

**Essential School Stream Keeper  
Essential School at Albany High  
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Janel Lange**

**Abstract:**

The Patroon Creek flows through industrial and residential areas in the City of Albany that pose potential threats to the water quality such as sewer overflows, pollution discharge, and polluted runoffs. Physical and chemical assessments were performed near the origin, midstream, and near the mouth to determine the profile of the stream. This data was then compared to previous years. High levels of alkalinity and nitrates were found throughout the stream. This data suggests poor water quality and an overall impacted stream. Additional studies are needed to determine the exact source but possibilities include construction, pollution and sewage. It is hopeful that this watershed will one day be a recreational area, but much clean up is needed.

## **Introduction & Background:**

This is Essential School's fifth year monitoring water quality of Patroon Creek. The focus is on scientific monitoring, restoration, and protection of this creek so that the neighboring communities can someday use it for recreational purposes. Recreational uses include swimming and fishing by the community. Restoration of this creek will be a value to aquatic life habitat, wildlife habitat, and provide scenic quality to the area. Threats and problems posed to this creek include combined sewer overflows, pollution discharges, and polluted runoffs. Patroon Creek is a Class C river. Class C: fishing, fish propagation and survival (aquatic life), can be suitable for contact recreation, but may be limited. In other words people can fish and fish and other aquatic life (bugs and larva) can survive.

Patroon Creek starts at our upstream sampling site at the Pine Bush Preserve, site 3, where it flows above ground to the Everett Road overpass. From there on it travels underground to Tivoli Lake Recreation Area next to Livingston Middle School. This is our midstream sampling site, site 2. Site 1 is at the top of Tivoli St. under Interstate 90. At Pleasant St. and Broadway it goes underground and resurfaces near the Corning Preserve into the Hudson River.

In the past we have been able to do BMI's. Due to the rapid flow of the stream this year we were unable to collect bug samples for testing. In 1993-1994 the stream was severely impacted. The DEC in 1995 labeled Patroon Creek as very poor because the IBI score (Index of Biotic Integrity) was very low (14), therefore the city made repairs. In 1997-1999 the stream was moderately impacted. In 1999 DEC found Ecoli Coliform,

therefore DEC took legal action. In 2000 the stream was moderately impacted again. In 2001 we found a large amount of T. Coli and E. Coli at all three sites.

### **Results:**

Figure 1 shows fall collection data for site 1 on Tivoli St. The dissolved oxygen levels are well above the standards for all three years ranging from 9-10 mg/L. The pH levels are right around the standard at about 7. Ortho-phosphate has no standard and for all three years the value was less than 1 mg/L. Nitrate has a standard of 1 mg/L and for all three years, the levels were right around that value. The air and water temperature for fall of 2000 were both at 5°C. The air and water temperature for fall 2002 were around 14°C. There was no air and water temperature data collected in the fall of 2001.

Figure 2 shows fall collection of data for Tivoli Lake, site 2. The dissolved oxygen standard is 4 mg/L. The results in 2000 were 12.13 mg/L, 2001 were 9 mg/L, and 2002 were 9.5mg/L. The pH levels are right around the 7.5 standard ranging from 6.5 to 8.5. There is no standard for ortho-phosphate but the results were less than 1 mg/L for all three years. The standard for nitrate in 1 mg/L and all three years were less than 1 mg/L. The air and water temperature for 2000 were around 8°C. In 2001 the air temperature was 18°C and the water temperature was 15.5°C. In 2002 the air and water temperature were both around 15°C.

Figure 3 shows fall collection of data for site 3, Rensselaer Lake Pine Bush Preserve. The dissolved oxygen levels are well above the 4 mg/L standard, ranging from 11 mg/L in 2000 to 8 mg/L in 2001. The pH standards are neutral at 7.5. In 2000 it above the standard at 8 and in 2001 it was around the standard at 7.6. Ortho-phosphate levels are 0 mg/L for 2000 and 2002 (we didn't visit site 3 for 2002). There is no standard

for ortho-phosphate. The nitrate level for 2000 was 1.32 mg/L and in 2001 was 1 mg/L, which is a little above and right at the standard of 1 mg/L. The air temperature in 2000 was 5°C and the water was 8°C. In 2001 the air temperature was 18.3°C and we did not collect the water temperature.

