Watershed Study of Patroon Creek

ALBANY HIGH

STREAM STEWARDS

Stream pollution of Patroon Creek, located in the City of Albany, is a pressing environmental concern not only for the ecosystem of the stream, but also for the Hudson River and its surrounding communities. A 1993-1994 report submitted by DEC placed Patroon Creek on the list for ten most severely impacted streams in New York State and has been on this list since.

Patroon Creek is approximately 6.0mi long, beginning in Colonie running west to east until it empties into the Hudson River. It flows through industrial and residential areas that pose potential threats (such as: sewage discharge, industrial pollution, etc.) to the water quality. Physical (side banks assessment, shading of trees, general condition of the water,), biological (bottom dwelling water bug larvae), and chemical (PH, Nitrates, Alkalinity, etc.) assessments are preformed near the Origin (Pine Bush Preserve) - **Upstream site 3,** Midstream (Tivoli Park in the rear of Philip Livingston Magnet Academy) - **site 2**, and Mouth (Tivoli St. below Henry Johnson boulevard overpass, which runs through a culvert and empties into the Hudson River) **– Downstream site1** to determine the health of the stream.

The purpose of this study of this study is to identify the point source pollutions and report findings to local officials for possible action taken that would be beneficial to the people and wildlife.

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Problem Under Investigation

Stream pollution of Patroon Creek, located in the City of Albany, is a pressing environmental concern not only for the ecosystem of the stream, but also for the health of the Hudson River and the health of the urban communities near the stream and Hudson River area. Once a water supply for the City of Albany, today Patroon Creek is depleted of quality water that can be used for recreational purposes.

Hypothesis

The poor quality of water in the stream will affect the living habitats in the water (bottom dwelling bug larvae – Benthic Macro-Invertebrates) as well as the ones living in the surroundings (wild life) of Patroon Creek.

Purpose

The purpose of this study is to identify the point source pollutions and report findings to local officials for proper action to be taken to help restore the creek back for recreational purposes. If this creek is not attended to, not only does the pollution make its way into the Hudson River, but it also enters the greater body of water ~ The Atlantic Ocean.

Patroon Creek is classified as a Class C stream. Which means it should be used for fishing, fish propagation and survival of aquatic life, and may be suitable for swimming and picnicking. The Albany High School (AHS) Students focus of scientific monitoring, restoration, and protection of this creek so that the neighboring communities can someday use it for mentioned recreational purposes. Restoration of this creek will be a value to aquatic life habitat, wildlife habitat, and provide scenic quality to the areas.

Albany High School Student kept data (physical survey, biological (BMI count), and chemical (PH, Alkalinity, Dissolved Oxygen, Phosphate, Nitrates, and Chloride)) since year 2000 - 2003 have indicated the creek to be impacted. Recent data from year 2004 to year 2005, the AHS Students have classified site 1 and site 2 as severely impacted and site 3 as moderately impacted. This research paper will address the data obtained and make a visual comparison through graph analysis over the years.

Background

Pollution occurs when excess waste or unwanted materials overburden natural processes and threaten nature, human and animal health, and offset the natural environmental and ecosystem balance (Kendal and Hunt, 2000). Historically, people assumed that the ocean, the atmosphere and the land soil would absorb the infinite amount of waste produced by mankind. Scientists now have data to support that our land, water, and oceans are being threatened by the exceeding amounts of pollution generated, not to mention the negative impact on the physical and emotional health of an ever-growing population of people.

Patroon Creek is approximately 6.0 miles long. It begins in the Town of Colonie running west to east until it empties into the Hudson River. It flows through industrial and residential areas in the City of Albany that pose potential threats (such as: sewage discharge, urban runoff, and industrial pollution) to the water quality of this watershed. In an effort to monitor and report findings to officials and community members for restoration, Hudson Basin river Watch Network (HBRWN) is assisting students to collect Physical, Biological, and Chemical Data for analysis. Physical, biological, and chemical assessments are preformed near the Origin (Pine Bush Preserve-Fuller Road (Albany)) designated Upstream site #3, Midstream (Tivoli Park behind Philip Livingston Middle School) designated site #2, and Mouth (Tivoli Street under Henry Johnson Boulevard Overpass which runs through a culvert and empties into the Hudson River) designated Downstream site #1 to determine the health of the stream.

