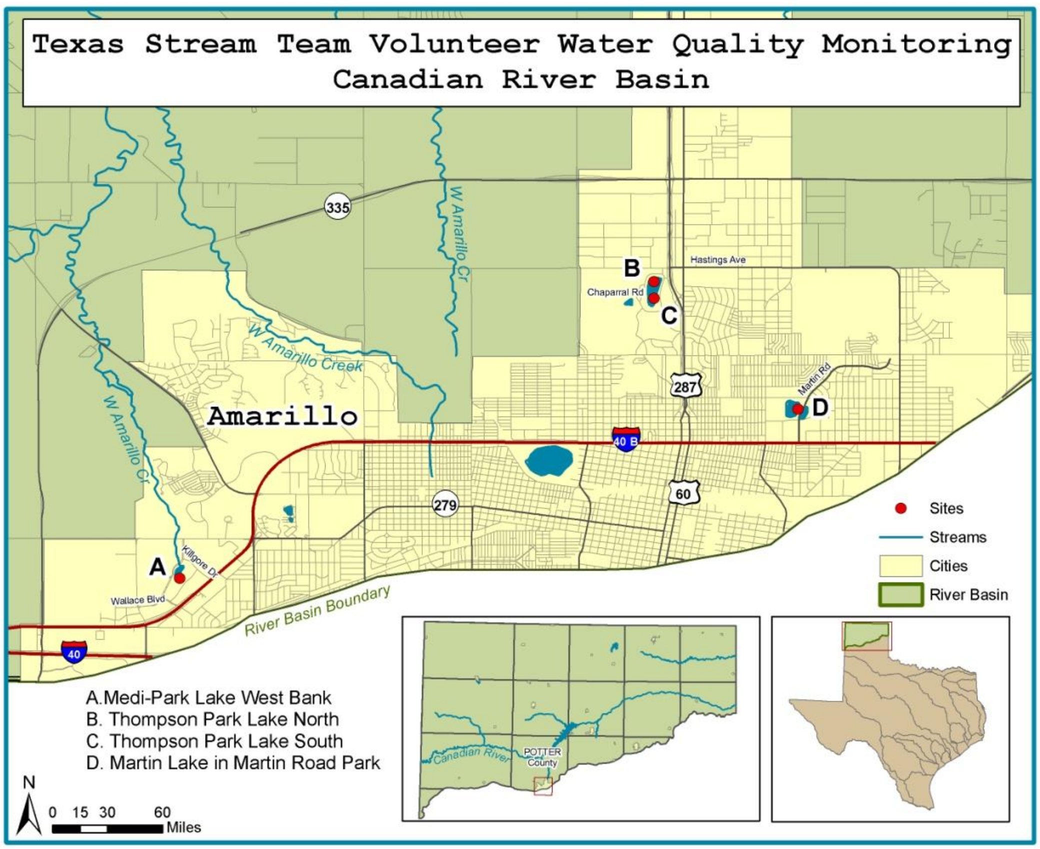
The data collected at Medi-Park Lake demonstrates a suitable environment for aquatic life. Of the 155 total observations, 100% of the samples met the standard for minimal aquatic life use, 98.7% of the dissolved oxygen observations met the TCEQ standard for high aquatic life use, and 97.42% met the standard for exceptional aquatic life use. 92.9% of the pH observations fell within the most suitable range for aquatic life. 100% of the water temperature observations were below a harmful temperature. On October 7, 2008, nitrates and phosphates were recorded. The nitrates level exceeded the TCEQ maximum standard for reservoirs of 0.37 ppm, amounting to 1.32 parts per million (ppm). The phosphates level also exceeded the TCEQ maximum standard for reservoirs of 0.2 ppm, amounting to 0.71 ppm.[iv] Although they are very high, more testing would be necessary to indicate the normal conditions of the lake.

Martin Lake

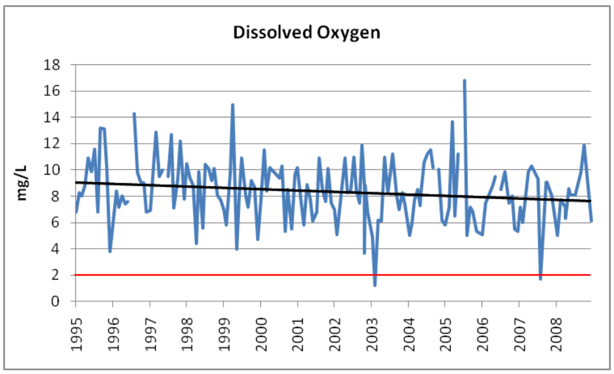
The data collected at Martin Lake demonstrates a suitable environment for aquatic life. Of the ten observations, 100% of the dissolved oxygen observations met the standard for high aquatic life use. 90% met the standard for exceptional aquatic life use. 100% of the pH observations fell within the most suitable range for aquatic life, and 100% of the water temperature observations were below a harmful temperature.

