Texas Watch Volunteer Water Quality Monitoring Program
2006 Blunn Creek Watershed Data Summary

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. All sites have been sampled more than nine times within five-year periods as required by the Texas Commission on Environmental Quality (TCEQ).

In alignment with Texas Watch'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 Watch 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 Watch 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; 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.tnrcc.state.tx.us/water/quality/data/wmt/contract.html.

Currently, Texas Watch 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.

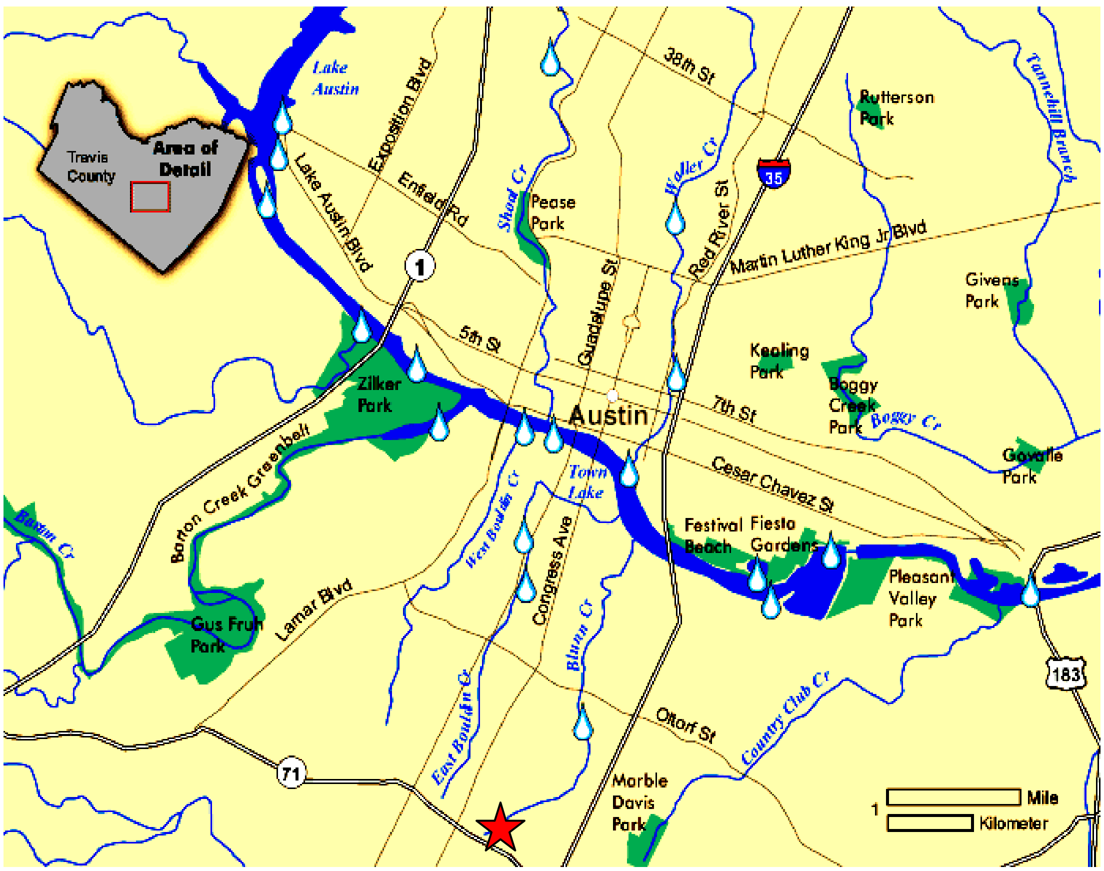
In general, Texas Watch efforts to use volunteer data may include the following:

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 Watch Data Viewer
8. Participate in professional coordinated monitoring processes to raise awareness of areas of concern

Information collected by Texas Watch 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: pH values were not transformed for graphing purposes or for developing mean statistics; 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

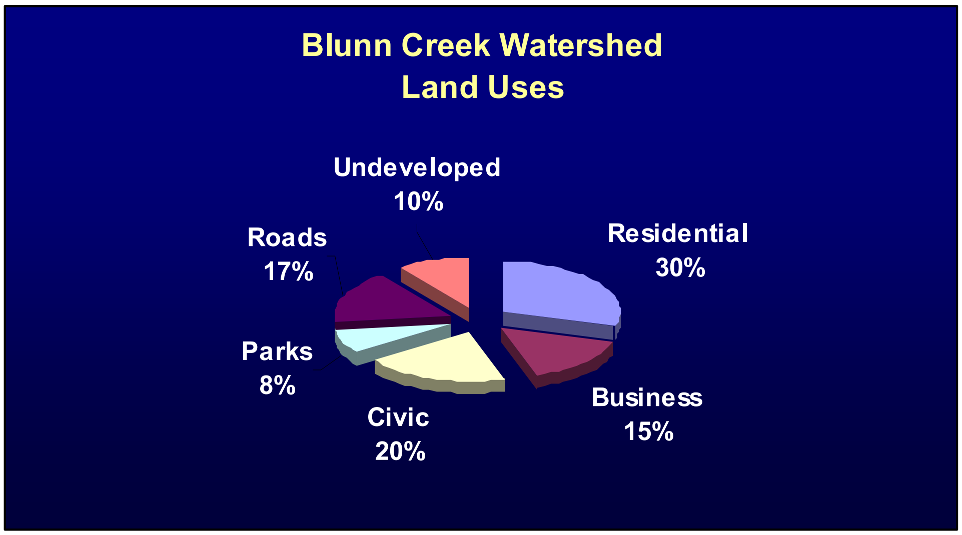
★ Indicates headwaters of Blunn Creek



Blunn Creek flows for 3 miles in south Austin beginning at St. Edwards University and draining into the Colorado River at Town Lake. The creek is fed by six springs and the drainage area is 1 square mile. The current population within the watershed is approximately 6,000 persons and is projected to reach 6,810 by the year 2030. Land uses surrounding the basin are predominantly residential with some business and a significant amount of impervious cover (see chart 1 below).

Overall, Blunn Creek has consistently seen better water quality than most urban creeks and it maintains good characteristics, such as stream habitat, aesthetics and recreational qualities. However, urbanization surrounding the creek has directly affected water quality. For example, nitrate levels in 2000 were considerably high for the entire year. Fecal coliform concentrations were above state standards in the year 2000 as well; and conductivity is often high throughout the creek (City of Austin – Watershed Protection Dept.). According to the City of Austin Master Watershed Protection Plan, pollution is predicted to increase 20% as existing undeveloped land is built upon. In addition, Blunn Creek usually dries up during the summer months despite the fact that spring flow from the nature preserve and discharge from Stacy Pool are constantly augmenting the creek's flow.

