Testing the Waters

A study of water quality at Round Pond Creek by the Genesee Community Charter School's 5th Grade Class
June, 2007



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ABSTRACT

Thirty-one fifth grade students at the Genesee Community Charter School studied the health of Round Pond Creek in Greece, New York because it flows into Lake Ontario within the Rochester Embayment, which is listed by the Environmental Protection Agency as an "area of concern." Visual surveys were performed at six sites, and three sites were chosen to study further. At those three sites, researchers tested dissolved oxygen, pH, alkalinity, conductivity, fecal coliform bacteria, chloride, fluoride, nitrates, phosphates, sulfates, air and water temperature and streamflow volume. Researchers used the percent model affinity method to sample macroinvertebrates. While gathering and interpreting data, researchers consulted with experts from the University of Rochester. Round Pond Creek rated in "fair/good condition" overall. Exceptions were macroinvertebrates ("severely impacted") and dissolved oxygen (16.6 to 22.2 ppm). One site had high levels of *E. coli*. Researchers concluded that just because water looks clean, does not make it healthy. The study makes recommendations for further testing and for taking action to help keep our environment clean.

INTRODUCTION

We are the 5th graders from the Genesee Community Charter School. We are an Expeditionary Learning school and we study in depth topics for 12 weeks. These are called expeditions. It is our responsibility to share what we learn about our expeditions. Our guiding questions for this expedition are: *How do humans affect the water in our community?, How do scientists work?,* and *How do scientists figure out the health of a body of water?* The name of this expedition is "Testing the Waters."

To help us with this expedition, we went on field studies to many different stops along Round Pond Creek. A field study is when you go out to the field and investigate the topic that you are studying. We went to Round Pond Creek multiple times so we could gather water samples, collect algae samples, and to sample macroinvertebrates. Some of the places we went to test the water quality were Sawyer Park, Greece United Methodist Church, and Apple Creek Lane/Latta Road.

Resources

Soon after we started our expedition we observed some organisms in our classroom. We made many observations using hand lenses and microscopes and took very detailed notes. We later discovered that our skills of observing would be important for our upcoming field studies. Next, we received a macro and micro-invertebrate identification sheet. We used this sheet to identify our macro-invertebrates, which after a class discussion we determined were Daphnia. Now we had some questions to be answered: What are these things specifically? Why do these organisms matter?

Then we received an article from the Democrat and Chronicle. It was called *Troubled Waters*, by Lara Becker Liu. It introduced us for the first time to the problems in Lake Ontario (specifically at Durand Beach). Additionally, it told us about the differences of storm and sanitary sewers. The article also answered the question of why a beach would be closed in Monroe County. We made an inference that the macroinvertebrates were connected to the article.

The next week we received some maps. We realized that some of the maps fit together. We discovered that the maps showed the sewer lines in Greece.

Later that week we invited a guest speaker to our classroom. Her name was Mrs. Mazurowski. She works for the Water Education Collaborative (WEC). Mrs. Mazurowski showed us how to perform an Enviroscape demonstration for a Science Saturday at the Rochester Museum and Science Center. The Enviroscape is a model of a watershed that shows how non-point source pollution affects the water. Mrs. Mazurowski also explained how non-point source pollution and point source pollution affect the water. She shared that 80 percent of the pollution problems we have with our water is from non-point source pollution. Additionally, she explained what people can do to stop these problems. Mrs. Mazurowski also told us how to separate and identify macro-invertebrates. She told us which macro-invertebrates were sensitive and tolerant.

We were fortunate to have experts, Tom Darrah and Amanda Carey, from the University of Rochester come and teach us about how to test the water for dissolved oxygen, pH, trace metals, chloride, fluoride, and phosphorous in the water. They also helped us analyze our results.

Research Question

For the last twelve weeks, we have focused on one question - How healthy is the water at Round Pond Creek? We are hoping this information will be useful to the Monroe County Health Department and the Water Education Collaborative.

Over the last month we have been performing tests on Round Pond Creek. Round Pond Creek is a tributary of Round Pond, which flows into Lake Ontario. We have tested for pH, alkalinity, air temperature, water temperature, stream width, average stream depth, average velocity, stream flow volume, dissolved oxygen, conductivity, fluoride, chloride, nitrates, phosphates, microbes, fecal coliform, and *E. coli.* We also took a macroinvertabrate count.

The problems at Charlotte Beach, including overabundant algae, can cause the beach to close. All the sediment, phosphorous, chlorine, fluorine, etc. that is in Round Pond Creek, eventually flows into Durand Beach and then Charlotte. Some contributing factors to the high levels of *E. coli* at Durand Beach are its tributaries such as Round Pond Creek. Additional factors that make Durand and Charlotte close are that there is too much sediment. An overabundance of sediment makes the water murky, with the result that lifeguards can't even see if someone is drowning!


Ontario Beach April 2006 (photo courtesy of Pictometry International Corp.)

We are hoping residents will get a better picture of how and why we should keep our water clean. More people would take action if they knew the severity of the problem.

Rationale

People depend on fresh water for many things. In 1972, the Federal Water Pollution Control Act Amendments began. In 1977, this became known as the Clean Water Act. It was created to protect the rights and safety of the more than 2/3 of our fresh water that still lies frozen in the glaciers and the less than 1/3 of available fresh water in the Great Lakes, including Lake Ontario.

As of last summer, Durand Beach was closed in July because of dangerously high *E. coli* levels and Charlotte Beach for an overabundant algae growth. Some scientists hypothesized the problem to be Lake Ontario's southeast current that doesn't enter Charlotte Beach & Durand Beach empty-handed – along with it comes algae. Along with the current comes algae better known for its part played as the home or hide out for bacteria. And when algae become overabundant, it can cause *E. coli* outbursts.

A water use impairment is when the body of water or reservoir's use is halted because of pollution. An example is when someone forgets to pick up there pet's waste and it gets washed into the water.

On May 17, 2007 the Water Education Collaborative held a press conference to unveil the new advertisement campaign about nonpoint source pollution and water quality. Some statistics that experts shared at the conference were:

A. Eighty percent of water use impairments come from nonpoint source pollution.

B. Two-thirds of people think the causes of the pollution are businesses and industries.

C. Two-thirds of people surveyed think storm water is treated even though it goes untouched into Lake Ontario.

These statistics were shared by Ms. Patty Malgieri (Deputy Mayor of Rochester), Dr. Jim Sperry (from the Water Education Collaborative), and Dr. Andrew Doniger (Monroe County Department of Health). The conference also gave a sneak peak of the newest advertisement created to raise public awareness about polluted storm water. The character is the H_2O Hero and his job is to remind people that any average person can help create public awareness of this issue.

Hypotheses

What are hypotheses? A hypothesis is a prediction or theory that can be researched. It is based on background knowledge, data, and observations. For example, a possible hypothesis could be there is a chance that it will rain. A scientist would have to observe stormy clouds that would be evidence for the prediction.

Why do scientists create hypotheses? Scientists form hypotheses so that research can be done and evidence gathered to prove the hypothesis. While scientists research they reflect on how they are working, and contrasting what the true results are.

The class formed hypotheses about the six points along the stream. At Carter Park 81.4% of the class hypothesized the water was unhealthy because of a dead woodchuck, orange liquid, and litter. From Greece United Methodist Church, animal life, little algae, and a lot of vegetation were observed. Therefore 85.1% of us hypothesized it was healthy water. Downstream at the Journey Home, 48.1% of us recorded healthy and 48.1% of us recorded neutral water because we observed vegetation, litter, and erosion. Later, at Greece Athena High School 51.8% of us hypothesized the water was unhealthy because we observed litter, color in the water, and bacterial iron in the water. From Sawyer Park, 85.1% hypothesized the water was unhealthy water because of a dead fish and a dying fish, litter, and the large amount of algae. Further downstream at Apple Creek Lane and Latta Road 37.0% of the class' hypotheses indicated healthy water after observing a little algae , animal life, and a tributary of storm drain water.

METHODS

Visual survey

We received a watershed walk survey from the Community Water Watch Program, or CWW. However, the watershed walk survey can be found in the Community Water Watch Participant's Manual (see Appendix A). This sheet consisted of a grid labeled with properties of a stream such as, streambed siltation, animal life, bacteria iron in streambed and many other features of a stream. Above each box is a heading or rating. The headings are to estimate the health of the stream, such as excellent, fair/good, and poor.