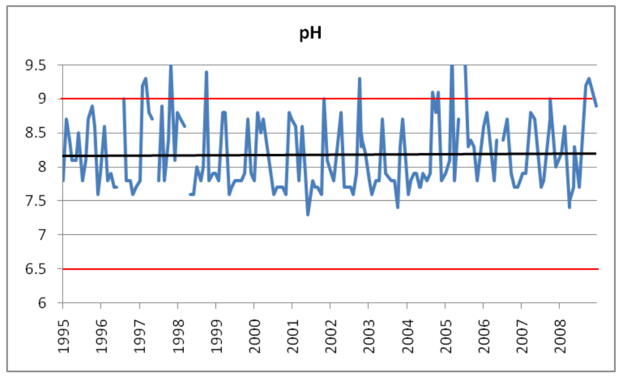
Thompson Park Lake

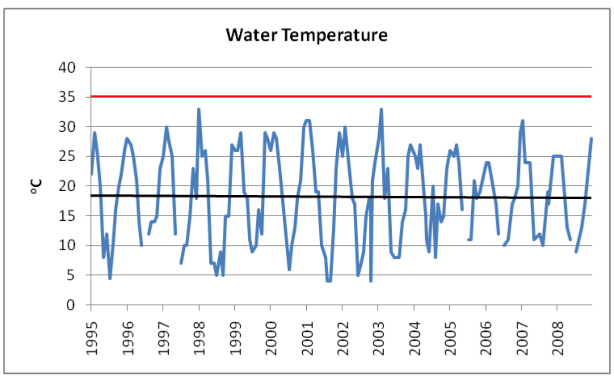
The data collected at Thompson Park Lake demonstrates a suitable dissolved oxygen and temperature levels, but the pH levels show the lake to be alkaline. Of the 49 observations at the two sites, 100% of the dissolved oxygen observations met the standard for exceptional aquatic life use. 81.58% of the pH observations fell within the most suitable range for aquatic life. 13.16% of the alkaline values were at the north site, and the remaining 5.26% were at the south site. 100% of the water temperature observations were below a harmful temperature. Of the 11 observations of nitrates and phosphates, 81.81% of the phosphate levels and 36.36% of the nitrate levels met the TCEQ standard for reservoirs. These samples were taken between October 20th and October 28th 2008. Although they are very high, more testing would be necessary to indicate the normal conditions of the lake.

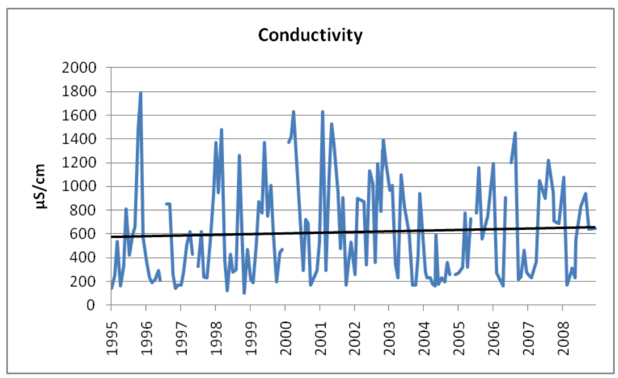


Medi-Park Lake West Bank In Amarillo						
Parameter	#	% Complete	Min.	Mean.	Max.	Std. Dev.
Sample Time	158	99	1:15	15:02	18:00	2:09
Total Depth (m)	151	94	0.05	0.61	3.2	0.3
Secchi Depth (m)	151	94	0.05	0.31	0.62	0.14
Water Temperature (^{o}C)	156	98	4	19	70	8.66
Specific Conductivity (µS/cm)	154	96	100	616.43	1790	413.07
Dissolved Oxygen (mg/L)	155	97	1.2	8.38	16.8	2.42
pH (su)	155	97	7.3	8.18	9.7	0.54