Chart 1. Types and percentages of land use within the watershed



DATA ASSESSMENT

All data included in this report was collected and analyzed by volunteer monitors. In this report, four sets of data are looked at and compared along the 3 mile course of Blunn Creek. All sites are consistently listed in order from the headwaters moving downstream to the creek's confluence at Town Lake. The following tables show a summary of the data used for this report:

Table 1. Identification and descriptions of monitoring sites used for this report

Monitoring Sites Used	
Site I.D. #	**Site Description**
15884	Blunn Creek at Woodward Street (headwaters)
16102	Blunn Creek at springs downstream of Woodward Street
15882	Blunn Creek in Blunn Creek Nature Preserve, 1,000 ft upstream of Oltorf Street
15885	Blunn Creek at Little Stacey Park, ¼ mile downstream from East Monroe Street

Table 2. Summary of descriptive statistics for the monitoring site located at the headwaters of Blunn Creek

Blunn Creek at Woodward Street – Austin, TX					
Site I.D. # 15884					
	# of samples	**% complete**	**Mean**	**Min**	**Max**
Conductivity (µS/cm)	12	100	604	110	750
pH (su)	12	100	7.5	6.9	8.0
Water Temperature (˚C)	12	100	23.2	9.0	32.7
Air Temperature (˚C)	12	100	24.6	9.5	31.0
Dissolved Oxygen (mg/L)	12	100	5.5	1.1	10.2
Dissolved oxygen exceedence [<6.0 mg/L] 6 out of 12 **50%**					

Table 3. Summary of descriptive statistics for the monitoring site located downstream of Woodward Street

Blunn Creek at Springs - Austin, TX					
Site I.D. # 16102					
	# of samples	**% complete**	**Mean**	**Min**	**Max**
Conductivity (µS/cm)	15	100	633	410	710
pH (su)	15	100	7.8	7.5	8.0
Water Temperature (˚C)	15	100	20.3	12.5	27.0
Air Temperature (˚C)	15	100	20.3	4.5	29.0
Dissolved Oxygen (mg/L)	15	94	8.2	1.4	12.7
Dissolved oxygen exceedence [<6.0 mg/L] 3 out of 15 **20%**					

Table 4. Summary of descriptive statistics for the Blunn Creek Nature Preserve monitoring site

Blunn Creek at Nature Preserve – Austin, TX					
Site I.D. # 15882					
	# of samples	**% complete**	**Mean**	**Min**	**Max**
Conductivity (µS/cm)	72	100	658	240	870
pH (su)	72	100	7.7	7.1	8.8
Water Temperature (˚C)	72	100	19.7	7.1	29.0
Air Temperature (˚C)	72	100	23.1	9.5	35.5
Dissolved Oxygen (mg/L)	70	97	7.5	3.1	13.2
Dissolved oxygen exceedence [<6.0 mg/L] 14 out of 70 **20%**					

Table 5. Summary of descriptive statistics for the most downstream monitoring site

Blunn Creek at Little Stacey Park – Austin, TX					
Site I.D. # 15885					
	# of samples	**% complete**	**Mean**	**Min**	**Max**
Conductivity (µS/cm)	21	100	707	400	1500
pH (su)	21	100	7.6	7.1	7.9
Water Temperature (˚C)	21	100	22.9	13.5	27.0
Air Temperature (˚C)	21	100	24.4	14.5	32.0
Dissolved Oxygen (mg/L)	21	100	5.1	2.2	7.4
Dissolved oxygen exceedence [<6.0 mg/L] 10 out of 21 **47.6%**					

The subsequent information summarizes each water quality parameter collected and its significance to surface water quality. Data collected by Texas Watch monitors include: pH, specific conductivity, water and air temperature, dissolved oxygen, total depth, and secchi depth. Each parameter is followed by a set of graphs illustrating trends, exceedences and relationships within the data. Note: Secchi depth and total depth values are not available for this water body; pH values were not transformed for graphing purposes or for developing mean statistics; 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.

DATA ANALYSIS

Specific Conductivity

Conductivity is a measure of how well water can conduct electrical currents. It is measured in micro Siemens per centimeter (µS/cm). When dissolved solids, such as chloride, sulfate, nitrate, phosphate, sodium, magnesium, calcium and iron, are present in water, the conductivity increases. The breakdown of these ionic compounds allows the water to conduct electricity because positive and negative charges exist between the particles (ions). Factors causing a variation in conductivity levels include: geology and soils of the watershed; mine tailings; and runoff from roads and/or agricultural lands. Also important to consider is the amount of rainfall affecting the stream. During dry periods, when less water is present, the concentration of ions in the water increase, thus increasing the conductivity.