Patroon Creek is classified as a **Class C** steam. The Albany High School Students focus 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, and provide scenic quantity to the area.

Albany High School Students have made major accomplishments in removing unsightly debris from Patroon Creek, one being a motorcycle. Each time the students are out at the sites, large amounts of garbage are collected. As a result of years of sewage discharge, urban runoff, and industrial pollution, portions of the watershed have been designated "areas of concern" by the New York State Department of Environmental Conservation.

Albany High School has kept data since year 2000 and over the years the physical survey, biological (Benthic Macroinvertebrate – BMIs), and chemical (PH, Alkalinity, DO, Phosphate, Nitrates, and Chloride) data have indicated the creek to get classified as a severely impacted steram in 1993 to impacted for year 2003. For year 2004 an 2005, the AHS Students have classified site 1 and 2 as severely impacted and site 3 as moderately impacted. This research paper will address the data obtained and make a visual comparison through graph analysis over the years.

Results:

See reference charts.

New York State Standards Used:

Dissolved Oxygen:

It 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 main ways it enters water are through turbulence and plant photosynthesis. Certain BMI, such as mayflies, caddisflies, and stoneflies, and certain fish, such as trout, require dissolved oxygen levels of at least 6.0 mg/l. The most oxygen that can be dissolved in water is about 14 mg/l. Humans can affect the DO level in a stream by adding oxygen – consuming organic waste from sewage plants or leaky septic tanks, adding nutrients that increase plant and algae growth, changing the flow of the water, or removing shading vegetation from side banks. Dissolved oxygen is measured in milligrams per liter which is the same as parts per million.

PH:

It 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 acceptable standard is around 7.5.

Phosphates:

It is a measure of aquatic ecosystems, phosphorus occurs mainly in the form of phosphate (PO4)3. 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. But, any human addition of phosphorus can cause great increases in aquatic plant growth which may result in higher water temperature, unstable dissolved oxygen, changes in habitat and ultimately a decrease in aquatic life. When plants die, decomposer bacteria use up dissolved oxygen. For a healthy stream the guideline for O-Phosphate indicate level less than 0.05 mg/l.

Nitrates:

It is a measure of nitrogen that is an essential nutrient for plants and animals as a building block for proteins. They are found naturally in unpolluted stream 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 1.0 mg/l.

Alkalinity:

It 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 stream. The lower the alkalinity level is, less likely it is for the creek to provide buffer capacity. Alkalinity is measured in milligrams per liter of calcium carbonate (CaCO3). Some amount of alkalinity is important to combat against PH changes from acid inputs into the stream. The standard range for a healthy sensitive stream is 10-20 mg/l.

Discussion:

Spring and Fall 2003

For the sites measured, the dissolved oxygen was well above the standard and will support a diversity of organisms provided the other parameters are within compliance. Spring 2003 ~ Site #1- 11.3 ppm, Site #2 -12 ppm, Site #3 – 8 ppm; Fall 2003 ~ Site #2 – 10ppm.

The PH values (all 3 sites) for spring 2003 exceeded 8.0 making it difficult for aquatic life to exist.

Nitrate and Ortho-Phosphate exceed the standards for supporting aquatic organisms. For spring and fall the values for Nitrates at all three sites were 1.0 mg/l or above. O-Phosphate results were above .05 mg/l for both seasons and all three sites, except for Fall - site #3 (value of 0 mg/l). In addition, alkalinity was within the 200 mg/l

range. Anything over 10-20 mg/l leads to loss of biodiversity organisms in the water. This may have been a possible reason for the difficulty in getting a 100 count BMI sample for site #1 and site #2. There was a greater count of aquatic worms and midges present in the spring BMI data, which indicated a polluted aquatic environment.

BMI – Due to time constraint site #3 was not analyzed in the fall and the flow of water was too rapid at site #2 to collect the BMIs. An attempt was made at site #1 and only 10 caddisflies were found.