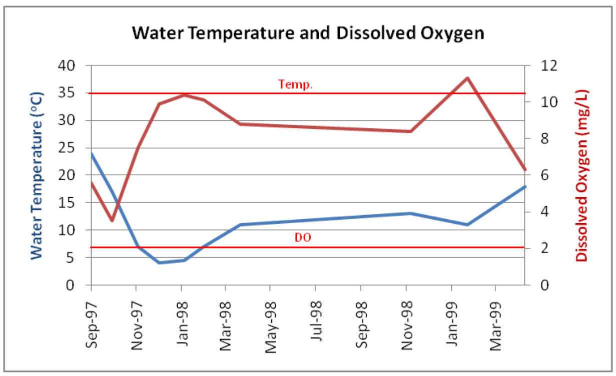


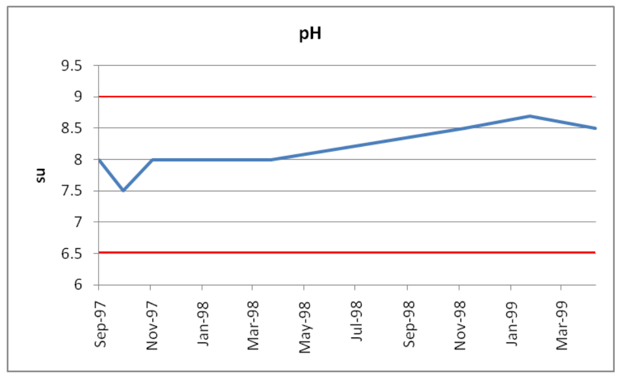


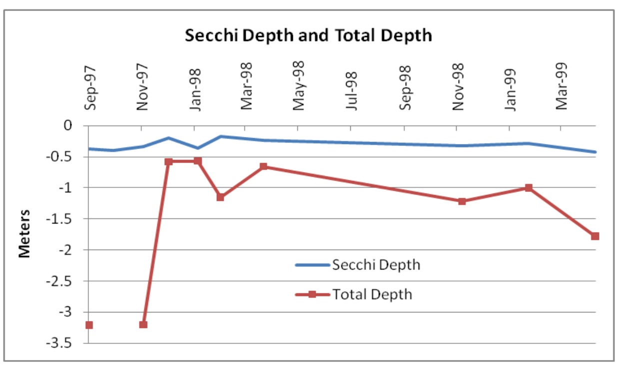
The Secchi Depth and Total Depth graph is omitted because the high number of counts hinders the ability to demonstrate conclusions.

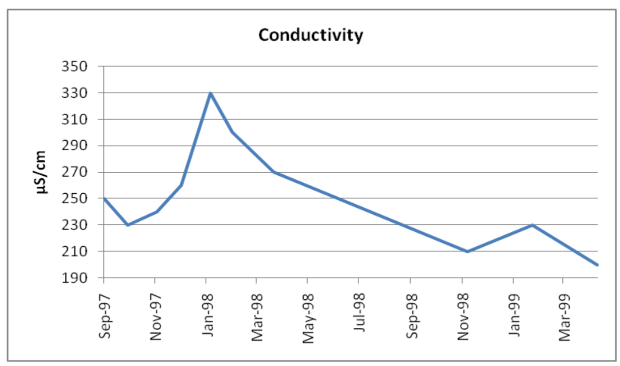
Data collected by: Jo Meaker (from 1995-2009), Betty Sitton, John Borden, Brennan Brosier, Megan Brown, Elise Burrough, Lizzy Chesnut, Ben Clendennen, Craig Cowden, Barbara Croft, Beau Cross, Kate Cross, Ben Cunningham, Kalea Diaz, Felicia Dixon, Katie Dryden, Jason Edwards, Aaron Feil, Merritt Fields, Tabitha Flores, Jason Gallardo, Alyse Goodfellow, David Gordon, Afton Graham, Marca Henderson, Preston Hodges, Patrick Hodges, Miriam Hook, Jessica Johnson, Ian Kelly, Lauren Krieg, Maegan Lovett, Sean Mcintosh, Melissa Mcwilliams, Justin Melugin, Ruston Mitchell, Jackie Moffett, Keith Morales, Nicole Morris, Josh Nipper, Beth Ann Nussbaum, Missy Orr, Caroline Pinkston, Hallie Prickett, Monika Purviance, Caitlin Robinson, Jay Romo, Amanda Ross, Kelley Sanders, Brittany Siess, Betty Sitton, Jill Smart, Brittany Smith, Sean Smoot, Jennifer Voelm, Kristan Werner, Megan Wolfe, Jacob Wood, and Bonnie Wright