Chart 1. 1997-1998 Conductivity levels for site at headwaters

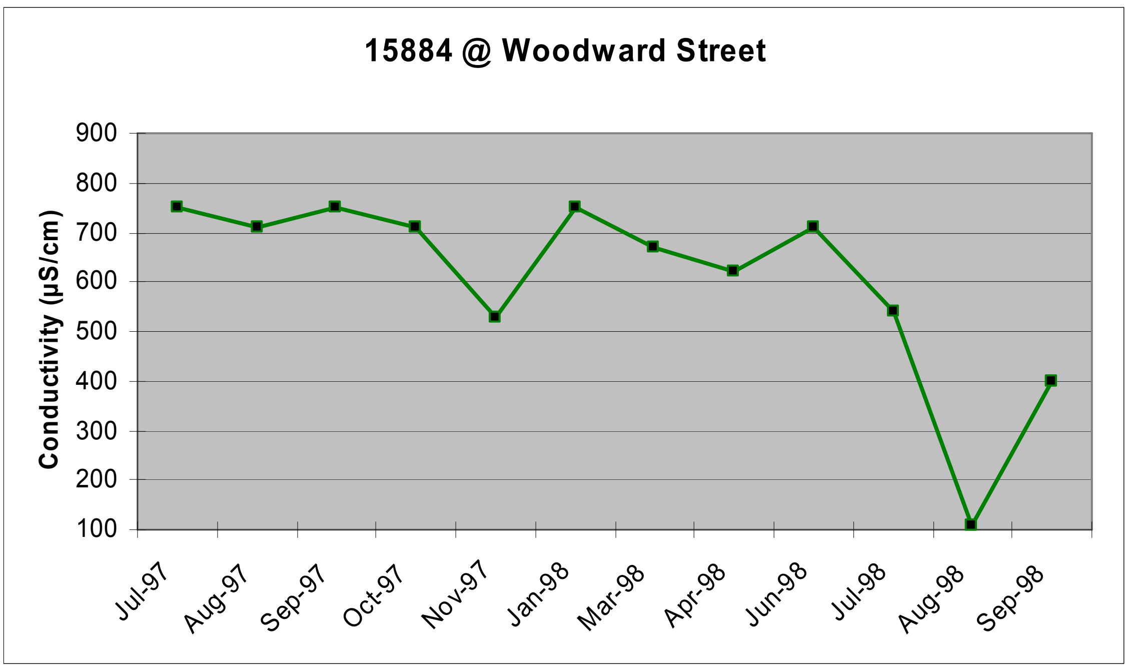


Chart 2. 1997-1998 Conductivity levels for Blunn Creek at the springs

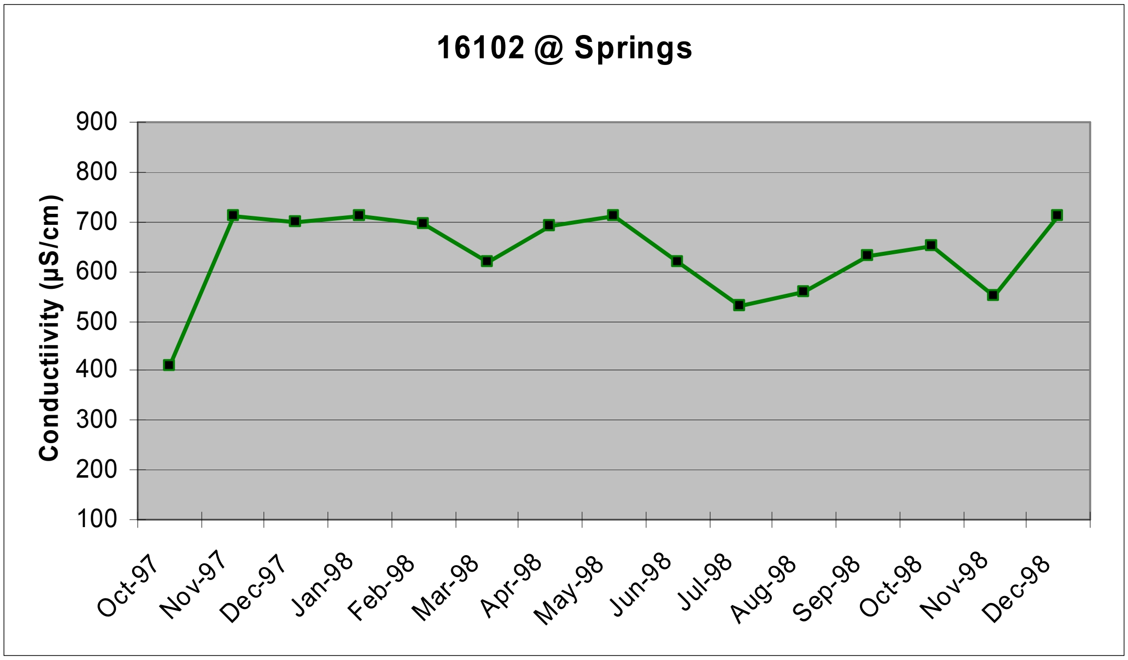


Chart 3. 1996-1997 Conductivity levels for monitoring site at the Blunn Creek Nature Preserve

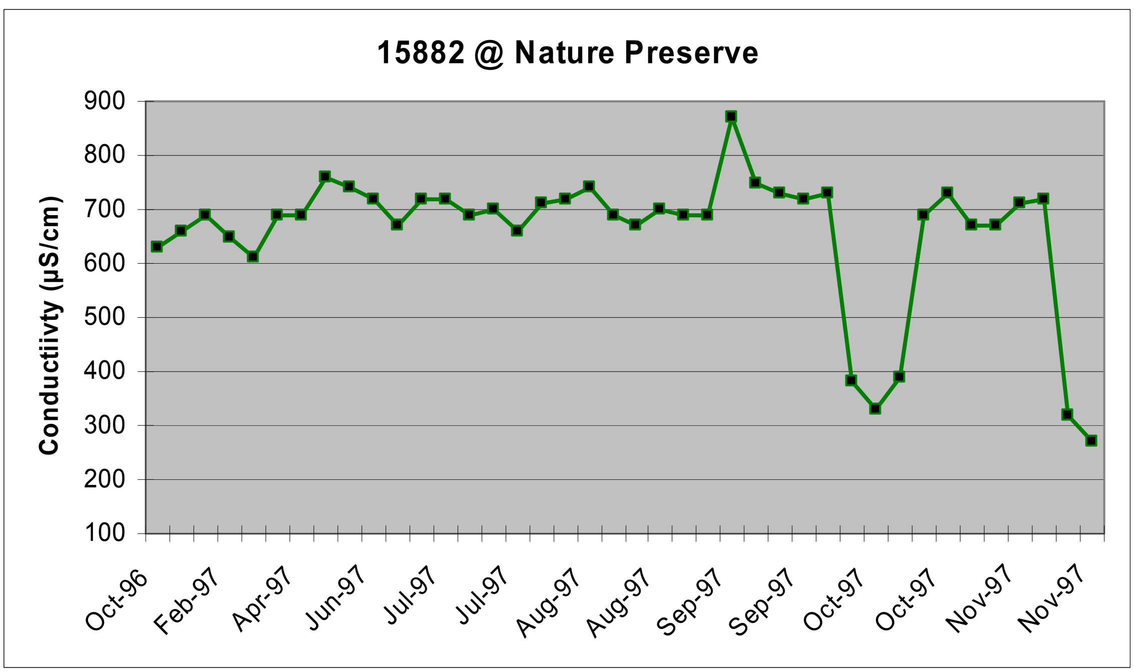


Chart 4. 2005-2006 Conductivity levels for monitoring site at Blunn Creek Nature Preserve