At every one of the six segments of the stream we visited and took the survey, (Carter Park, Greece United Methodist Church, Journey Home, Athena High School, Sawyer Park, and Apple Creek Lane), we observed our surroundings and took note of what would be contributing information to the watershed walk surveys. When all the surveys were complete for each segment along the Round Pond Creek, we took the surveys back to the classroom.

The next step was to compile all the data into crew charts. We divided our class into crews, groups of five to six students and shared what data we gathered. After the crew charts were completed we added our tallies to the final class charts.

For the first attempt at the final class charts we used a strategy, and it was, every crew took a "watershed walk" at each of the six chosen segments of Round Pond Creek that we visited. We would add our tally marks according to our recorded observations. All the people who recorded their data at one of the six stops along Round Pond Creek would find the crew assigned that stop and give them their data.

The first attempt did not work and ended in a failure. We found what was wrong and revised it. This didn't help, because the second time we tried we were also unsuccessful. Finally, the third time we tried we were successful.

Out of the six stops, we needed to pick three to visit once again. The way this happened is we created sheets that had all the observations and wonderings on it and reasons why we thought we should visit each segment again. Out of the six, we chose Greece United Methodist Church, Sawyer Park, and Apple Creek Lane. We picked these because the class had the most wonderings and ideas what to do next, plus they all met the characteristics needed for macroinvertebrate counts, like having nice riffles.

Physical measurements

The materials that we used for physical measurements were an apple, a timer, a rope, a net, a pH meter, and two tape measures.

To get the width, first we got a tape measure and spread it across the stream. Someone walked across the stream to get to the other side. For the depth we used a tape measure. We got five depth measurements at each of the three locations. For the average depth we added all five measurements up and divided that by five.

For the velocity we used a rope, an apple, a timer, and a net. First we stretched out the rope at 25 feet. Each foot was marked. Secondly, we got the net ready in the water. Then we dropped the apple in the water three times. Lastly we got three different times from the timer. For the average velocity we added all three times up and divided it by three.

For the stream flow volume we multiplied the average depth by the width and multiplied that by the average velocity.

For the air temperature we used the pH meter with the appropriate probe. (A probe is something you put into the water to get information like pH or temperature.) For the water temperature we used the pH meter with the appropriate probe.

Dissolved oxygen

We visited Sawyer Park, Apple Creek Lane/Latta Road, and the Greece United Methodist Church on, May, 15, 2007, to test the water sample from the stream. The first step was gathering the sample of stream water. Standing down stream, we held the bottle that was used for the sample collection and let the water flow into it. Once it was partly filled, we shook the bottle a little to rinse it out. After we rinsed it out we filled it again and put the cap on while it was under the water because the air has more oxygen than the water and we wanted to make sure the water is "as is" so we could get accurate results.

The next step was "fixing" the sample. With our pipet, we added 8 drops of

Manganous Sulfate Solution and 8 drops of Akaline Potassium Iodide Azide Solution. Additionally, we put in the Sulfamic Acid. We placed 8 drops of Starch Indicator while we were at the stream.

To store the sample, we wrapped it with foil because the foil blocks the sunlight and prevents photosynthesis. Photosynthesis puts oxygen into the water. After we wrapped the sample we put it on ice in a cooler. The sample was stored for approximately 4 hours.

The final step involved the math and titrating. We added 20mL of water with mixed chemicals. Then we added Sodium Thiosulfate Solution until the color changed from a black/blue color to clear. For the math, we measured the amount of Sodium Thiosulfate Solution and multiplied that number by 20 to get our numbers for dissolved oxygen in parts per million (ppm).

We kept track of how much solution we were adding so we had accurate data. Also, we kept track of the number from the beginning to the end so we could find the range. The range is the difference between the highest point and the lowest point. For example, when we added 1.08 mL of Sodium Thiosulfate Solution to the sample, there wasn't a change, but when we added the next drop, the sample turned clear.

pH

pH stands for potential of hydrogen. It is a scale used to measure the acidity or alkalinity of a solution. The pH scale ranges from 0 to 14, with 7 being neutral (in the middle), lower than 7 is acidic, and higher then 7 is basic. We used two different instruments to measure the pH of our water samples. The first one was called the Corning Checkmate pH meter. The second instrument was a handheld pH meter called Check-Mite pH 10.

Before we used the Check-Mite pH 10, we had to make sure it worked. So we had to us something called a buffering solution, which is a water sample where people know what the pH level is. We had to do this three times, with three different buffering

solutions. The first time the buffering solution pH level was 4.01, and our meter read 4.0. The second time the buffering solution pH level was 7.01, and our meter read 7.0. The last time the buffering solution pH was 10.01, and our meter read 10.0.

We took our samples on May 15, 2007 at Greece United Methodist Church, Sawyer Park and Apple Creek/Latta Road. At the stream, we did some testing for pH using the Check-Mite pH 10. First we gathered the sample from the stream. We took our samples by cleaning the container three times (dumping the water back into the stream the first three times) with the stream water, then the 4th time kept the water in the bottle. Then we put the pH meter in the sample and swished the meter 10 times. Then we waited for about 10 seconds then pressed the read button, waited 5 seconds, and then we got the results.

Alkalinity

Alkalinity is a measure of the "buffering," or a stream's ability to neutralize an acid pollution from rainfall or wastewater. We took the samples at Greece United Methodist Church, Sawyer Park and Apple Creek Lane/Latta Road on May 15, 07. We took the samples the same way we sampled for pH, and then put the sample in a cooler.

Before we could do the titration we had to filter our water samples. First, we had to set up the filter. There is the hand-held vacuum pump, glass bottle, the filter unit (which is one-time-use-only), and another bottle to pour the filtered sample (water) into. Next we had to connect all of the parts. We connected the pump to the filter unit and then screwed the filter unit to the glass bottle. After that we poured the sample into the filter then put a cap on to prevent contamination. Then we pumped the pump, which sucked the water through the filter and left the debris behind. The water sample went into the glass bottle. We poured some of the filtered sample into the other bottle and shook that around and dumped the filtered sample into the sink. We repeated this three times. Then we poured the rest of the filtered sample into the clean bottle. The reason why we cleaned the bottle out three times is because we didn't want any contamination from the bottle to get into our sample. We rinsed out the glass bottle three times with deionized water. Also we had to get a new filter. The water was much clearer then before. We used the Brinkman Methrohm 632 pH-meter the 655 Dosimat to measure the alkalinity.

Here are the steps for the titration for alkalinity. First we weighed out approximately 50 grams of water for each sample and recorded the weight. Secondly, we put in the pH probe and recorded the initial pH. Then we added 0.1 normal hydrochloric acid in 0.1 mL increments using an auto acid titrator. Next we monitored the pH as more acid was added. Then we continued to add acid until we reached a pH of 4.5. Once we reached a pH level of 4.5, we recorded the amount of acid added. Lastly, we used the acid added to calculate the amount of alkalinity that was present initially.

Conductivity

We hade to measure conductivity. Conductivity is a measurement of the ability of a solution to conduct an electric current. Samples where taken from the same places as alkalinity and pH and at the same time and using the same procedure. To filter the samples, we followed the same steps for alkalinity filtering.

We used the Dionex ICS-1000 Ion Chromatograph to measure the conductivity. What we did was measure all of the major dissolved anions. (Anions are ions carrying a negative charge. An anion is formed from an atom by the gain of electrons.) There are minor concentrations of other anions, but they are significantly lower. Therefore, we can get a pretty good idea of conductivity with measuring the major anions. However, it is only an estimate.

Fluoride, Chloride, Nitrates, Phosphates & Sulfates

To determine how much chloride, fluoride, nitrates, phosphates, and sulfates there were in the water we needed some materials. The materials included a vial (which is a small tube with a round bottom and flat lid), a filter, an ion chromatograph (which is the machine that measures chloride, fluoride, nitrates, phosphates, and sulfates), a computer, two chemicals (helium gas and sodium hydroxide), and several bottles.

We collected the samples by filling the bottles with water, dumping them out then filling them again and dumping them out again. We did this a few times to clean the bottles out and to make sure they had no traces of other water in them which could ruin the results. Finally, we filled the bottles for the last time, labeled them, and put them in a cooler to brought them back to the lab at the University of Rochester.

Once we were at the University of Rochester, we entered the lab. We then got the bottles of water and poured some water into a filtering container, and attached it to the filter, and started pumping the water through the filter. We filtered the water because if sediment, macroinvertebrates, or plants got in the ion chromatograph, it could be damaging.