Martin Lake In Martin Road Park In Amarillo						
Parameter	**#**	**% Complete**	**Min.**	**Mean.**	**Max.**	**Std. Dev.**
Sample Time	10	100	9:30	12:23	13:00	1:07
Total Depth (m)	9	90	0.57	1.49	3.21	1.05
Secchi Depth (m)	10	100	0.17	0.31	0.42	0.09
Water Temperature (^{o}C)	10	100	4	12	24	6.47
Specific Conductivity (µS/cm)	10	100	200	252	330	39.94
Dissolved Oxygen (mg/L)	10	100	3.5	8.18	11.3	2.46
pH (su)	10	100	7.5	8.12	8.7	0.35





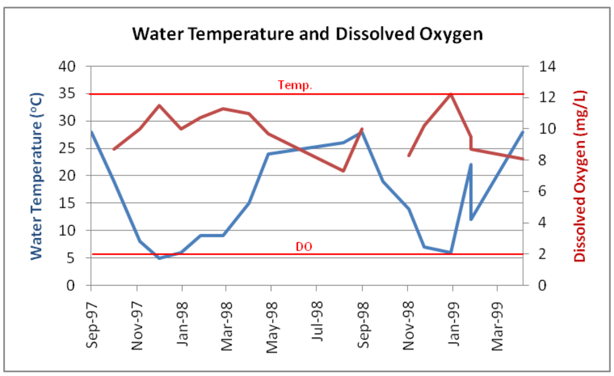


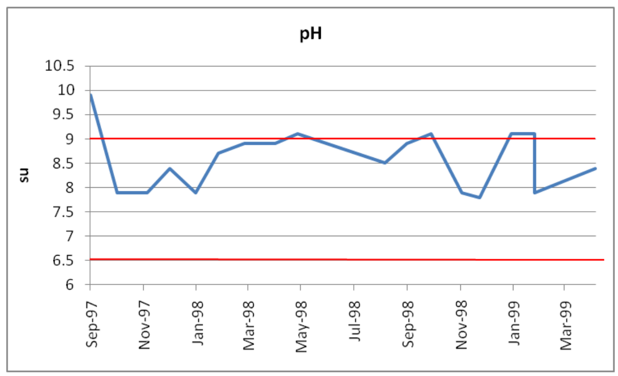


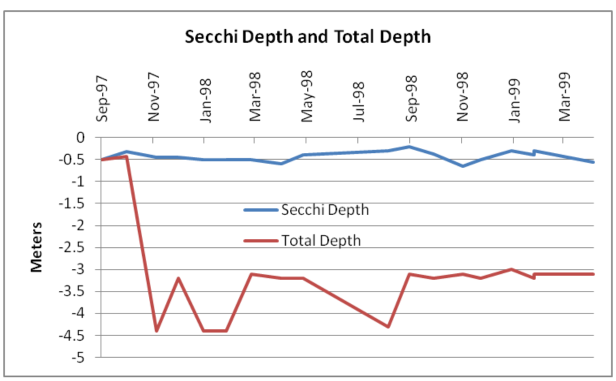
Data collected by: Jim Wood and Shamanique Bodie

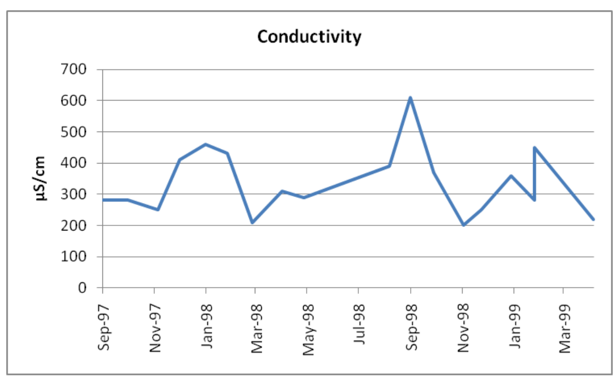
Thompson Park Lake North						
Parameter	**#**	**% Complete**	**Min.**	**Mean.**	**Max.**	**Std. Dev.**
Sample Time	30	100	8:00	12:21	16:20	3:45
Total Depth (m)	30	100	0.43	3.24	4.4	0.89
Secchi Depth (m)	30	100	0.2	0.42	0.65	0.11
Water Temperature (°C)	30	100	5	14	28	6.83
Specific Conductivity (µS/cm)	30	100	200	289.67	610	100.94
Dissolved Oxygen (mg/L)	28	93	7.3	9.15	12.2	1.29
pH (su)	30	100	7.5	8.32	9.9	0.58