Figure 4 shows the spring collection of data for Tivoli Street, site 1. The dissolved oxygen standard is 4 mg/L and the levels for all three years are well above the standard (2000, 10.6mg/L; 2001, 8mg/L; 2002, 10.4mg/L). The pH levels are above the standard (7.5) for all three years (2000, 8.5; 2001, 8; 2002, 8.1). The ortho-phosphate levels were below 1 mg/L all three years and there is no standard. Nitrate for 2000 was 0.1 mg/L, 2001 was 1 mg/L and 2002 was 1.9 mg/L and the standard is 1 mg/L. The air temperature for 2000 was 4°C, for 2001 was 24°C, and for 2002 was 12°C. The water temperature for 2000 was 3°C, for 2001 was 12°C, and for 2002 was 10°C.

Figure 5 shows the spring collection of data for Tivoli Lake, site 2. The dissolved oxygen standard is 4 mg/L, the levels for 2000 was 11.25 mg/L, for 2001 was 9 mg/L, and for 10.9 mg/L. The pH levels are above the standard of 7.5, (2000, 7.75; 2001, 8.18; 2002, 7.9). The ortho-phosphate levels were below 1 mg/L for all three years. Nitrate for 2000 was 1 mg/L, for 2001 was 1.4 mg/L, and for 2002 was 1.1 mg/l. The standard is 1 mg/L. The air temperature for 2000 was 5°C, for 2001 was 9.5°C, and for 2002 was 13°C. The water temperature for 2000 was 14°C, and 2001 and 2002 were both at 12°C.

Figure 6 shows the spring collection of data for Rensselaer Lake Pine Bush Preserve, site 3. The dissolved oxygen for 2001 was 6.2 mg/L, for 2002 was 9.8 mg/L, and the standard is 4 mg/L. The pH for 2001 was 7.75, for 2002 was 7.9 and the standard is 7.5. The ortho-phosphate for 2001 was 0 mg/L, for 2002 was 0.07 mg/L and there is no

standard. Nitrate for 2001 was 0.2 mg/L, for 2002 was 0 mg/L and the standard is 1 mg/L. The air temperature for 2001 is 23°C, and for 2002 was 15°C. The water temperature for 2001 was 12°C and for 2002 was 15°C.

Figure 7 shows the alkalinity for all three years (spring and fall), and for all three sites. The standard for alkalinity is within the range from 10 to 20 mg/L. In the fall 2000 all three sites tested 0 mg/L. For the spring of 2000, site 1 was 160 mg/L, site 2 was 180 mg/L and site 3 was 0 mg/L. In the fall of 2001 site 1 was 0 mg/L, site 2 was 200 mg/L, and site 3 was 222 mg/L. In the spring of 2001, site 1 was 230 mg/L, site 2 was 270 mg/L and site 3 was 0 mg/L. In the fall of 2002 site 1 was 84 mg/L, site 2 was 83 mg/L, and we did not collect data for site 3. Spring 2002 data for site 1 was 212 mg/L, site 2 was 203 mg/L, and site 3 was 193 mg/L.

### **Discussion:**

Dissolved oxygen is a measure of the concentration of oxygen gas that is dissolved in the water. A highly dissolved oxygen level in a stream ecosystem is considered healthy and capable of supporting a diversity of organisms. The most oxygen that can be dissolved in water is 14 mg/L. Patroon creek at all three sites in all three years that data was collected indicates a healthy stream based on the dissolved oxygen levels being well above the standards in the fall and spring seasons (figures 1,2,3,4,5,and 6).

pH is a measure of the acidity of a solution. Many fish and invertebrates are sensitive to high (above 8.6) and low (below 6.50) pH levels. The standard is in the middle of the range at 7.5. The fall data is well within the range for all three years at all three sites ranging from 7.4 to 8.3 (figures 1, 2, and 3). In the fall of 2000, the three sites were a bit on the basic side of the scale around 8. The pH levels in the spring at site 1 for

all three years (figure 4) were a bit more basic than the rest of the sites ranging from 8 to 8.5, but still within range. Site 2 and site 3 for all three years were well within range, 7.75 to 8.18, but still a little on the basic side (figures 5 and 6).

In aquatic ecosystems, phosphorus occurs mainly in the form of phosphate ( $\text{PO}_4$ )<sub>3</sub>. Phosphates are a plant nutrient found in phosphate containing rocks, soil, and animal wastes. High levels of phosphates can also be found in detergents, cattle feedlot runoff, and human sewage effluent. Usually phosphate is in short supply and therefore limits the growth of plants. Any human addition of phosphorus can cause great increases in aquatic plant growth which may result in higher water temperatures, unstable dissolved oxygen, changes in habitat and ultimately a decrease in aquatic life. In the fall collection data for all three sites, for all three years (figures 1, 2, and 3), the ortho-phosphate levels are very low, less than 1 mg/L, which indicates a healthy stream with low human addition. The spring data collected also had very low level of ortho-phosphate at all three sites in all three years with less than 1 mg/L indicating healthy levels (figures 4, 5, and 6).