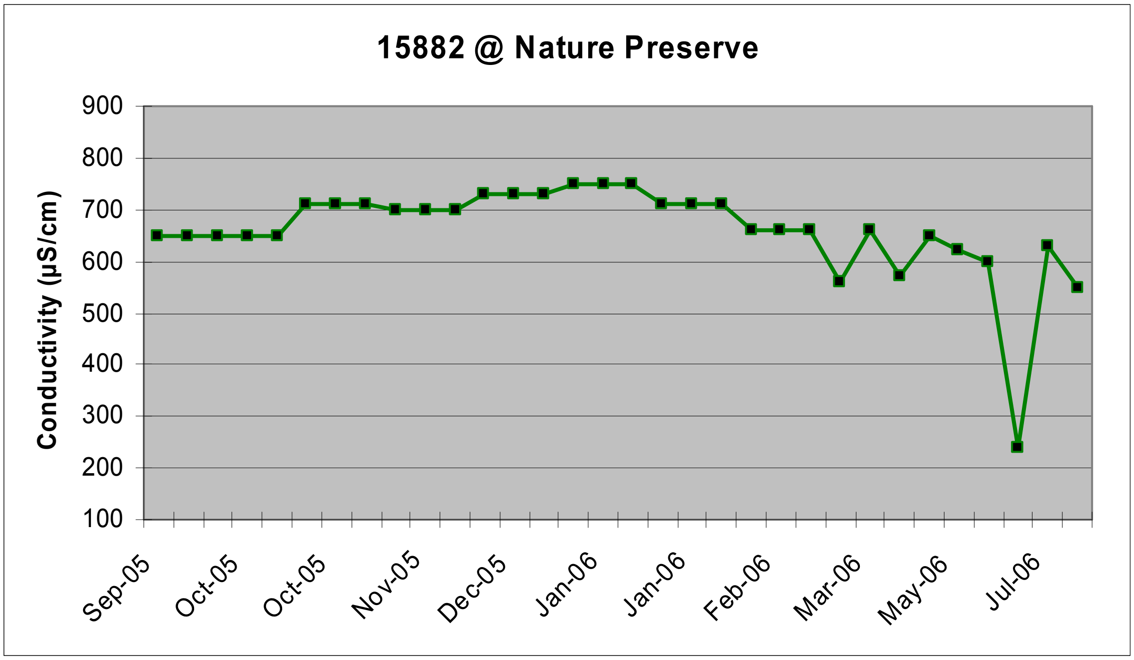


Chart 5. 1997-1998 conductivity levels from monitoring site at Little Stacy Park

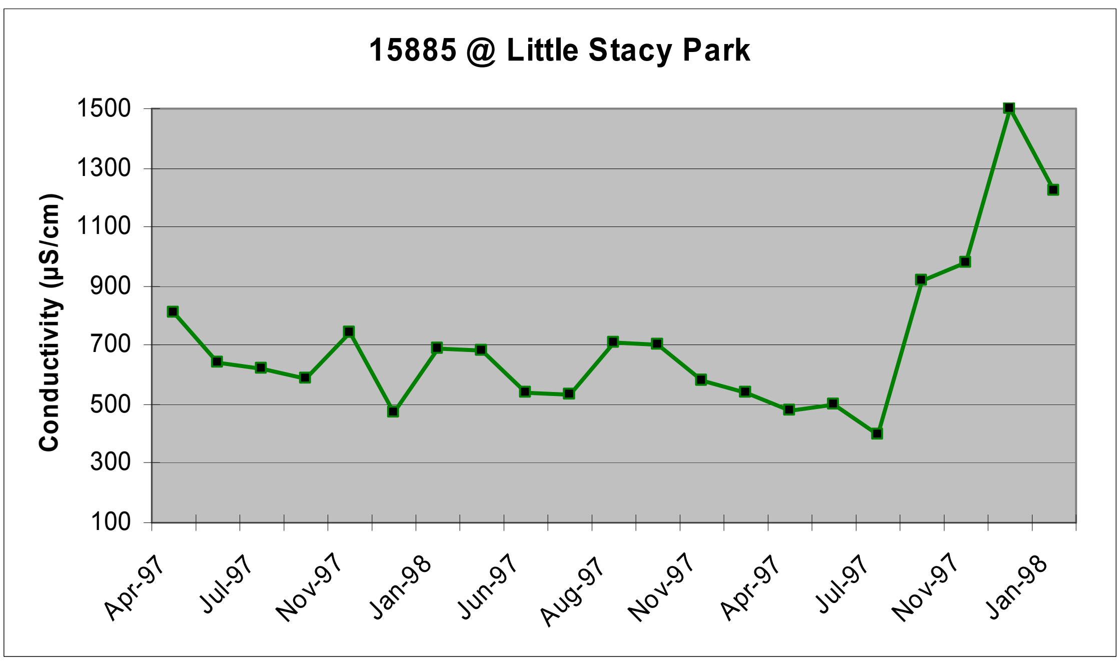
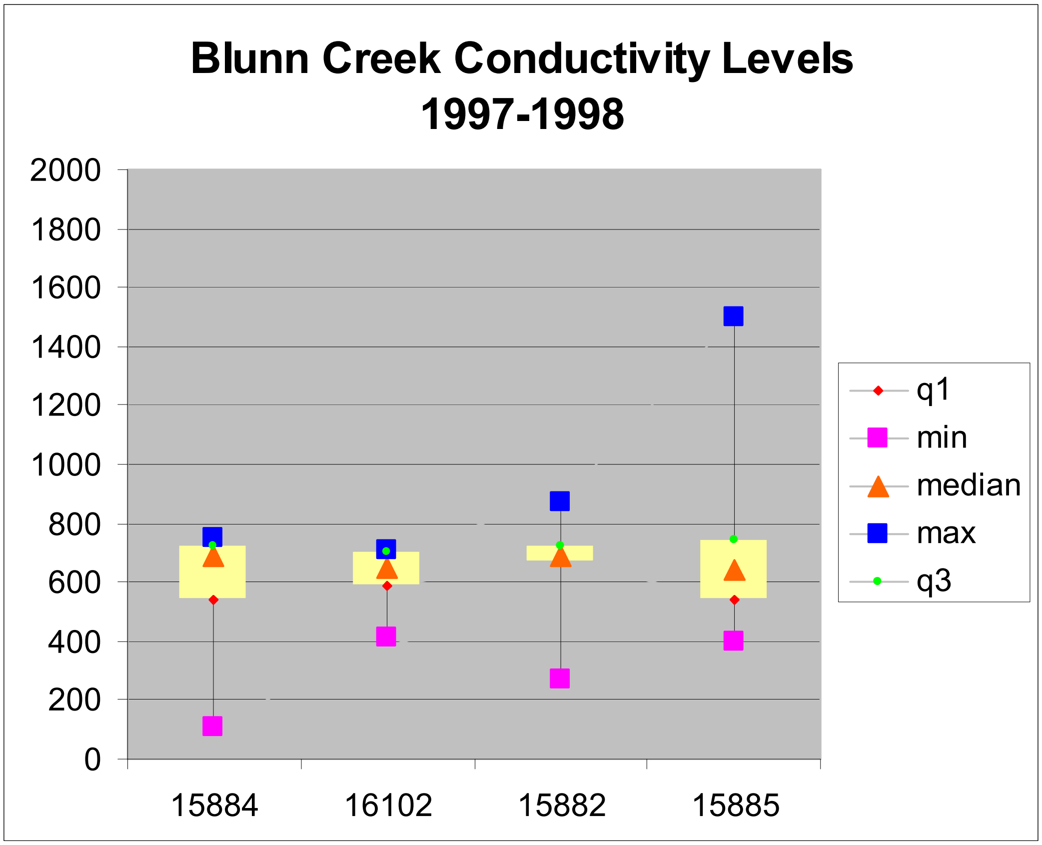


Chart 6. Comparison of all 1997-1998 conductivity levels including minimum, maximum and median values



Conductivity throughout the watershed averages around 600 to 700 µS/cm; however, the values range from 100 to 1500. These wide variances in conductivity don't follow any specific trend according to climate or season. Furthermore, the normal trend for conductivity in a spring fed stream is decreasing over time and distance from the source. Thus, the box and whisker plot above should show a decrease in conductivity averages from one location to the next as the water moves downstream away from it spring-fed source. This pattern is not evident in the boxplot; therefore, this is an indication of pollution occurring somewhere downstream from the headwaters of Blunn Creek.

pH

PH measures the concentration of hydrogen ions in water. Fluctuations in pH are a result of algal photosynthetic processes, the concentration of carbon dioxide in the water, the geology of the watershed and air pollution. Generally, pH levels decrease during the night and increase during daylight hours when photosynthesis peaks within the plants due to sunlight. Correspondingly, dissolved carbon dioxide (CO_2), which has lower concentrations during the day, forms a weak acid changing the pH of the system. Furthermore, acidic and alkaline compounds from different types of rock and soil release minerals into the surrounding water, that also affect the pH of a water body. Lastly, air pollution from car exhaust and power plant emissions increase the concentrations of nitrates (NO3) and sulfides (SO2) in the air that react with the atmosphere and rain to form acids. When it rains, these acidic compounds combine with moisture in the air and fall into our streams and lakes.