We took the filtered water to the next lab that had an ion chromatograph and poured the water into a vial then added a chemical called sodium hydroxide (a 2.4 millimolar solution), which is used to keep things moving in the ion chromatograph. There is also another chemical called helium gas and it keeps things tight and moving. All together we had five mL of solution. We then capped the vial and swirled the mixture. We tried not swirl too hard because the mixture might splash out. Finally, we poured the mixture into the ion chromatograph, which was hooked up to a computer, and started watching the computer.

The computer showed a graph. A peak on the graph showed a high concentration of one of the chemicals we tested for. We knew what the chemical was based on how much time had passed, and with help from another graph that came with the ion chromatograph. The graph on the computer was a line graph that showed time with one axis and how much of a chemical in the other. We watched the computer to look for these things.

Fecal coliform bacteria

To determine the quantity of fecal coliform bacteria at all of our three stops (Greece United Methodist Church, Sawyer Park and Apple Creek Lane/Latta Road), we first collected water samples from the three stops in vials and kept them on ice for18 hours. Then in class we started our tests after a one-day period.

To start, we gathered our materials that were in Petri dishes, sterile pipettes, permanent marker and Easygel in a bottle. Easygel is a substance that makes bacteria grow. First, we labeled the top of the Petri dish with permanent marker stating the location of where the sample came from, the kind of test we conducted, and our name. Secondly, we opened the bottle with the Easygel (depends on what kind of test for Total Count or Coliscan) and placed the Easygel on the table. Next, we opened the vial with the sample from the location. After that, we opened our sterile pipet and made sure nothing touched the bottom. Next, we opened the pipet and put it in the stream sample to get the water. We removed the pipet and added 4 drops for the Total Count test or 40 drops for the Coliscan of the water sample in the bottle of Easygel. The next step was to place the cap on the Easygel with the drops in it and swirl it. We opened the Easygel and put it on the bottom of the Petri dish and swirled it again with the container closed. Then we stored it for 2 days at room temperature.

After awhile, we observed dots on the bottom of our Petri dishes that were bacteria. For this step we first needed one more person to record the tally marks and one to label the Petri dish. We got a partner and one of us made a dot on the bottom of the Petri dish (on top of the bacteria colony) with a permanent marker. The other partner said, "1, 2, 3, 4," and so on as they dotted. Total Count bacteria appeared white, non-*E.coli* coliforms appeared pink, and the *E. coli* appeaared blue/ purple. To get the total coliform results we added the blue/purple and pink bacteria. After adding the counts of bacteria, we divided by the average amount of water in the 4 or 40 drops to figure out the colonies per mL. We multiplied by 100 to get colonies per 100 mL.

Macroinvertebrates

We sampled for macroinvertebrates on May 25, 2007 between 9:00 a.m. and 12:00 p.m. at Greece United Methodist Church, Sawyer Park, and Apple Creek Lane/Latta Road.

The materials we used to sample were waders (important if the water is dangerous and for comfort), buckets (to hold the sample), and "D" nets (for sampling). We sampled macroinvertebrates by pushing the "D" net on the bottom of the stream bed about one foot downstream from us and using the kick method. The kick method is when we got the toe of our waders slightly under the streambed and kicked strongly until we filled the net about 25% of the way. Furthermore, we put the sample in buckets one handful at a time to get out glass and anything else that could harm the macroinvertebrates. After that, we lugged the bucket onto the stream bank. We repeated this enough times so we could easily have 100 macroinvertebrates.

On the bank, we separated 100 macroinvertebrates into a shallow pan with extra water in it. After we counted out 100 macroinvertebrates we sorted them into 7 groups: *Oligochaeta* (worms), *Ephemeroptera* (mayflies), *Plecoptera* (stoneflies), *Coleoptera*

(beetles), *Trichoptera* (caddisflies), *Chironomidae* (midges) and Other. We had a jar for each. (Note, at Greece United Methodist Church we only had time to count 50 macroinvertebrates, but we then doubled our numbers.) To count how many macroinvertebrates (and what kinds) we used spoons, forceps, shallow pans, and buckets. Finally, we recorded our findings on the recording sheet (see Appendix B) and safely returned the macroinvertebrates to the stream.

When the recording sheet says "lesser value," it means whichever number is smaller in that row goes there. The total for that is just adding those numbers together. The higher the total number, the healthier the stream.

RESULTS

Carter Park

In our project to determine Round Pond Creek's health, we first stopped at a section of the creek called Carter Park. A concerning piece of data is that 18 students rated the stream in poor condition in the category of litter (see Table 1). As for algae growth, 17 students rated it as excellent. Like algae growth, streambed had the most votes for excellent condition, with a total of 9 votes. Although those last 2 sections rated excellent, 19 students thought the stream's land use and animal life were both in fair/good condition. Meanwhile, 14 students rated Carter Park's sediment deposits as fair/good condition. Water clarity received 14 votes for fair/good condition.

Table 1: Carter Park Watershed Walk Visual Survey Responses

	Carter Park					
	NR	EX	F/G	PR	TOT	RESP
Land use by stream	3	0	19	9	31	28
Banks- erosion	3	0	19	9	31	28
Banks- vegetation	3	12	13	3	31	28
Water surface	3	0	17	11	31	28
Water color/clarity	3	3	14	11	31	28
Water odor	3	1	19	8	31	28
Stream bed siltation	3	0	16	12	31	28
Algal growth in stream	4	17	2	8	31	27
Animal life	2	10	19	0	31	29
Bacteria iron in stream bed	13	4	12	2	31	18
Litter	3	0	10	18	31	28
Human impacts in stream	2	0	13	16	31	29
Total	45	47	173	107	372	327
Average	3.8	3.9	14	8.9	31	27.3
% of Responses	0	14	53	33	100	

Table 2: Watershed Walk Habitat Survey Responses by Location

	Carter Park							Greece United Methodist Church						
	NR	EX	GD	FR	PR	TOT	RESP	NR	EX	GD	FR	PR	TOT	RESP
Stream Bed	4	9	7	6	5	31	27	5	17	8	1	0	31	26
Sediment Deposits	5	1	8	14	3	31	26	5	7	9	8	2	31	26
Streambank Stability	6	1	9	11	4	31	25	5	5	12	9	0	31	26
Streambank Cover	4	3	10	11	3	31	27	5	6	14	6	0	31	26
Total	19	14	34	42	15	124	105	20	35	43	24	2	124	104
Average	5	4	9	11	4	31	26.3	5	9	11	6	1	31	26
% of Responses		13	32	40	14	100			34	41	23	2	100	

	Journey Home							Athena High School						
	NR	EX	GD	FR	PR	TOT	RESP	NR	EX	GD	FR	PR	TOT	RESP
Stream Bed	5	11	12	3	0	31	26	9	5	10	6	1	31	22
Sediment Deposits	5	7	11	8	0	31	26	9	1	10	11	0	31	22
Streambank Stability	5	0	14	11	1	31	26	9	3	9	10	0	31	22
Streambank Cover	5	7	13	6	0	31	26	10	2	11	5	3	31	21
Total	20	25	50	28	1	124	104	37	11	40	32	4	124	87
Average	5	6	13	7	0	31	26	9	3	10	8	1	31	21.8
% of Responses		24	48	27	1	100			13	46	37	5	100	

	Sawyer Park							Apple Creek Lane/Latta Road						
	NR	EX	GD	FR	PR	TOT	RESP	NR	EX	GD	FR	PR	TOT	RESP
Stream Bed	5	7	14	1	4	31	26	11	3	7	8	2	31	20
Sediment Deposits	5	3	9	10	4	31	26	12	10	6	3	0	31	19
Streambank Stability	5	2	9	11	4	31	26	11	7	11	2	0	31	20
Streambank Cover	5	5	12	5	4	31	26	11	6	8	5	1	31	20
Total	20	17	44	27	16	124	104	45	26	32	18	3	124	79
Average	5	4	11	7	4	31	26	11	7	8	5	1	31	19.8
% of Responses		16	42	26	15	100			33	41	23	4	100	

Greece United Methodist Church

At Greece United Methodist Church, the class ranked the stream as being excellent or fair/good condition with 49.2% and 47.7% respectively (see Table 3). The class rated both water odor and algae growth as excellent with a rating of 25. 24 students rated water color/clarity as excellent. Water surface was also considered excellent with a rating of 18. The litter and stream bank erosion were both rated as fair/good condition by 24 students. The land use by the stream was rated as 21 and stream bed was rated as 18. Both of these numbers were rated as fair/good condition. Stream bank vegetation received a rating of 28 with excellent and fair/good condition combined. Human impacts in the stream received a rating of 26 with excellent and fair/good condition combined. Some of the animals that were present during our observations were ducks.