Nitrate ( $\text{NO}_3$ ) is the form of nitrogen that is an essential nutrient for plants and animals as a building block for proteins. They are found naturally in unpolluted streams and ponds due to the process of plant and animal growth and decay. Excess nitrates can cause great increases in plant growth and adversely affect the health of aquatic animals and humans. Some effects include: unstable dissolved oxygen, higher water temperatures, and changes in habitat. The standard for nitrates is less than 1 mg/L (figures 1,2,3,4,5, and 6). In the fall of 2000, the stream's nitrate levels were a bit above the standard with site 1 and site 3 having 1.32 mg/L of nitrate. Site 2 was a bit below the standard at 0.88 mg/L of nitrates. The nitrate levels in the spring varied from year to year

and site to site. In the spring of 2000, at site 1 the level was at 0.1 mg/L, at site 2 the level was 1 mg/L, which is just at the standard. Therefore the se levels indicate a healthy stream. In the spring of 2001, the nitrate levels varied from site to site with site 1 at 1 mg/L, site 2 at 1.4 mg/L and site 3 with 0.2 mg/L. So midstream levels were a little high, but not high enough to make a significant difference. In the spring of 2002, the nitrate levels decreased from site 1 (1.9 mg/L) to site 3 (0 mg/L). The stream became more impacted as if flowed from the Pine Bush Preserve into the Hudson River. This is due to sewers runoffs, and residential and industrial areas. Overall the nitrate levels are not indicating a healthy stream, but a poor quality stream.

Alkalinity is a measure of the capacity of water to neutralize acids found in the water and thus supports aquatic life. Acid deposition in the stream may be from rain, snow, dry particles, wastewater discharges, industrial discharges, and acid rain drainage. It varies from watershed to watershed depending on the type of soil and bedrock found in the steam. The lower the alkalinity level is, the lower the creek's the ability to buffer. It is important because it protects against pH changes from acid inputs and thus affects the waters' ability to support life. The standards range for a healthy sensitive stream is 10 - 20 mg/L. Looking at figure 7, in the fall of 2000, alkalinity was at 0 mg/L for all three sites meaning there is no buffer in the water. In the fall of 2001 alkalinity level increased as we tested upstream from site 1 to site 3, from 0 to 222mg/L. The fall of 2002 had lower alkalinity levels at site 2 but increased at site 1 compared to 2000. The levels were both too high above the sensitive range. The spring season in all three years had very high alkalinity levels ranging from 160 to 270 mg/L. This data indicates poor stream quality. Some of these levels can be accounted for by construction starting in the spring

of 2001 and lasting until the summer of 2002. This high alkalinity also had a severe impact on the BMIs and accounts for low samples of bug collections. An example is seen in the spring of 2001 and 2002 where the BMI only average 6 bugs.

### **Conclusion:**

Over the past three years of data collection from the Patroon Creek Watershed, it is evident that the stream is impacted. The dissolved oxygen, pH, and ortho-phosphate levels are all within a normal range. The impact is seen over the years in the high levels of nitrates and alkalinity. This is especially seen in 2001 and 2002. Some of the levels can be accounted for due to construction, but it still has a great negative impact of the stream that leads into the Hudson River. The chemical data is just a start to see the negative impact, because these poor levels of chemicals also impact the aquatic life. Without the right balance of chemicals and buffers, the plants and animals cannot survive. This is evident by the BMI's in the spring of 2001 and 2002 averaging only six bugs, which is really bad.

Some suggestions for clean up of the stream include; less construction run off, more community involvement more often to clean the stream area and its surrounding areas, staying in touch with the DEC, and posting data on the web site to alert the DEC of a potential problem ahead of time.