Chart 7. 1997-1998 pH values for site at headwaters

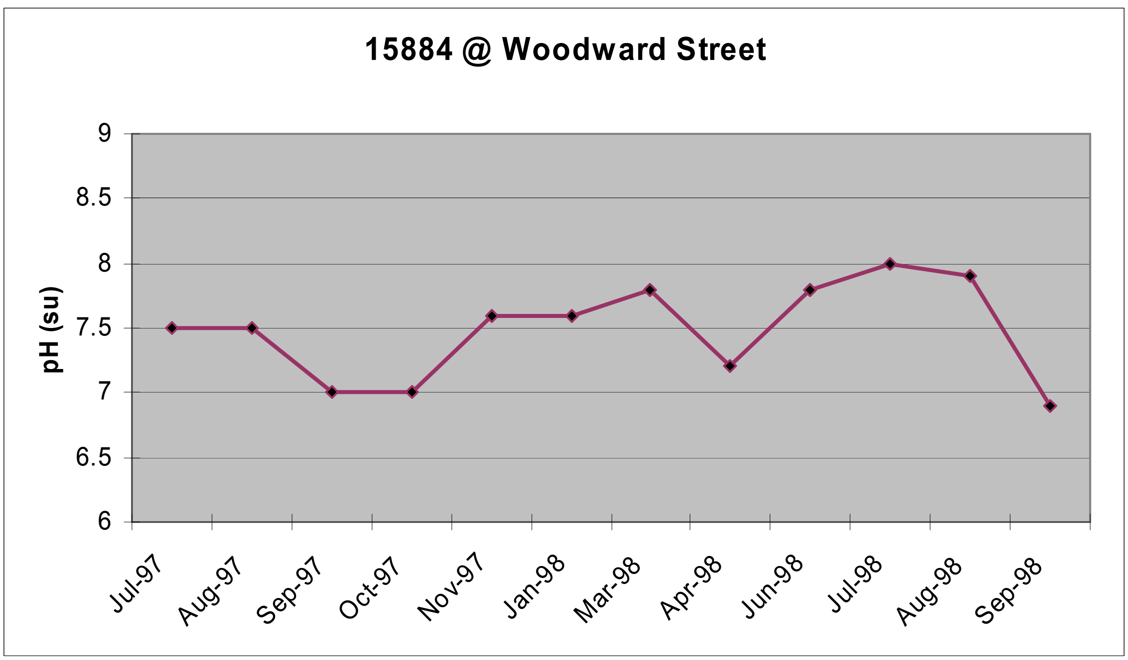


Chart 8. 1997-1998 pH values for monitoring site located at the springs

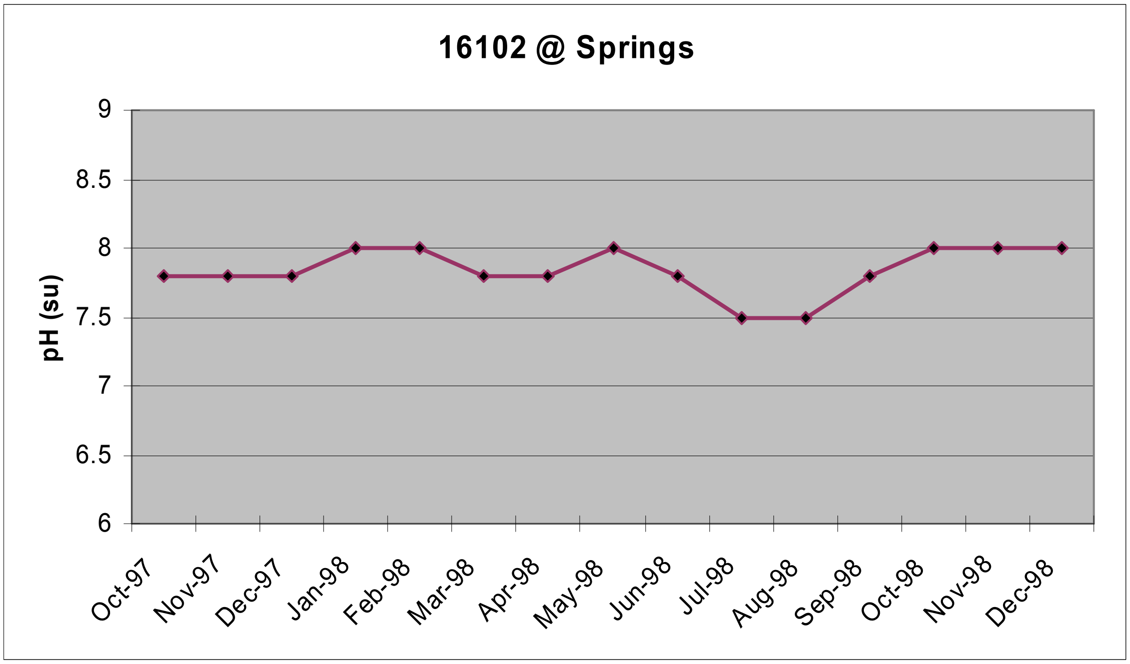


Chart 9. 1996-1997 pH values from Blunn Creek Nature Preserve

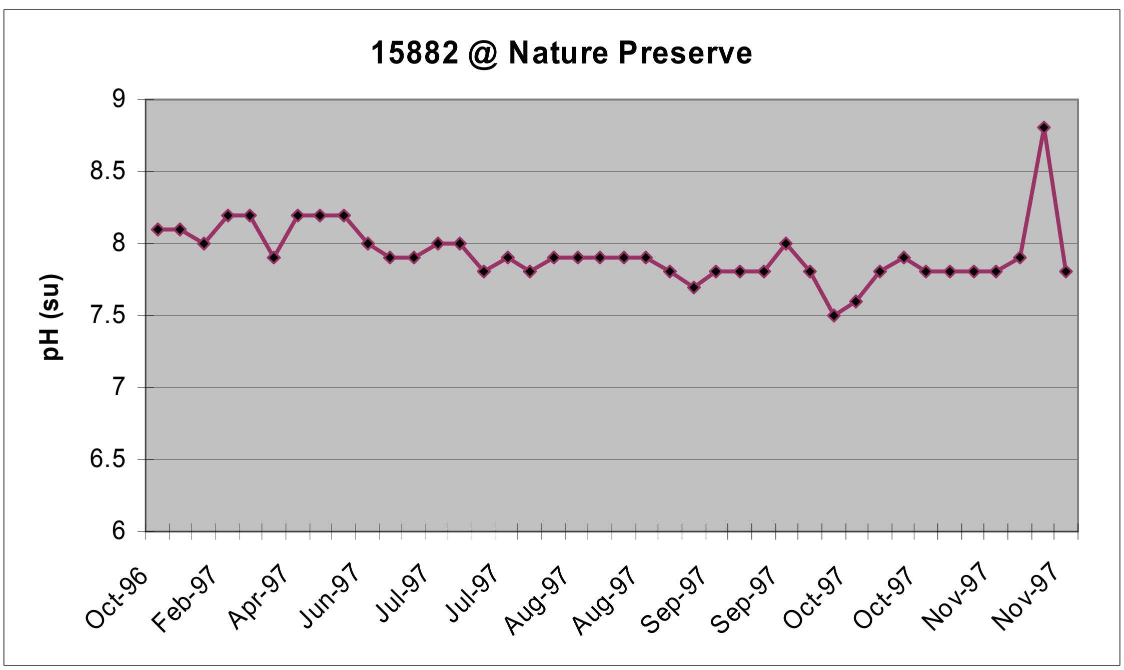


Chart 10. 2005-2006 pH values from Blunn Creek Nature Preserve

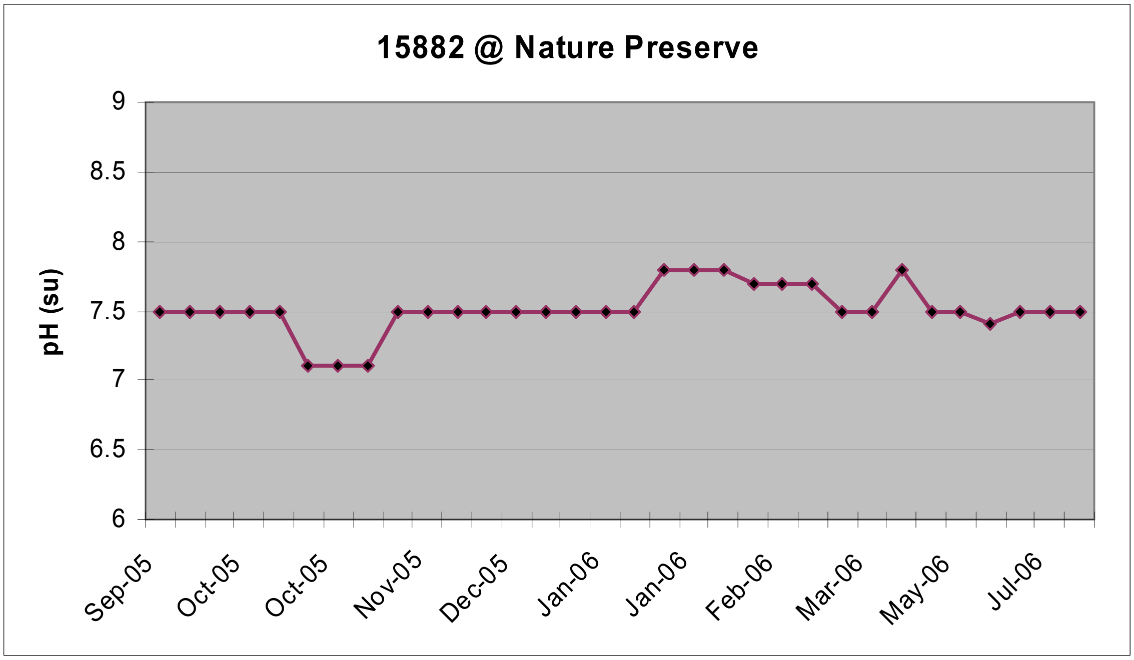
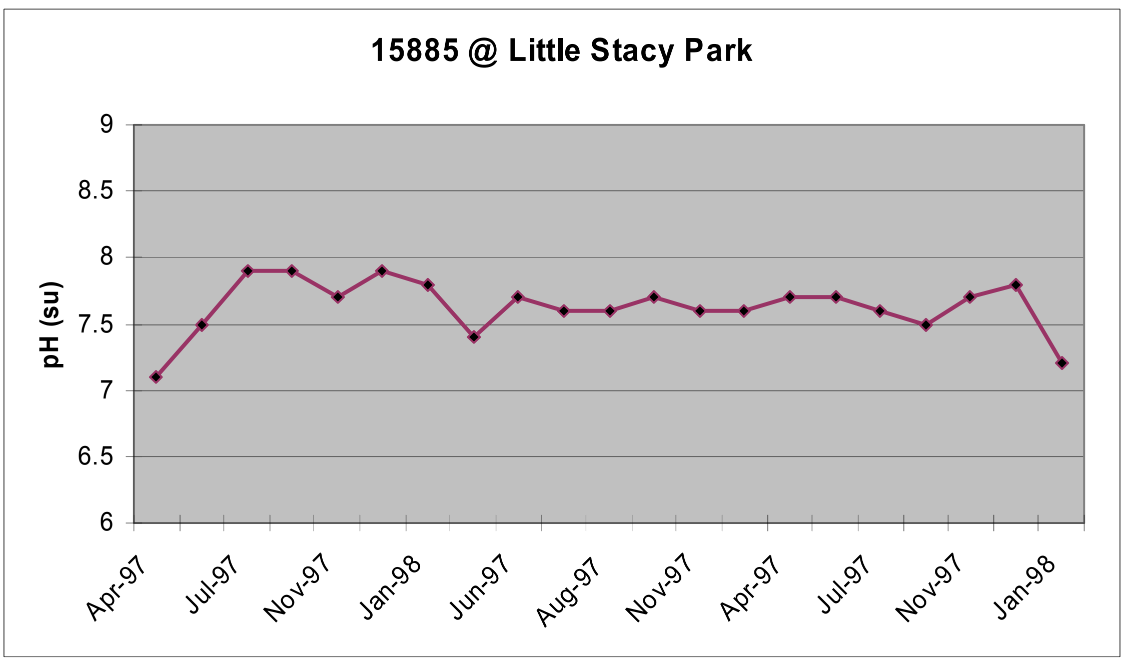


Chart 11. 1997-1998 pH values from Little Stacy Park



Average pH found in Blunn Creek is near 7.5, which is quite normal for a spring fed stream. Total values from the entire watershed range from 6.9 to 8.8. The fluctuations in pH are a result of small diurnal patterns and rain events.

Water Temperature

Water temperature is measured in degrees Celsius (˚C). Variations in temperature can result from air temperature changes that occur diurnally and seasonally. Furthermore, water temperature is affected by runoff from impervious cover, flow rates, and riparian vegetation. Greater amounts of impervious cover, less flow and less vegetation all cause the water temperature to increase.

The range of values for water temperature (7.1˚C to 32.7˚C) in Blunn Creek is quite large; however, normal due to seasonal changes and differences in air temperature. The average water temperature for the creek is about 23˚C.

Dissolved Oxygen

Dissolved oxygen (DO) is an important indicator of the water body's overall ability to support aquatic life. DO are microscopic bubbles found in water and are measured in mg/L. Fish breathe by absorbing this dissolved oxygen, so a certain level of it is necessary in order to support aquatic life. Oxygen enters the water by aeration and plant photosynthesis and leaves the system by respiration and decomposition of organic matter. Characteristics of the water body affecting dissolved oxygen include: velocity of water flow; climate/season; variety of organisms in the water; dissolved solids; and the amount of nutrients in the water. In addition, dissolved oxygen has an inversely proportionate relationship with water temperature. This is because more oxygen can be dissolved in colder water. The red line on the following charts indicates the dissolved oxygen exceedence of less than 6.0 mg/L, the amount needed for a fully supporting water body according to the designated aquatic life use.