At the Greece United Methodist Church the water quality received a rating of 83.34%. The pH levels of the creek were 7.88 (see Table 6), which are within the neutral range. Conductivity was 86.449 microsiemens, which is within average range. The

Table 3: Greece United Methodist Church Watershed Walk Visual Survey Responses

	Greece United Methodist Church					
	NR	EX	F/G	PR	TOT	RESP
Land use by stream	2	8	21	0	31	29
Banks- erosion	2	3	22	4	31	29
Banks- vegetation	3	13	15	0	31	28
Water surface	4	18	9	0	31	27
Water color/clarity	3	24	4	0	31	28
Water odor	2	26	3	0	31	29
Stream bed siltation	4	7	18	2	31	27
Algal growth in stream	4	25	1	1	31	27
Animal life	3	10	17	1	31	28
Bacteria iron in stream bed	6	13	12	0	31	25
Litter	4	2	24	1	31	27
Human impacts in stream	4	14	12	1	31	27
Total	41	163	158	10	372	331
Average	3.8	3.9	14	8.9	31	27.3
% of Responses	0	49	48	3	100	

Table 4: Journey Home Watershed Walk Visual Survey Responses

	Journey Home					
	NR	EX	F/G	PR	TOT	RESP
Land use by stream	4	2	24	1	31	27
Banks- erosion	5	0	17	9	31	26
Banks- vegetation	4	17	10	0	31	27
Water surface	4	10	15	2	31	27
Water color/clarity	5	14	12	0	31	26
Water odor	5	20	6	0	31	26
Stream bed siltation	4	3	13	11	31	27
Algal growth in stream	6	23	1	1	31	25
Animal life	4	8	18	1	31	27
Bacteria iron in stream bed	6	20	5	0	31	25
Litter	5	11	14	1	31	26
Human impacts in stream	4	2	12	13	31	27
Total	56	130	147	39	372	316
Average	4.7	11	12	3.3	31	26.3
% of Responses	0	41	47	12	100	

nitrates and phosphates were also within acceptable levels at 1.06 ppm and 0.042 ppm. Sulfate levels were 1.24 ppm. A few readings were abnormally high. Those were chlorine at 78.1 ppm and E. coli levels which were higher than allowed for recreational use at 617 ppm, which is above safe levels by 401 ppm. Even though the macroinvertebrates were severely impacted at only 30 out of 100, the dissolved oxygen was at high levels of 21.6 ppm and 22.2 ppm, which are favorable levels for macroinvertebrates to survive.

Journey Home

The water clarity at Journey Home was rated excellent by 41.1% of the class (see Table 4). When testing human impact on the stream, 13 students rated it as poor. 12.3% of the class rated it as having major impacts on the stream. For land use by the stream, the class rated it fair/good. Little to moderate vegetation cover received a rating of 46.5% and 16 people rated the bank vegetation as excellent. 41.1% of the class rated the odor as excellent, while 46.5% of the class rated animal life as fair/good because very few animals lived there. When we looked at bacteria iron, 41.1% of the class rated it as excellent.

Table 5: Greece Athena High School Watershed Walk Visual Survey Responses

	Athena High School					
	NR	EX	F/G	PR	TOT	RESP
Land use by stream	6	4	19	2	31	25
Banks- erosion	5	2	20	4	31	26
Banks- vegetation	5	12	12	2	31	26
Water surface	5	6	18	2	31	26
Water color/clarity	5	8	17	1	31	26
Water odor	6	10	14	1	31	25
Stream bed siltation	6	1	22	2	31	25
Algal growth in stream	7	17	4	3	31	24
Animal life	7	0	22	2	31	24
Bacteria iron in stream bed	7	0	21	3	31	24
Litter	6	0	12	13	31	25
Human impacts in stream	5	4	5	17	31	26
Total	70	64	186	52	372	302
Average	5.8	5.3	16	4.3	31	25.2
% of Responses	0	21	62	17	100	

Greece Athena High School

On May 8th, 2007, at Greece Athena High School, 61.6% of the class rated the stream as fair/good condition (see Table 5). While 22 students gave a score of fair/good condition for animal life and stream bed siltation, bacterial iron in the stream bed was rated by 21 students as fair/good condition. Bank erosion was scored by 20 students as fair/good condition for land use by the stream. 19 students rated the water clarity as

Table 6: Summary of Additional Sampling Data

	G.U.M.C.	Sawyer P.	A.C./Latta
Air Temperature (degrees C)	23.1	22.9	22.8
Water Temperature (degrees C)	17.1	15.8	16
Width (feet)	15.83	11.42	11.75
Average Depth (feet)	0.43	0.55	0.627
Average Velocity (feet per second)	1.57	1.6	1.056
Streamflow Volume (cubic feet per second)	10.69	10.05	7.78
Dissolved Oxygen (parts per million - lower #)	21.6	16.6	19.4
Dissolved Oxygen (parts per million - higher #)	22.2	17.4	20
pH	7.88	7.33	7.4
Conductivity (microsiemens)	86.449	62.34	30.636
Alkalinity	5.877	5.233	5.196
Florine (parts per million)	0.13	0.12	0.1
Chlorine (parts per million)	78.1	54.7	22.3
Nitrates (parts per million)	1.06	0.89	1.12
Phosphates (parts per million)	0.042	0.037	0.03
Sulfates (parts per million)	1.24	1.36	1.89
Macroinvertebrates (% Model Affinity)	30	23	26
Microbes (colonies per 100 mL)	54,740	32,012	35,670
Fecal Coliform (colonies per 100 mL)	9,205	2,131	2,963
E. Coli (colonies per 100 mL)	617	128	137
Habitat: Stream Bed (qualitative)	Excellent	Good	Good/Fair
Habitat: Sediment Deposits (qualitative)	Good	Good/Fair	Excellent
Habitat: Streambank Stability (qualitative)	Good	Good/Fair	Good
Habitat: Streambank Cover (qualitative)	Good	Good	Good
Date of Watershed Walk	5/8/2007	5/11/2007	5/11/2007
Date of Measurement & Most Sampling	5/15/2007	5/15/2007	5/15/2007
Date of Macroinvertebrate Sampling	5/25/2007	5/25/2007	5/25/2007
Date of Coliform Sampling	5/28/2007	5/28/2007	5/28/2007

fair/good condition. Even though 17 students gave a mark of excellent condition for algae growth in the stream, human impact on the stream was given a rating of poor condition by 17 students. Examples of human impacts in the stream were a dam in the river, a bridge, and a parking lot.

Sawyer Park

At Sawyer Park, 54.4% of the class rated Round Pond Creek in fair/good condition (see Table 7). 23 students rated the land use by the stream in fair/good condition as well. Likewise 21 students rated litter in fair/good condition. There was a rating of fair/good condition for vegetation on the stream banks, water odor, and

Table 7: Sawyer Park Watershed Walk Visual Survey Responses

	Sawyer Park					
	NR	EX	F/G	PR	TOT	RESP
Land use by stream	4	4	23	0	31	27
Banks- erosion	3	1	13	14	31	28
Banks- vegetation	3	7	18	3	31	28
Water surface	4	12	13	2	31	27
Water color/clarity	3	17	11	0	31	28
Water odor	4	9	17	1	31	27
Stream bed siltation	4	2	17	8	31	27
Algal growth in stream	3	19	5	4	31	28
Animal life	5	11	12	3	31	26
Bacteria iron in stream bed	6	15	9	1	31	25
Litter	3	2	21	5	31	28
Human impacts in stream	3	6	19	3	31	28
Total	45	105	178	44	372	327
Average	3.8	8.8	15	3.7	31	27.3
% of Responses	0	32	54	13	100	

streambed siltation with a rating of 17. Algal growth was rated excellent with a rating of 19, and 17 students rated the water color as excellent.