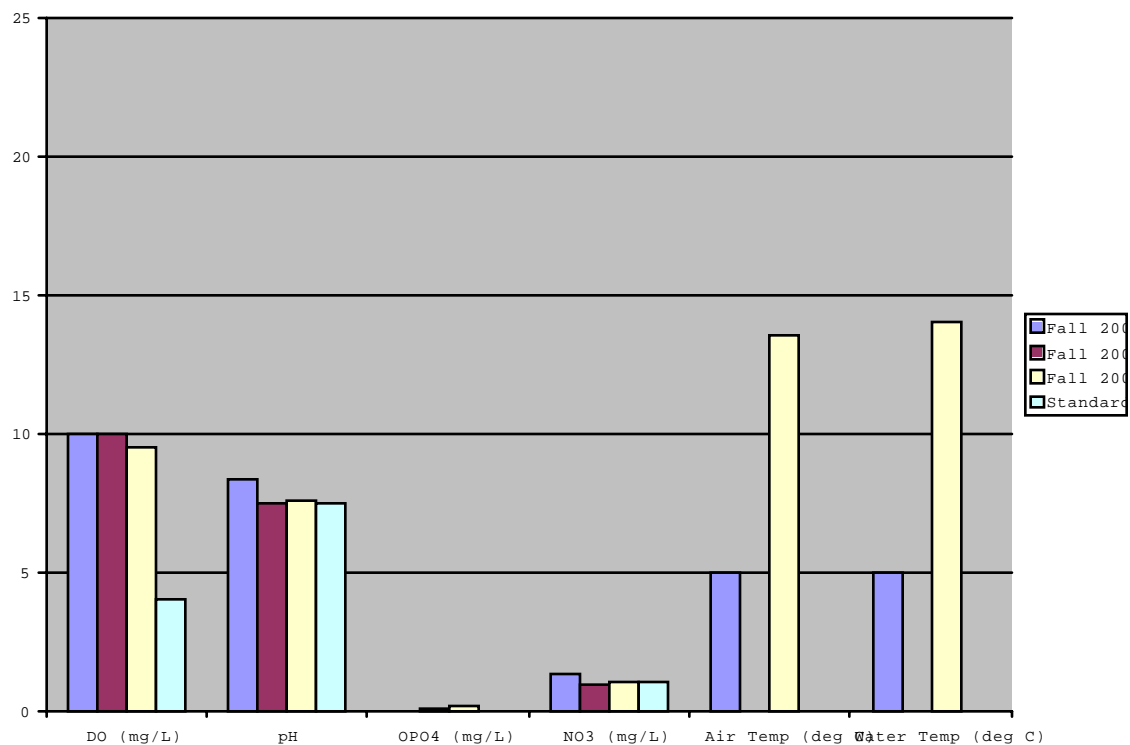


Figure 1 Site 1 Tivoli St. Fall 2000-2002. DO levels were around 10mg/L, which is above the 4mg/L standard. PH levels are closely even with the 7.5 standard for all 3 years ranging from 7.5 to 8.3. OPO4 has no standard and levels for all 3 years were under 1mg/L. NO3 has a standard of 1mg/L and in 2000 it was 1.32mg/L, 2001 was 0.9mg/L and in 2002 was 1mg/L. The air and water temp in 2000 were both 5°C and in 2002 were both around 14°C.