Chart 12. Relationship between water temperature and dissolved oxygen for data collected at headwaters from 1997 to 1998

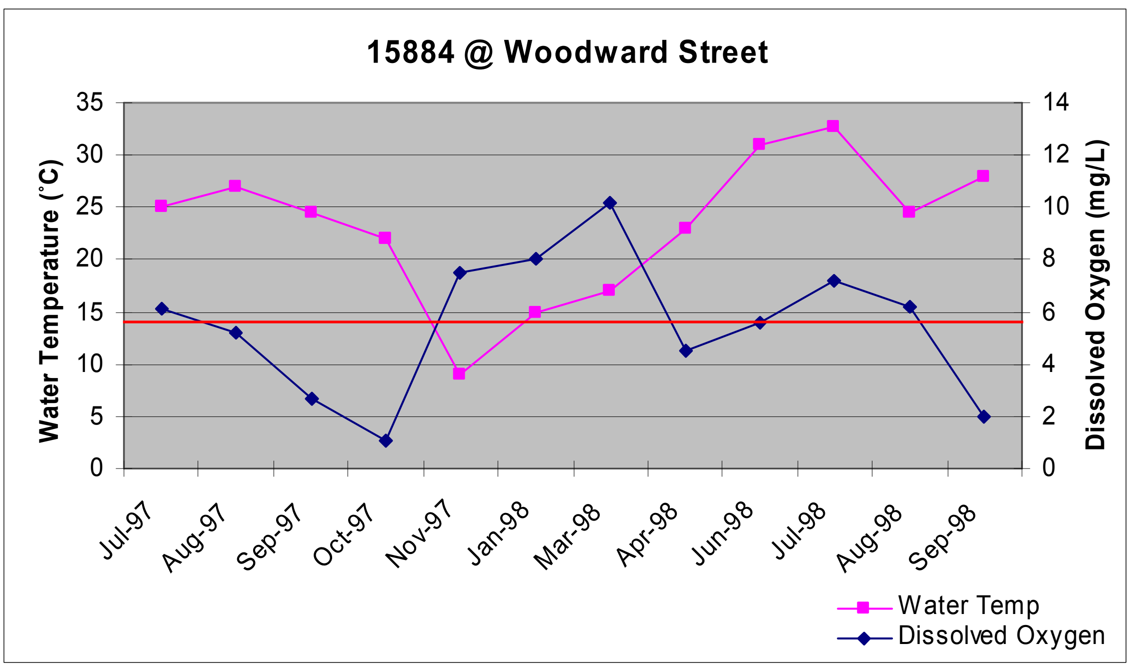


Chart 13. Relationship between water temperature and dissolved oxygen for data collected at the springs from 1997 to 1998

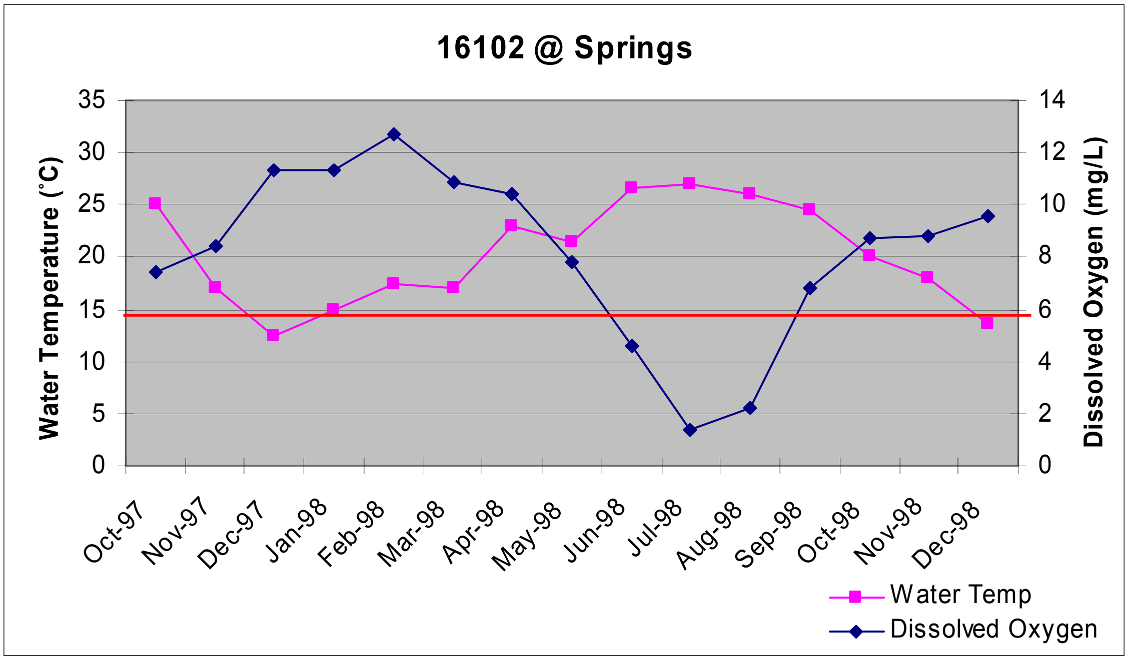


Chart 14. Relationship between water temperature and dissolved oxygen for Blunn Creek Nature Preserve location 1996-1997

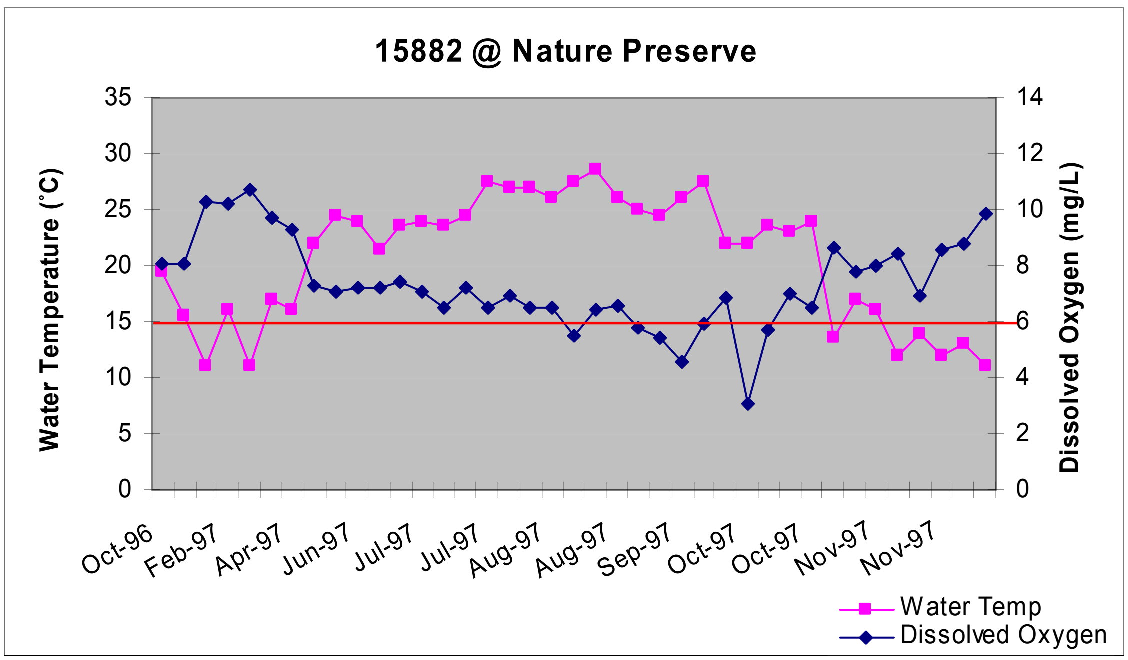


Chart 15. Relationship between water temperature and dissolved oxygen for Blunn Creek Nature Preserve location 2005-2006