Spring and Fall 2004

For the sites measured, the dissolved oxygen is well above the standard and will support diversity of organisms provided the other parameters are within compliance. Spring ~ Site #2 – 11ppm, Fall 2004 ~ Site #1 – 11ppm, Site #2 – 9.0 ppm, Site #3 – 9.0 ppm.

The PH values for Spring were above the acceptable standards of 7.5 making it difficult for aquatic life to exist. In fall, PH for site #3 are greater than 7.5, making it difficult for trout spawning.

O-Phosphates for spring were less than the standard .05 mg/l. In the fall, result indicated levels above .05 mg/l. A possible reason for the high levels in the fall than in the spring, is that spring water flow washes out the phosphates. In the fall there is more plant decay and leaves in the water which increases the level of phosphates.

Nitrates are higher than acceptable standard (less than 1.0 mg/l) in the spring indicating impact. High levels would allow for growth of algae which would lower the dissolved oxygen levels. In the fall nitrates were less than 1.0 mg/l at site #1 and site #3. Site #2 indicated a level greater than 1.0 mg/l ~ sure sign impact is present.

Alkalinity was high in the spring and fall (standard is 10 – 20 mg/l). This was possible due to seasonal variations. High alkalinity in the fall could be a reason for why we were not able to get 100 count BMI sample at any of the three sites.

Conductivity was extremely high in spring 04 compared to 03 date. This was a possible indication of solid particles present in the water. The conductivity dropped 2nd day at site 2. This was due to rain and rapid movement of water.

Spring and Fall 2005

For the sites measured, the dissolved oxygen were well above the standard and would support diversity of organisms provided the other parameters stayed within compliance. Spring ~ Site #1 – 10.29 ppm, Site #2 – 10.75, and Site #3 – 9.98 Fall 2005 ~ Site #1 – 10.14ppm, Site #2 – 9.5 ppm, Site #3 – 9.11 ppm.

The PH values for Spring and fall were with the within the NY State Water Quality Standards Guidelines ~ between 6.5-8.5. Values obtained were in optimal PH range for most life to exist.

O-Phosphates for spring were less than in the fall. Refer the data sheets. A possible reason for the high levels in the fall than in the spring, is that spring water flow washes out the phosphates. In the fall there is more plant decay and leaves in the water which increases the level of phosphates. Although site #3 in the fall indicate a value of zero, which may be an error since the nitrate level is high, which is another plant source as is phosphate.

Nitrates are higher than acceptable standard (less than 1.0 mg/l) in the spring and fall at site #3 indicating impact. High levels would allow for growth of algae that would lower the dissolved oxygen levels.

Alkalinity was high in the spring and fall (standard is 10 – 20 mg/l). This was possible due to seasonal variations. High alkalinity in the fall could be a reason for why we were not able to get 100 count BMI sample at any of the three sites.

Conductivity was less both seasons compared to 04 data, but the values were still more than the NY State recommendation of 150 – 500 S/cm. This was a possible indication of solid particles present in the water. Conductivity is increased when failed sewage problem persists which tends to raise the levels of phosphates and nitrates.

Conclusion:

High levels of ortho-phosphates, nitrates, and alkalinity indicate the stream to still be impaired at all three sites. BMIs collected were caddisflies, midges and worms at all three sites. At sites 1 and 2 it was difficult to get a 100 count sample. About 10-20 count

sample at each site were obtained. Site 3 has a larger count but not 100 count. These results are an indication of poor quality water present.

Data collected over the years indicate Patroon Creek Watershed is impacted. The dissolved oxygen and PH seem to be stable from season to season and year to year. The impact is seen over the years in the high levels of nitrates, o-phosphates, and alkalinity. As stream stewards of Patroon Creek we have just scratched the surface of why the stream is still impaired since 1993 when DEC declared it severely impacted. More legal action needs to be taken by EPA and DEC to investigate why this stream continues to be impaired.

As stream stewards we will continue our Community Service of monitoring and clean up of the sites twice a year and will continue to inform the community to voice their concern to the officials to bring attention to this Patroon Creek.