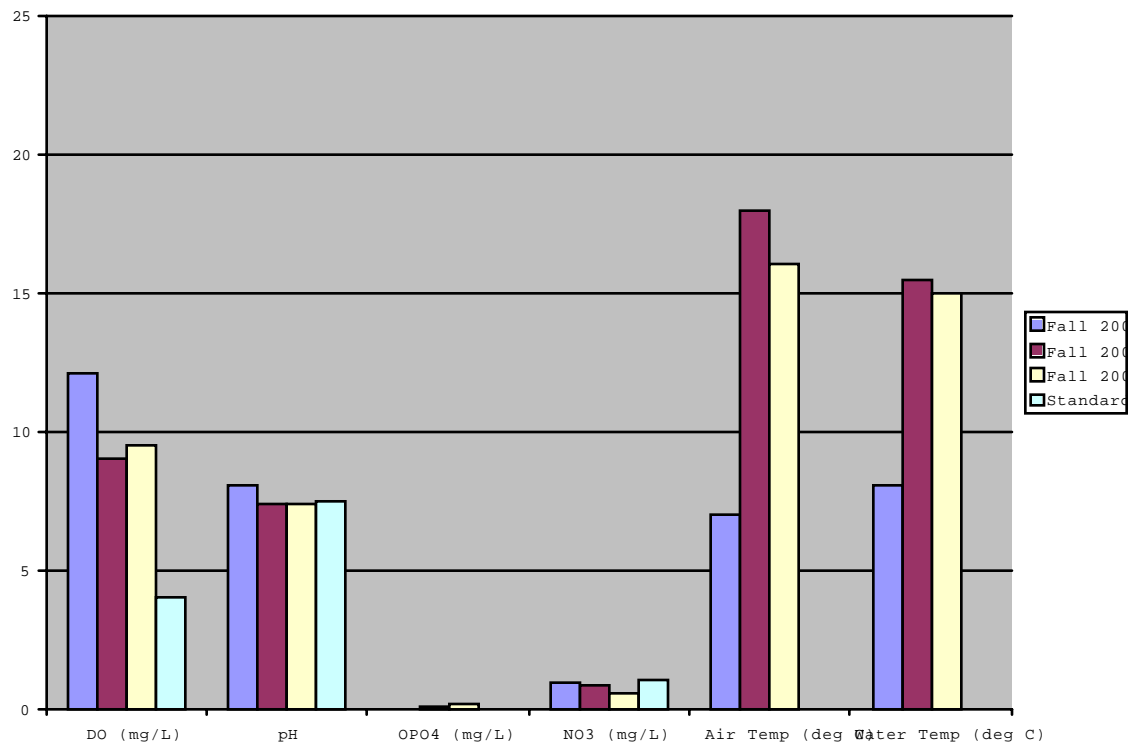


Figure 2 Site 2 Tivoli Lake Fall 2000-2002. DO levels ranged from 12 mg/L in 2000 to 9 mg/L in 2001 and 9.5 mg/L in 2002. These were all above the standard of 4 mg/L. pH levels for all 3 years are around the 7.5 standard. OPO4 has no standard and the levels for the 3 years ranged from 0 to 0.13 mg/L. NO3 has a standard of 1 mg/L. All 3 years were below the standard ranging from 0.88 mg/L in 2000, to 0.5 mg/L in 2002. The air temperatures varied each year from 7°C in 2000 to 18°C in 2001 and to 16°C in 2002. The water temperature was at 8°C in 2000, 15.5°C in 2001 and 15°C in 2002.

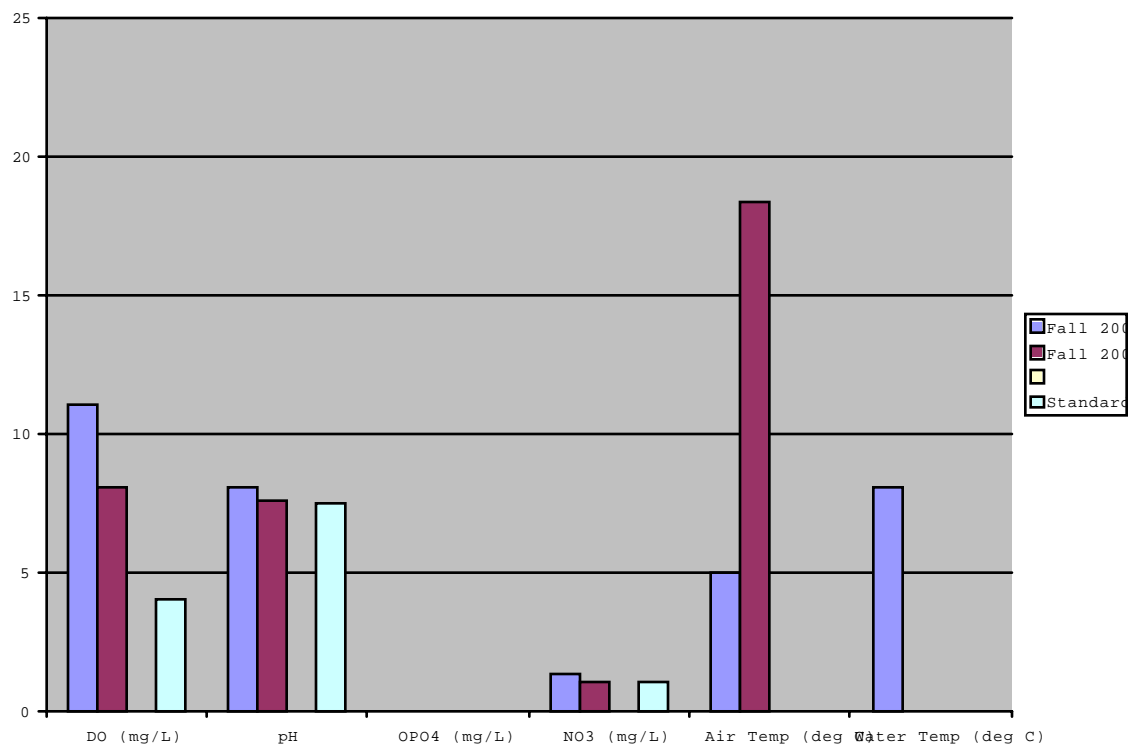


Figure 3 Site 3 Pine Bush Preserve Fall 2000-2001, DO levels were around 11mg/L in 2000 and 8mg/L in 2001, which are both above the 4mg/L standard. pH levels were right around the standard of 7.5. There is no OPO4 present at the site in either year. The standard for NO3 is 1mg/L and in 2000, it was above at 1.32mg/L and in 2001 was right at 1mg/L. The air temperature in 2000 was 5°C and in 2001 was 18.3°C. The water temp was 8°C in 2000 and no data was collected in 2001.