Date	Phosphates (ppm)	Nitrates (ppm)	Date	Phosphates (ppm)	Nitrates (ppm)
20-Oct-08	0.5	0.13	21-Oct-08	0	1.1
20-Oct-08	0	1.1	27-Oct-08	0.5	0.25
21-Oct-08	0	0.2	27-Oct-08	0	0.88
21-Oct-08	0	0.25	27-Oct-08	0	0.88
21-Oct-08	0.2	1.1	28-Oct-08	0	1.1
21-Oct-08	0.2	1.1	28-Oct-08	0	1.1



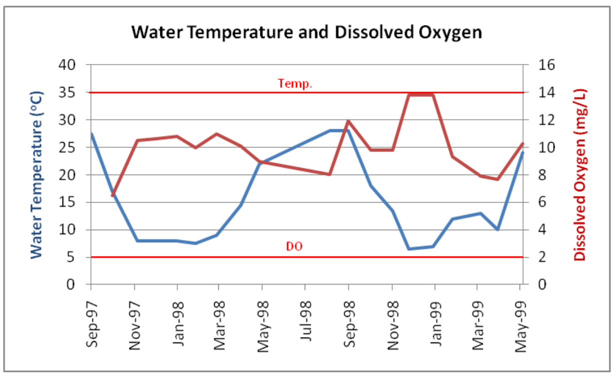


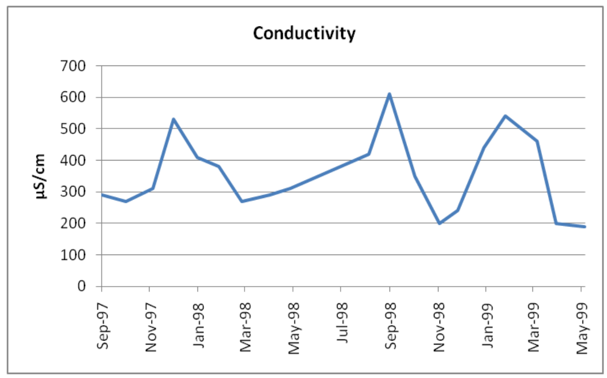


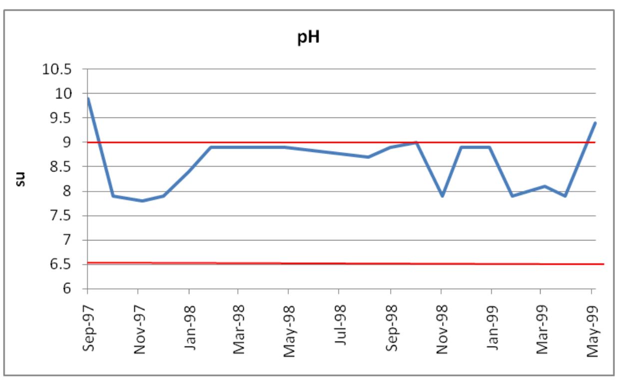


Data collected by: Tiffany Naylor, Jeffrey Jury, Milcah Ray, Ryan Fore, Jackie Brazille, and Kourtney Witt

Thompson Park Lake South						
Parameter	**#**	**% Complete**	**Min.**	**Mean.**	**Max.**	**Std. Dev.**
Sample Time	19	100	12:30	15:55	17:20	0:55
Total Depth (m)	19	100	0.1	0.27	0.4	0.07
Secchi Depth (m)	19	100	0.1	0.27	0.4	0.07
Water Temperature (^{o}C)	19	100	6.5	353	610	122.79
Specific Conductivity (µS/cm)	19	100	190	353.16	610	122.79
Dissolved Oxygen (mg/L)	19	100	6.5	10.04	13.8	1.91
pH (su)	19	100	7.8	8.58	9.9	0.60







The Secchi Depth and Total Depth graph is omitted because the values are identical.

Data collected by: Tiffany Naylor and Jeffery Jury

[i] Texas State Historical Association, *Canadian River*, 22 February 2010, available from http://www.tshaonline.org/handbook/online/articles/CC/rnc2.html, accessed April 7, 2010.

[ii] Texas Stream Team, *Canadian River Basin Report,* 2005, available from *http*://txstreamteam.rivers.txstate.edu/Data/Data-Reports/contentParagraph/0114/document/2005+Canadian+River+Basin+Report.pdf, accessed April 7, 2010.

[iii]Texas Parks and Wildlife, *Canadian River Basin,* n.d., available from http://www.tpwd.state.tx.us/business/grants/wildlife/cwcs/media/docs/rivers/canadian2.doc, accessed April 7, 2010.

[iv] ibid.