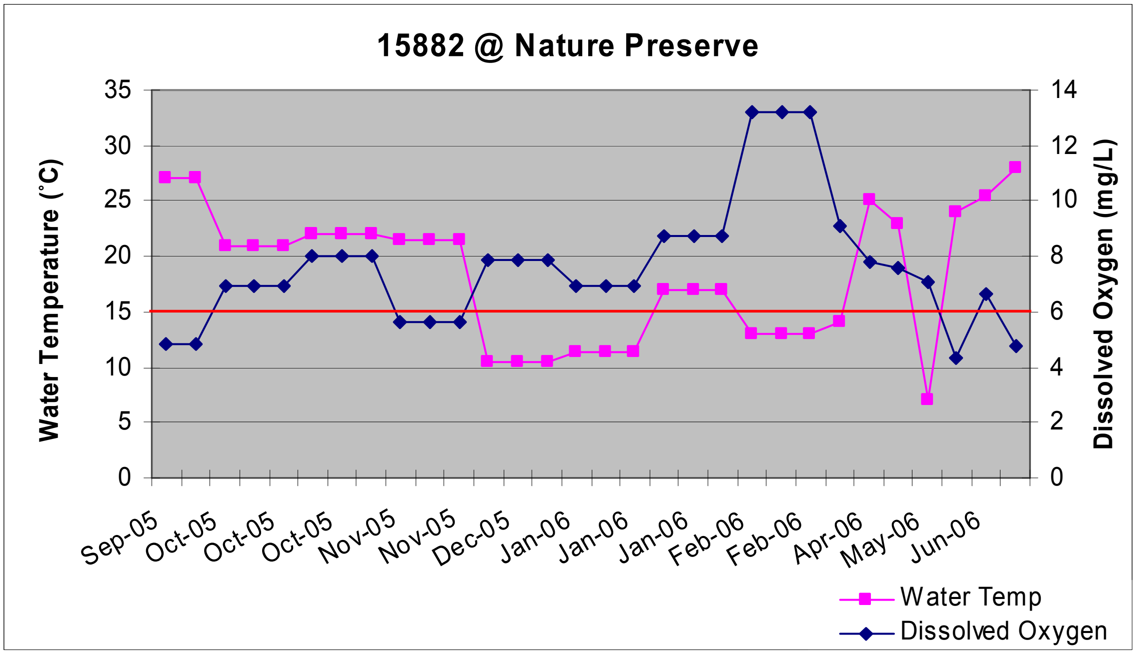
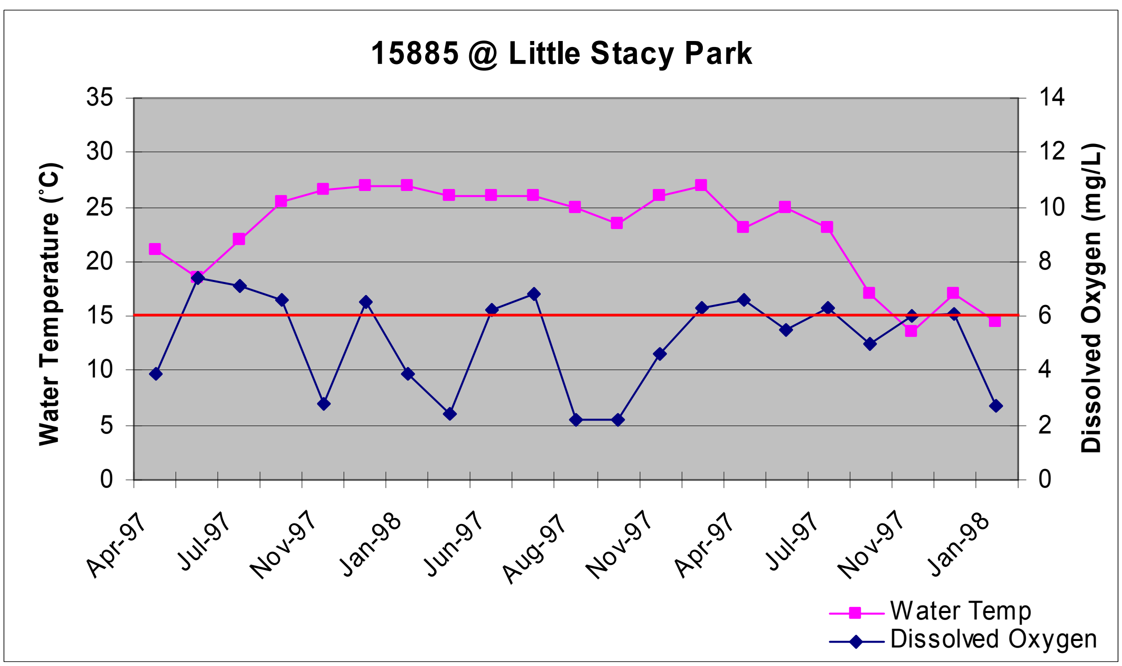


Chart 16. Relationship between water temperature and dissolved oxygen for Little Stacy Park location 1997-1998



Average dissolved oxygen values for the watershed are quite scattered, ranging from 5.1 to 8.2 mg/L. The total range of all measurements is as low as 1.1 and as high as 13.2 mg/L. More importantly, all four monitoring site have a significant amount of dissolved oxygen exceedences. Exceedence percentages starting at the headwaters and moving downstream are 50%, 20%, 20% and 47.6% respectively. These are all critical numbers that indicate concern for aquatic life use.

DATA SUMMARY

The two greatest indicators of water pollution in Blunn Creek are low dissolved oxygen (DO) levels and high specific conductivity. Because the charts do not show a high correlation between dissolved oxygen and water temperature, it is possible that other elements are affecting the amounts of DO in the stream. One explanation is due to the runoff from roads and impervious cover that contributes salts and suspended sediments into the waterbody. Salinity and dissolved/suspended solids reduce the solubility of oxygen in water. Another factor that may reduce dissolved oxygen is excess organic waste. Organic wastes that enter the waterbody may include leaves, grass clippings, fecal matter and sewage. When an abundance of organic matter exists in a stream, it provides a feeding ground for bacteria. Breathing by extreme amounts of bacteria will rapidly decrease the DO in a waterbody. Lastly, there is the process of eutrophication. This is a result of high amounts of nutrients in the water, such as nitrate (NO_3) and phosphate (PO_4), both of which are found in fertilizer. These nutrients are much like the organic matter; they are food for algae. High amounts of nutrients can produce large quantities of algae and dead algae are a favorite food for the bacteria that use up the oxygen.

Runoff from fertilizers and roadways also increases the conductivity of water. Leaky automobile fluids, nutrients from fertilizers and the chemical composition of the surrounding geology of the creek are all examples that may contribute to high conductivity within the watershed. When the water comes up through the springs and enters the creek, it has a high concentration of ions in it from the dissolution of $CaCO_3$ found in the aquifer limestone. Because of this, we usually see higher conductivity levels at the headwaters that steadily decrease downstream. As seen on Chart 6, this is not the case. An explanation for this pattern may be the addition of nitrate, phosphate and oils in the creek that further increases the number of ions in the water.

In conclusion, evidence of human impact and pollution can be seen in the water quality of Blunn Creek. With the current land uses surrounding the creek and the further development projected over the next 25 years, the quality of the water faces many challenges. Nonpoint source pollution is the greatest factor contributing to these challenges. In addition, the mean dissolved oxygen levels at the headwaters and at Little Stacy Park are not sufficient to meet the TCEQ standards for fully supporting of aquatic life use. Furthermore, because Blunn Creek only flows a mere 3 miles before joining the Colorado River, it has the potential of affecting the water quality of Town Lake and the Colorado River as well.