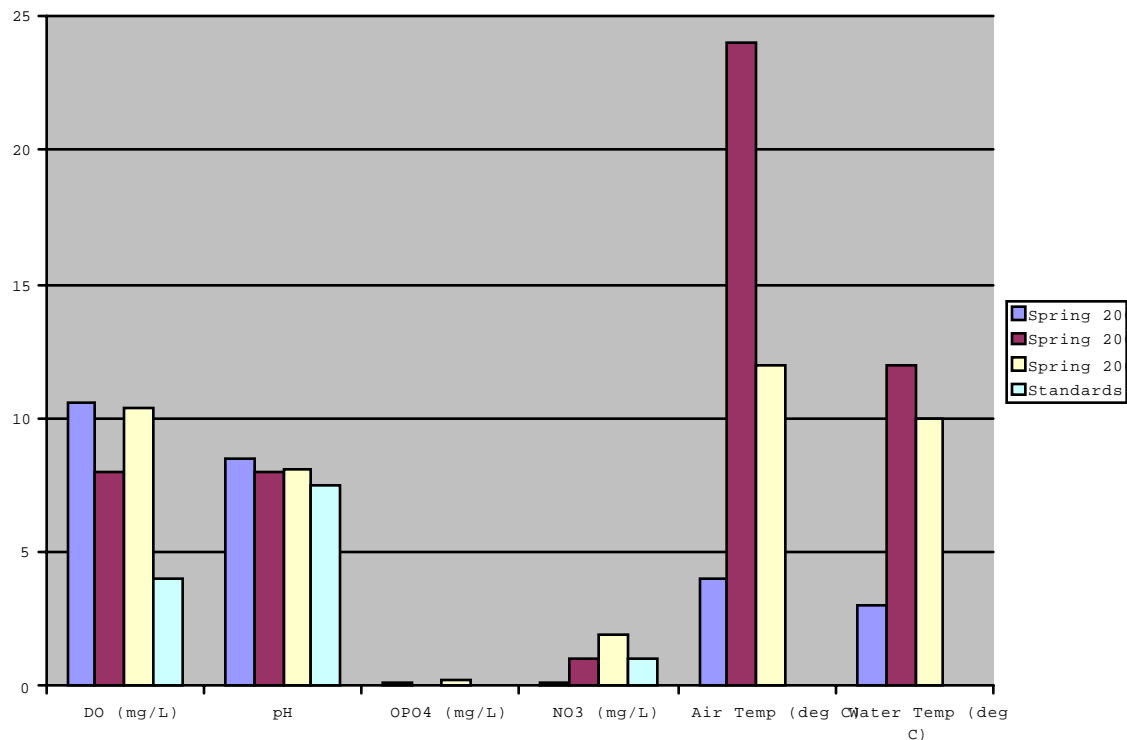


Figure 4 Site 1 Tivoli St. Spring 2000-2002. DO levels were at 11mg/l in 2000, 9mg/L in 2001, and 11mg/L in 2002. All are above the 4mg/L standard. pH levels above the 7.5 standard 2ih 7.75 in 2000, 8.18 in 2001, and 7.9 in 2002. OPO4 was 0.1mg/L in 2000, 0mg/L in 2001, and 0.19mg/L in 2002. NO3 in 2000 was below the 1mg/L standard with 0.1mg/L. In 2001, it was equal to the standard and in 2002; it was above the standard at 1.9mg/L. The air temp was 5°C in 2000, 9.5°C in 2001, and 12° in 2002. The water temp was 3°C in 2000, 12°C in 2001, and 12°C in 2002.