We returned to Sawyer Park to do further testing on May 25, 2007. Our macroinvertebrate count yielded twenty-three (see Table 6). This indicates a severely impacted stream. In fact, twenty-three was found to be the lowest result from all three stops. Additionally, the *E. coli* was found to be unhealthy for shell fishing with a count of

128 per 100mL. However, the *E. coli* level was acceptable for recreational use. Interestingly, the alkalinity measurement was 5.233, which is unhealthy for the water. The dissolved oxygen levels were between 16.6 and 17.4 parts per million (ppm). The nitrate level was 0.89, which is an acceptable level for nitrates, according to Tom Darrah at the University of Rochester. Furthermore, our phosphate level was 0.037. That is an acceptable level for Round Pond Creek. Our pH level yielded a score of 7.33 which is acceptable for the water quality in Round Pond Creek.

Apple Creek Lane/Latta Road

The first things to notice about Apple Creek Lane and Latta Road are the concrete walls along one portion of the bank and the thick green algae along the streambed. Out of

Table 8: Apple Creek Lane/Latta Road Watershed Walk Visual Survey Responses

	Apple Cr./Latta					
	NR	EX	F/G	PR	TOT	RESP
Land use by stream	9	2	19	1	31	22
Banks- erosion	11	8	12	0	31	20
Banks- vegetation	11	12	8	0	31	20
Water surface	11	5	14	1	31	20
Water color/clarity	11	3	14	3	31	20
Water odor	10	13	8	0	31	21
Stream bed siltation	12	4	14	1	31	19
Algal growth in stream	11	19	4	7	31	20
Animal life	11	0	16	4	31	20
Bacteria iron in stream bed	12	13	6	0	31	19
Litter	12	6	12	1	31	19
Human impacts in stream	11	1	15	4	31	20
Total	132	76	142	22	372	240
Average	3.4	14	13	0.8	31	27.6
% of Responses	0	32	59	9.2	100	

all the categories, algal growth in stream received the poorest ratings of 7 (see Table 8). The excellent ratings were given to water odor, and bacteria iron in streambed.

Overall, 59.2% of the class rated Apple Creek Lane and Latta Road as fair/good. 31.7 % of the class rated Apple Creek Lane and Latta Road as excellent, and only 9.17% rated it as poor.

Most of our class agreed that there were some vegetation, some bare ground, and some paved ground, and few animals in the area. Unfortunately, there was also some litter, including a brown paper bag, and a Capri Sun in the water. The macroinvertebrates sampling yielded a score of 26 indicating that life in the creek is severely impacted (see Table 6). We took these samples on May 25, 2007. Additionally, there was a count of 137 *E. coli* colonies per 100 ml at this site, which is within acceptable limits. The conductivity was 30.636. This result was lower than expected for most creeks. The chlorine was 22.3.

Table 9: Number of Bacterial Colonies per 100 mL by Sample and Type

	TCWhite1	TCWhite2	AvgTC	Purple1	Purple2	AvgPurp	Pk+Pr1	Pk+Pr2	AvgPk+Pr
	Bact1 Colonies	Bact2 Colonies	AvgBact Colonies/100 mL	EColi1 Colonies	EColi2 Colonies	AvgEColi Colonies/100 mL	Cform1 Colonies	Cform2 Colonies	AvgCform Colonies/100 mL
GUMC - Up	63	142	56250	16	12	768.2926829	249	160	11222.56098
GUMC - Down	113	81	53231.70732	6	11	466.4634146	57	205	7189.02439
SP - Up	114	89	55701.21951	2	0	54.87804878	36	11	1289.634146
SP - Bridge	25	96	33201.21951	4	1	137.195122	30	49	2167.682927
SP - Down	16	10	7134.146341	2	5	192.0731707	77	30	2935.97561
AC/L - Up	18	12	8231.707317	2	3	137.195122	103	39	3896.341463
AC/L - Down	125	105	63109.7561	4	1	137.195122	43	31	2030.487805
AC/L Outfall	TNTC	TNTC	TNTC	5	14	521.3414634	117	227	9439.02439
GUMC Subtotal			54740.85366			617.3780488			9205.792683
SP Subtotal			32012.19512			128.0487805			2131.097561
AC/L Subtotal			35670.73171			137.195122			2963.414634

Key:

TC = Total Count	GUMC = Greece United Methodist Church
Bact = Bacteria	SP = Sawyer Park
Avg = Average	AC/L = Apple Creek Lane & Latta Road
NEC = Non-*E. coli* coliforms	Up = Upstream
Ecoli = *E. coli* coliforms	Down = Downstream
Cform = Total coliforms	TNTC = Too numerous to count (greater than 300)
Pink = Pink or red	
Purple = Purple or blue	
Pk = Pink or red	
Pr = Purple or blue	

Acceptable Levels for Bacteria in Water

Use	Maximum allow *E. coli* count (colonies/100 mL)
Drinking	4
Shellfishing	70
Recreation	235

DISCUSSION

Findings

At Greece United Methodist Church, the land around the stream seemed very natural, and had little to no litter. We hypothesized this was going to be the healthiest stop because of how clean it looked, the dissolved oxygen, and it had the highest and most variety of macroinvertebrates. However, it had the highest *E. coli* count. In fact, the count was higher than the state limit for drinking, fishing, and using the water for recreational use. Even though the water at Greece United Methodist Church is unhealthy, the water at Sawyer Park and at Apple Creek Lane/Latta Road is lower than the state limit for recreational use so it can be used for swimming, but not for drinking or shellfishing, or people might get sick because of the *E. coli*.

There was a rating of Carter Park for the watershed walk. 67.3% of the people thought that it was either in excellent or fair/good condition. There were animal tracks, which meant that it was a constant source of water for animals. Some parts of the water seemed pretty clear, although that doesn't always mean that the water is clean. 32.7% thought it was in poor condition. We observed film, foam, and oil in the water. These could be unhealthy factors.

Overall at the Journey Home, 87.6 % felt that the water condition was either excellent or fair to good. 12.4 % felt that the condition of the water was in a poor state. This might mean that the people who work at the Journey Home care for water by growing many plants that helps to keep the soil in place. This may help to prevent erosion.

While observing at Greece Athena High School, 82.8 % of the people thought that the conditions were excellent or fair/good condition. Trout were found in the water, above the dam, which might mean that the water is in good condition. Another thing that may have helped the trout survive was the cattails in the water, which are used in wetlands to take out all of the bad things, kind of like a filter. 17.2% of the people thought that the water conditions were poor because of all the garbage in the water like trash bags, computers, barrels, flash drives, etc. Along the edges of the river there was bacterial iron.

Trends that might impact the quality of the water are all the trash thrown into to the water. At all of the stops there wasn't one that had no garbage. Also it might have to do with the *E. coli* levels that were at each stop. None were safe for drinking or fishing and only two were safe for recreational use. From all the data that we collected we can think about what the health of the water is.

At all the three stops we sampled (Apple Creek Lane/Latta Road, Sawyer Park, and Greece United Methodist Church), the sulfates, phosphates, nitrates, fluoride, and chloride. Even though the chlorine was rather high, we know that all of these are at the acceptable range, however, we can't conclude their effect on Round Pond Creek. Also, all the three stops had unusually high dissolved oxygen levels, Greece United Methodist Church being the highest. We found out from two experts from the University of Rochester that dissolved oxygen levels that are unusually high (like ours) should be retested, or backed up with data from another scientist who tested the water in the past. Unfortunately we do not have that past data. Also, the experts said that since we tested in riffles, which tend to have more dissolved oxygen, that could also be the reason for high levels of dissolved oxygen.

At all the stops we sampled, the macroinvertebrate count was quite low for how high the dissolved oxygen was. This was quite puzzling, because the more dissolved oxygen, we would think the more macroinvertebrates, and if there are macroinvertebrates you can tell how healthy the water is. This is because there are two different kinds of macroinvertebrates, sensitive and tolerant. Sensitive macroinvertebrates can only live in little to no pollution and tolerant macroinvertebrates can live in polluted water or non-polluted water. At the stops we had a low count, which might mean that the water is impacted, or slightly unhealthy.