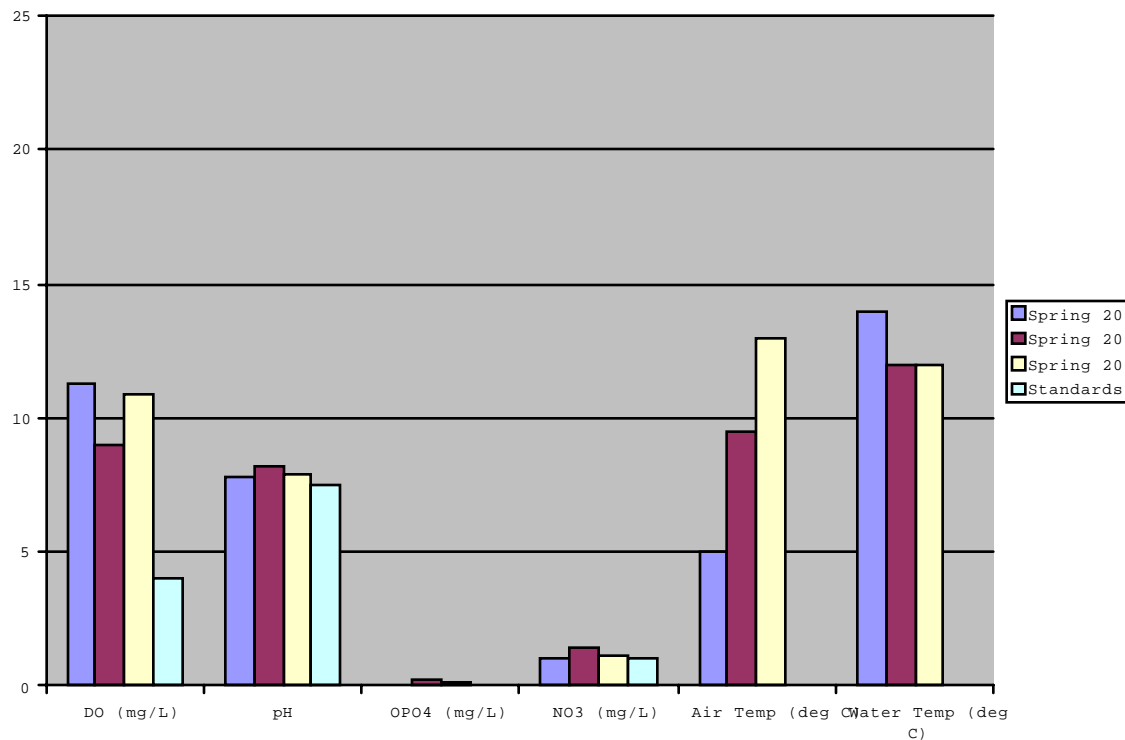


Figure 5 Site 2 Tivoli Lake Spring 2000-2002. DO levels for all 3 years were above the 4mg/L standard, (2002, 11.25mg/L; 2001, 9.0mg/L; 2002,10.9mg/L. pH was 7.75 in 2000. 8.18 in 2001, and 7.9 in 2002 and are all above the 7.5 standard. OPO4 levels are low with 0mg/L in 2000, 0.2mg/L in 2001, and 0.14mg/L in 2002. There is no standard. NO3 levels were all around the standard of 1mg/L. The air temp was 5°C in 2000, 9.5°C in 2001, and 13°C in 2002. The water temp was 14°C in 2000, 12°C in 2001, and 12°C in 2002.