At Sawyer Park we observed exposed tree roots, loose soil, and steep banks. These are all signs of erosion, which is not a good thing to have around a stream. Even though Sawyer Park had erosion, the other stops we sampled at did not seem to have much erosion. Actually at Apple Creek Lane/Latta Road it seemed there to be a man made wall of concrete to maybe to stop erosion. We noticed at Journey Home that the workers put up a wall to try and stop erosion. Although at both sites there was an attempt to stop erosion, it was successful at Apple Creek Lane/Latta Road. At Journey Home, the crumbling walls did not prevent erosion. The trees, which were located along the bank, until you came to the wall, were starting to rot, so the roots could not hold in the soil. Therefore, water is washing the soil away and the trees are starting to fall over. As erosion occurs, loose sediment gets pulled into the stream by rushing water. The sediment causes the water to be clouded and sunlight cannot penetrate it to reach the plants. Plants need sunlight and carbon dioxide to produce their own food. While doing this they put oxygen in the air or water. This is called photosynthesis. Photosynthesis raises the dissolved oxygen level.

Improving on our work

If we could redo this expedition, we would fix many failures we've had. We have noticed many problems with data collection, analysis, and scientific procedures. We would fix these problems so that our findings could be more accurate. We could also get more done successfully and have time to do other related projects.

A problem we have had was when we were sampling for macroinvertebrates. We were supposed to collect 100 macroinvertebrates from each stop so that we could count the number of types of macroinvertebrates found in that particular area. At Apple Creek Lane/Latta Road and Sawyer Park we collected 100 macroinvertebrates. However, at Greece United Methodist Church, we only counted 50 macroinvertebrates because we ran out of time. Then we doubled the number of each type to equal a total of 100. We might have had incorrect numbers of macroinvertebrates when we doubled. What we could have done that would have worked better was to have counted consistent numbers of macroinvertebrates at each site. This would have improved our data because then the numbers would be more reliable.

When we were testing *E. coli* levels, there were a few tests we would have done differently. One thing is that we would have used a different method to put the drops of water samples in. We noticed that the drop sizes varied and this might have given us inaccurate data. We only did two *E. coli* and fecal coliform tests because we didn't have enough Petri dishes, but the directions called for three or more tests. We believe if we did more than two tests we would have more accurate data because some of our results on the two tests were very different and one more test would have given us a better understanding of our data. When we were counting bacteria colonies we had different perspectives of pinhead sizes, but if we all had the same perspective, our data could be even more reliable. For example, some people might count ten colonies on a Petri dish when another person might only count nine colonies because they had different perspectives of pinhead sizes.

When people were doing the dissolved oxygen test, we once again observed that the drop sizes were different. We should have used a different method of putting the water samples in the solution so we could have consistent drop sizes. The data isn't as reliable as it could be. A different method would be more reliable because it would give you the same drop sizes every time.

Another problem we had was when we were sampling pH on the sites. When we were doing this, we had only observed our teachers do it once before in the classroom. This didn't necessarily mean that our data was off, but it made it more likely. What we could have done was to practice in the classroom more before we left to do it in the field.

When people were measuring depth in the water, it was hard because we had to measure with a measuring tape. The measuring tape isn't a very reliable tool for depth because the currents might have slightly bent the measuring tape, giving us incorrect data. A yardstick would have been better because it wouldn't have bent when the currents hit it.

Another problem we had was when we were marking watershed walk visual surveys. The problem was that we only did this once for each stop that we considered important to observe. If we had done these surveys more times in different weather, we could see the creek from different perspectives. Also, conducting multiple surveys under the same conditions could help us find consistencies and inconsistencies in and around the creek that may affect our data.

Recommendations for further research

At Carter Park we only had the chance to do a watershed walk. We would suggest testing pH and dissolved oxygen. We think this because litter was very common and there were also many riffles. As the litter breaks down, acid could be released into the water. The acid would lower the pH level. With extremely low or high pH levels, the water can begin to burn the flesh of animals and humans.

Recently we discovered that at Carter Park the creek has changed since we were there on May 8, 2007. Because of our weather, some algae and water had dried, affecting what we observed. Researchers may want to go back and take a visual survey of the watershed. We noticed many animal tracks and inferred that animals were drinking the water. We might want to investigate the safety of the water for the animals. We also recommend testing to find out if pH and dissolved oxygen change at different points in the creek.

Most of the class noticed that there was moderate erosion, some vegetation cover, small evidence of soil loss, and a slight slope. Because of that, researchers might have to test for sediment deposits. Carter Park was the first stop we went to, meaning anything that occurred at Carter Park might affect the whole creek.

Although the Journey Home was not chosen to do any further testing than the watershed walk, we suggest testing for *E. coli* because there are five storm drain outfalls. Here there are also some man made changes. We might test the dissolved oxygen beyond the waterfall since we did not. Researchers might want to test for dissolved oxygen beyond the waterfall because that is one way dissolved oxygen gets into the water.

We suggest testing for macroinvertebrates because it did not look like a stable habitat. There were many large rocks on the streambed and there were not a lot of aquatic plants. It also might be a good idea to see if the bridge changes anything like chlorine from road salt.

At Sawyer Park we tested the dissolved oxygen. According to our results and experts from the University of Rochester, the dissolved oxygen is much unexpected. There are no available test results to compare it to. However, at Sawyer Park for our macroinvertebrate test, the creek received a score of 23 out of 100. This means the stream is "severely impacted." Apple Creek/Latta Road and Greece United Methodist Church are also severely impacted. We don't know what caused the stream to be severely impacted and wonder if there may be some studies researchers can do to figure it out.

It may be a good idea to find out how many people come to the park each day and how many bring pets. Pets make feces and people may not clean it up. Feces contains *E. coli*. We should also monitor if the creek changes in any way.

Here we saw that there was a good amount of erosion so the water has lost sediment deposits. This is bad because it blocks out sunlight. Amazingly there was a lot of dissolved oxygen that plants make, but plants need sunlight.

We were not able to get any tests done except for the watershed walk at Greece Athena High School. There was large amount of litter. There was a storm drain outfall and what looked to be a large concentration of bacterial iron. Because we only did a watershed walk here, we wonder what test results might come out that and what that would tell us about the health of the creek. We recommend that anyone who does testing here test the water for pH, to tell us if the water is safe for animals. Other researchers should also test dissolved oxygen to see if there is enough for fish and other animals to live.

E. coli should be tested because high levels of *E. coli* are not safe for people to ingest and it is harmful to animals. Trace metals should be tested because there was a large deposit of bacterial iron on the side of the bank and trace metals can cause many kinds of poisoning. Macroinvertebrates sampling should be done because they are a good indicator of stream health.

At Greece United Methodist Church there were undercut banks, a high dissolved oxygen level and five riffles. We recommend that people re-sample riffles for macroinvertebrates because we did not find many. We had a high dissolved oxygen level that was unexpected because macroinvertebrates need dissolved oxygen to live, and more macroinvertebrates should live in a place with a high dissolved oxygen.

One puzzling piece of data is that there was an *E. coli* count of over 700 colonies per 100 mL, which dropped to around 400 colonies/100ML in a matter of yards. Yet Greece United Methodist church seemed to be the cleanest site. We think *E. coli* testing should be redone at this site.

At Apple Creek Lane/Latta Road there were few animals, numerous storm drain outfalls and large amounts of algae; we recommend that people do more nitrates and phosphates tests to determine if the algae was there because of nitrates and phosphates or if it was natural. The dissolved oxygen should be retested because our test came out overly high and we do not have anything to compare the tests to. People might want to take more samples from the stream overall so that in the future people have something to compare their results to.

Actions to take

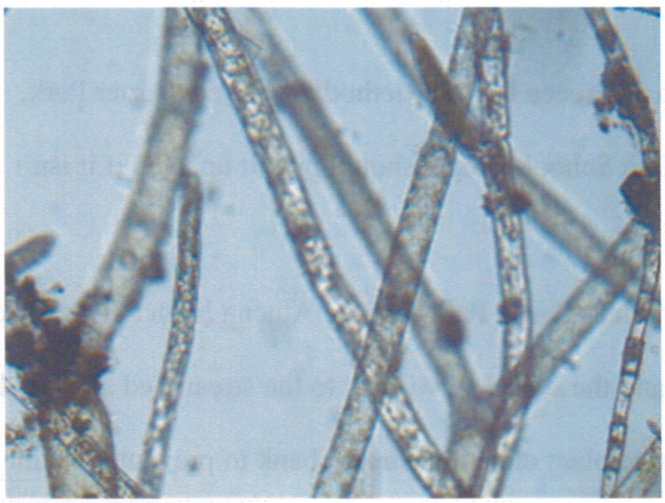
Because litter is very common at Greece United Methodist Church, Carter Park, Journey Home, and Greece Athena High School, people should pick it up even if it isn't theirs.

We did not see a lot of vegetation at Carter Park, Greece Athena High School, and Sawyer Park. This can cause erosion and the sediment will get to the streambed and block the sun. People can ask for permission to plant along the stream bank to prevent erosion. When the people plant, they should make sure the people at that site will take care of the plants so the firm roots will take hold in the soil.

What is nonpoint source pollution? It is pollution that you cannot trace back to the place where it came from. Some examples of nonpoint source pollution are fertilizer, pet waste, pesticide, herbicides, and car oil.

To pickup the oil after somebody's car has leaked, people can put kitty litter or sand on top of it and scoop it up. After people do that, they can put a baking sheet under it so that it won't leak on the driveway or the road any more. Also people can bring their oil to any shop that sells it and they must dispose of it properly for free.

Fertilizer is something people put on their lawn so that the grass will grow. It can be a problem because it has a nutrient called phosphorous and phosphorous can cause algae to grow. If too much algae grows, it can kill other plants and animals that live there. *Cladophora* is the most common type of algae. *Cladophora* is what we found mostly in Round Pound Creek with our guest speaker Mrs. Arnold. Algae is the main reason that Charlotte Beach is closed. When you call the Cornell Cooperative Association, you will be mailed a kit that explains how to determine the amount of fertilizer that can safely be absorbed by the soil.



E. coli is a type of bacteria that comes from feces. *E. coli* can grow in a type of algae called *Cladophora*. When *E. coli* levels get too high, that body of water will be closed to the public. If somebody ingests too much of the *E. coli*, they could get bloody diarrhea and kidney failure. To stop *E. coli,* people can use a bag to pick up feces when a dog defecates or when it is seen. When people take it home they can put it in the garage or flush it down the toilet. The better thing to do is flush it down the toilet, because people can recycle the bag so it doesn't have to decompose for 1000 years and the feces will go straight to the treatment plant. The reason that Durand Beach is mostly closed is because of *E. coli.*

Animals drink the water so if it's polluted, they could get sick from the water. Fish and macroinvertebrates also live in the water and they need clean water. It matters that people help prevent pollution so that when they want to go swimming, play in the water, or drink the water they can. Remember that everyday people doing everyday activities can harm the water, but if you follow these strategies, you'll be one more person who can help.

Appendix A: Watershed Walk Visual Survey Recording Sheets

WATERSHED WALK SURVEY

Please circle the condition that best describes your stream segment for each category. Consider the 1-mile area upstream of your stream segment as the watershed for ranking purposes.

Category	Excellent Condition	Fair/Good Condition	Poor Condition
Land use by the stream	undisturbed, good cover all year	little to moderate cover, some bare ground and some paved	bare dirt or completely paved, maximum disturbance
Banks - erosion	no erosion dirt is covered, no evidence of soil loss	moderate erosion some exposed dirt and some cover, slight evidence of soil loss, gentle slope	severe erosion exposed dirt, obvious loss of soil, steep slope
Banks - vegetation	good vegetation cover	moderate vegetation problems at high flow times	little or no vegetation exposed dirt
Water surface	no slick, film or foam	slight film or foam	film or foam is pronounced
Water color/clarity	clear water	little color or slight loss of clarity	highly colored or low clarity
Water odor	no odor	slight odor	severe odor
Stream bed siltation	no silt no erosion	slight silt some erosion	much silt shows erosion
Algal growth in stream	Moderate algal growth	no algae	overabundant algal growth
Animal life	abundant	few	none
Bacteria iron in stream bed	none	moderate	over abundant
Litter	none	small amount	very common
Human impacts in stream	little seems natural	moderate, some evidence of change	major - dams, pipes, road culverts, etc.

Category	Excellent Condition	Good Condition	Fair Condition	Poor Condition
Stream Bed	More than 50% rocks, logs, vegetation, undercut banks or other stable habitat.	50% to 30% rocks, logs, vegetation, or undercut banks. Adequate habitat for fish and aquatic insects.	30% to 10% rocks, logs, vegetation, or undercut banks. Less than desirable habitat for fish and aquatic insects.	Less than 10% rocks, logs, vegetation or undercut banks. Obvious lack of habitat for fish and aquatic insects.
Sediment Deposits	Little or no sediment deposits. Less than 5% of stream bed has sediment.	Some sediment deposits, mostly in pools. 5% to 30% of stream bed has sediment.	Moderate sediment deposits. 30% to 50% of stream bed has sediment.	Heavy deposits of sediment. More than 50% of stream bed has sediment.
Streambank Stability	Stable. No evidence of erosion.	Moderately stable. Only small areas of erosion.	Moderately unstable. Up to 60% of banks have evidence of erosion.	Unstable. 60% to 100% of banks have evidence of erosion.
Streambank Cover	More than 80% of streambank covered with vegetation, rocks and other stable material.	80% to 50% of streambank covered with vegetation, rocks and other stable material.	50% to 25% of streambank covered with vegetation, rocks and other stable material.	Less than 25% of streambank covered with vegetation, rocks and other stable material.

Please submit your completed form to:
Community Water Watch Volunteer Coordinator
249 Highland Avenue
Rochester, New York 14620

Appendix B: Macroinvertebrate Sampling Recording Sheets

Form #4
Monroe County Community Water Watch

Macroinvertebrate Data - Percent Model Affinity Method

Your team is asked to analyze benthic macroinvertebrates using the "Percent Model Affinity Method," at both of your monitoring sites, once each season. Please perform your analysis at the same time and locations as your visual surveys. Follow the instructions provided in the "Participants Manual."

Team Name: ______________________________

Team Members Present: ______________________________

Stream Name: ______________________________

Monitoring Site (#1 or #2): ______________________________

Date: ______________________________

Group	Common Name	% (#) in Sample	Model %	Lesser Value
Oligochaeta	worms		5	
Ephemeroptera	mayflies		40	
Plecoptera	stoneflies		5	
Coleoptera	beetles		10	
Trichoptera	caddisflies		10	
Chironomidae	midges		20	
Other	other		10	
Totals		**100**	**100**	

Water Quality Impact:

_____ Severe (≤34)
_____ Moderate (35-49)
_____ Slight (50-64)
_____ None (≥65)

Please submit completed form to:
Community Water Watch Volunteer Coordinator
249 Highland Avenue
Rochester, New York 14620

Appendix C: Local Organizations

Water Education Collaborative
c/o Rochester Museum & Science Center
657 East Avenue
Rochester, New York 14607

Phone: (585) 271-4552 ext. 324

Website: http://www.h2ohero.org/

They will help with storm drain marking, watershed walks, and macroinvertebrate sampling.

Cornell Cooperative Extension of Monroe County
249 Highland Avenue
Rochester, New York 14620

Phone: (585) 461-1000

E-mail: monroe@cornell.edu

Website: http://counties.cce.cornell.edu/monroe/monroe.html

They will test your soil.

Monroe County Household Hazardous Waste Program
444 East Henrietta Road
Rochester, New York 14620

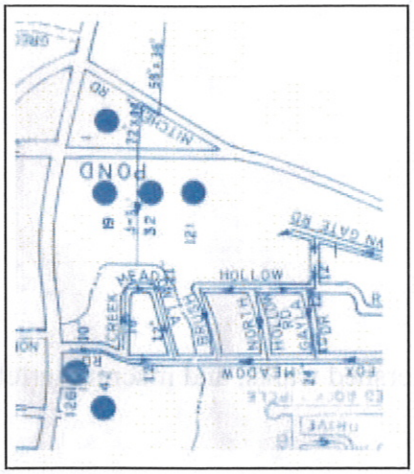
Phone: (585) 753-7600 (select option 3)

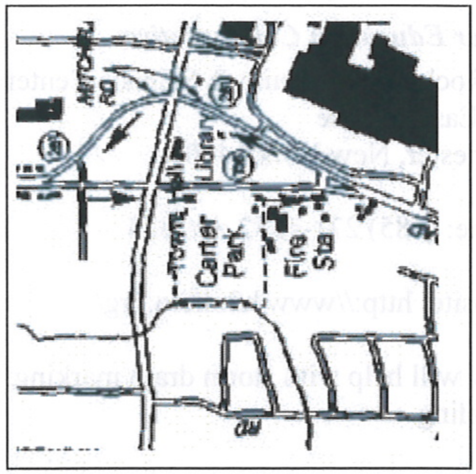
Website: http://www.monroecounty.gov/des-hhw.php

They will help you dispose of hazardous waste safely.