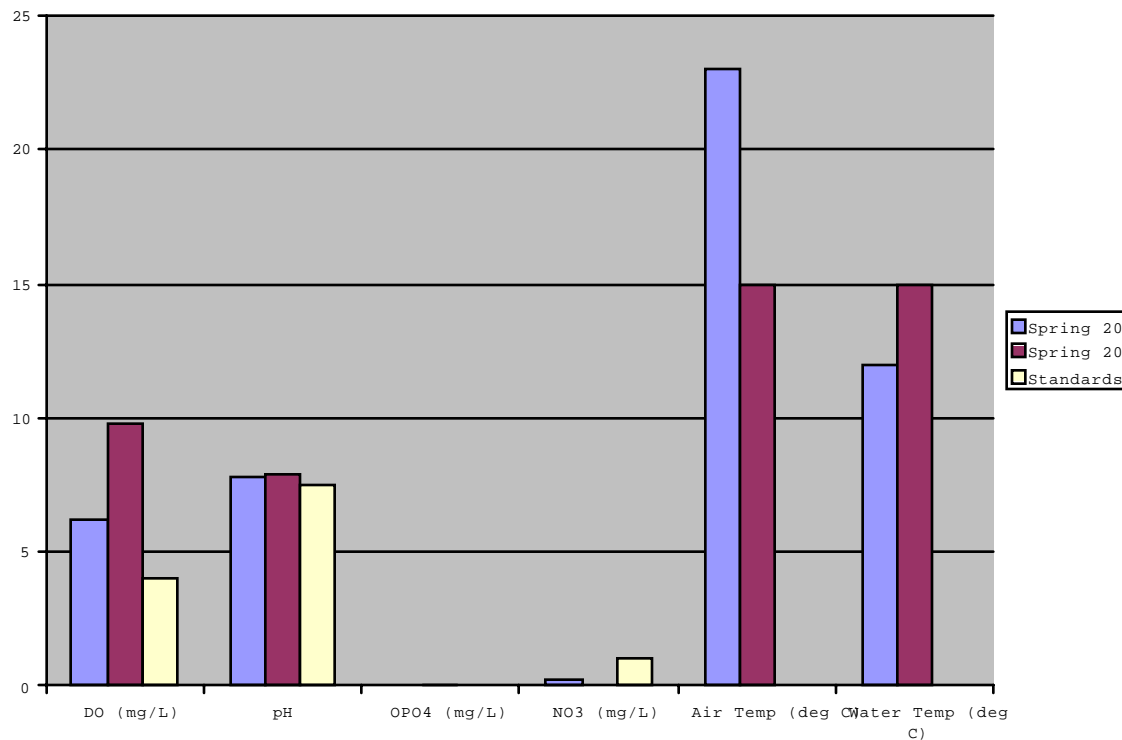


Figure 6 Site 3 Pine Bush Preserve Spring 2001-2002. DO levels were at 6.2mg/L in 2001 and 9.8mg/L in 2002, which are well above the 4mg/L standard. pH levels in 2001 were at 7.75 and at 7.9 in 2002 and both are above the 7.5 standard. OPO4 in both years are right around 0 and there is no standard. The standard for NO3 is 1 and in 2001 the level was 0.2mg/L and in 2002 was 0mg/L. The air temp was 23°C in 2001 and 15°C in 2002. The water temp was 12°C in 2001 and 15°C in 2002.

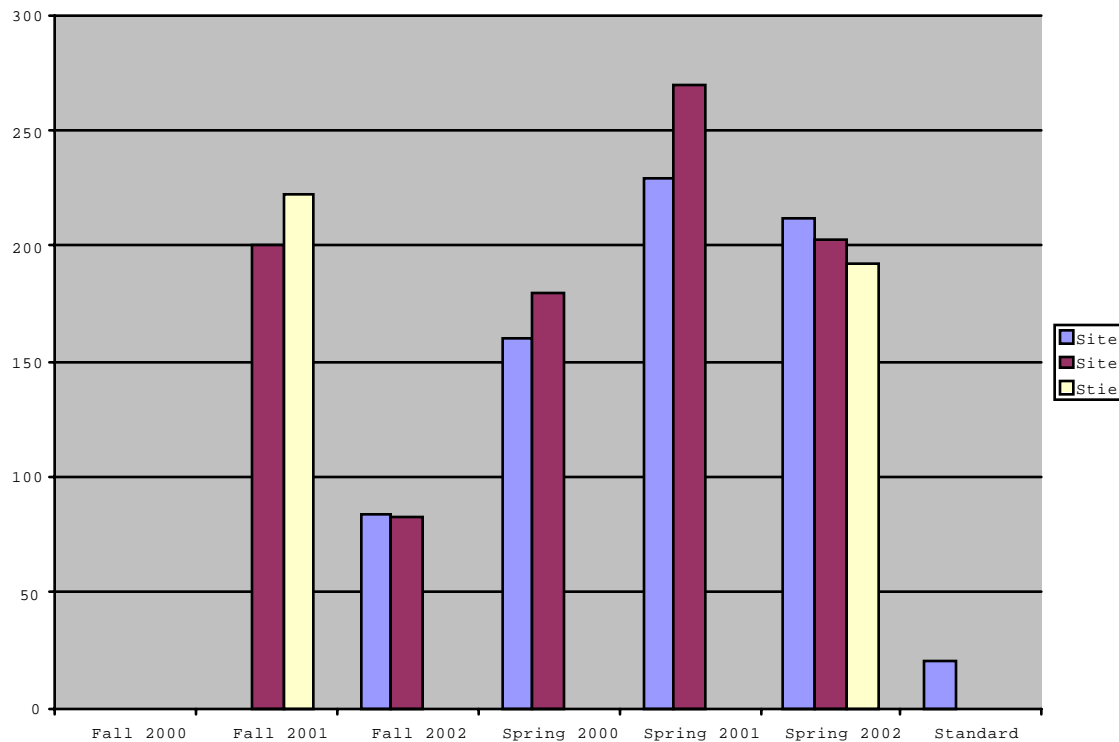


Figure 7 Alkalinity (mg/L) Fall and Spring 2000-2002. At site 1 in fall 2000 and 2001, the level was 0mg/L and in fall 2002 it was 84mg/L. At site 1 in the spring of 2000, it was 160mg/L, in 2001 it was 230mg/L and in 2002 it was 212mg/L. At site 2 fall 2000, 0mg/L; 2001, 200mg/L; 2002, 222mg/L. In the spring at site 2 in 2000 it was 180mg/L, in 2001 it was 270mg/L and in 2002 it was 203mg/L. At site 3 in the fall of 2000 it was 0mg/L, in 2001 it was 222mg/L, and there was no recording in the fall of 2002. In the spring of 2000 at site 3 it was 0mg/L, in 2001 it was 0mg/L and in 2002 it was 193mg/L. The standard is in the range from 10 to 20mg/L.