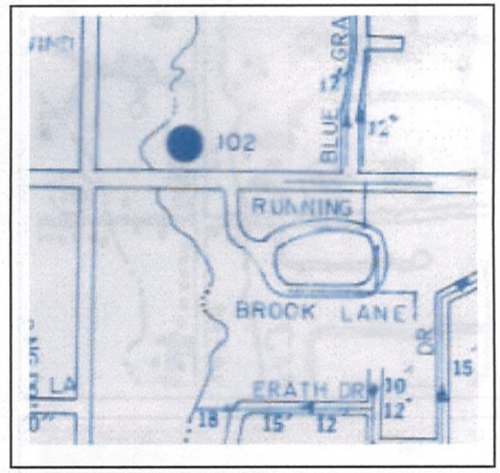
Appendix D: Stream Segment Maps

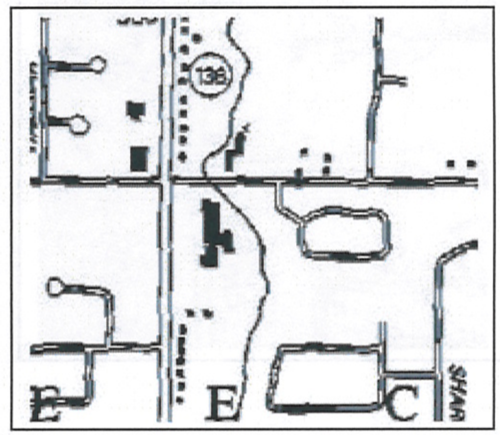
CARTER PARK & CREEKSIDE APARTMENTS



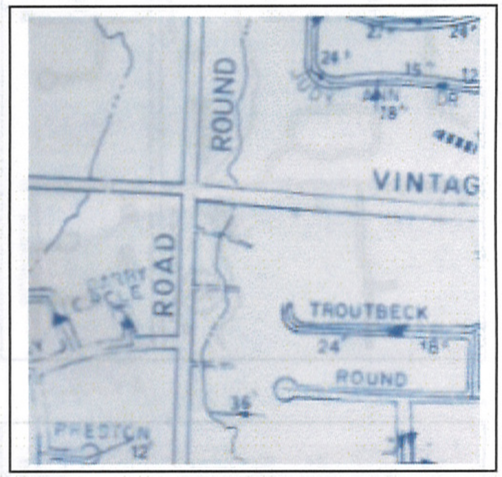


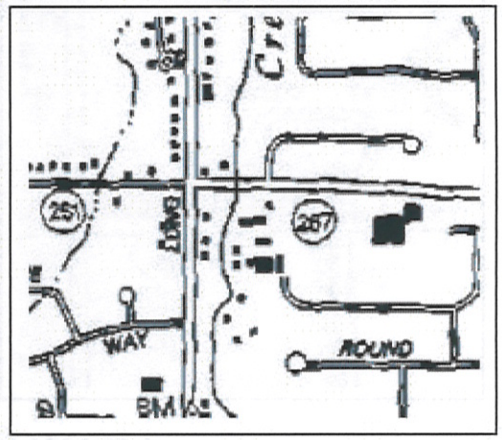
GREECE UNITED METHODIST CHURCH



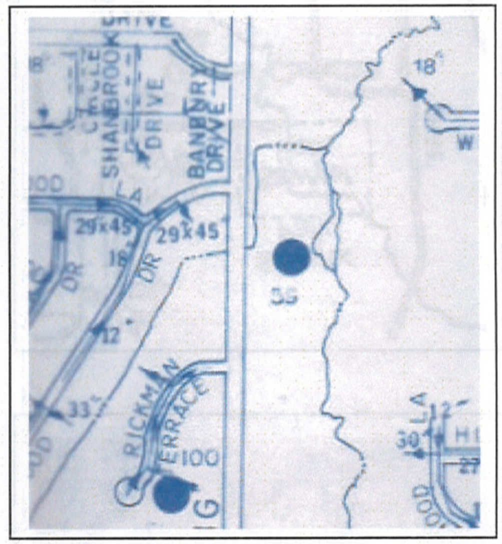


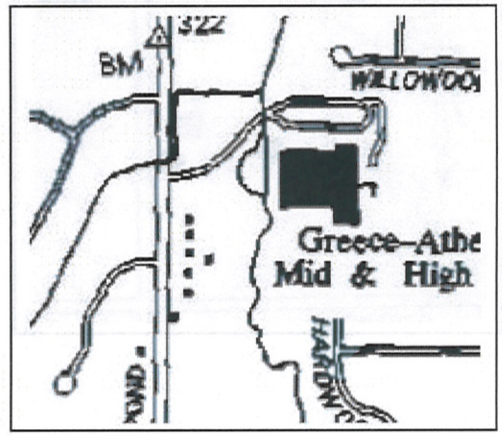
JOURNEY HOME





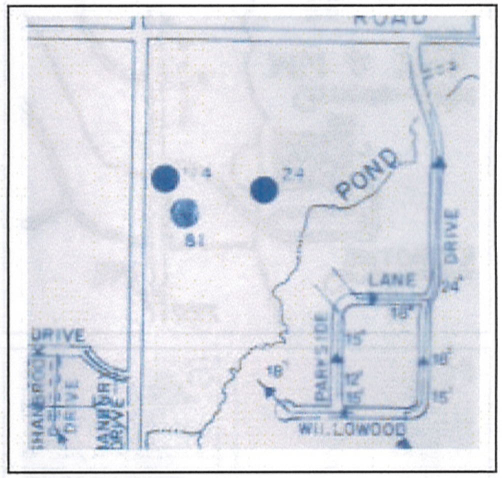
GREECE ATHENA HIGH SCHOOL

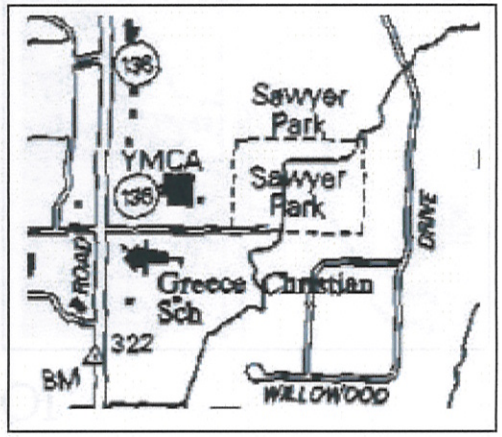




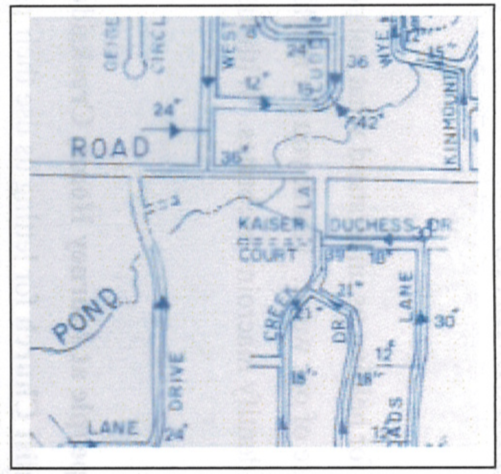
SAWYER PARK

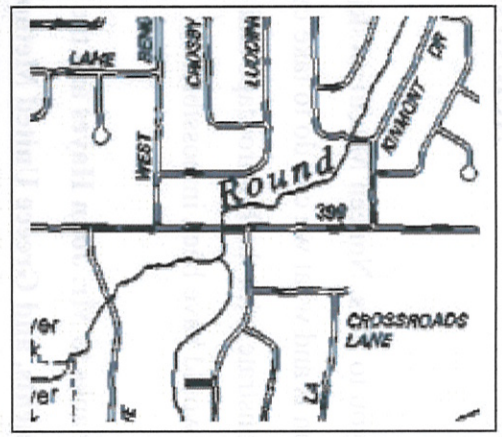

Google
Image © 2007 New York GIS
Pointer 43°14'54.67" N 77°41'30.04" W
Streaming ||||||||| 100%
Eye alt 2204 ft


ROAD
POND
DRIVE
LANE
PARKSIDE
WILLOWOOD
DRIVE


Sawyer Park
YMCA
Sawyer Park
DRIVE
ROAD
Greece Christian Sch
322
BM
WILLOWOOD

LATTA ROAD & APPLE CREEK LANE





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