MUSKEGON COMMUNITY COLLEGE

The effects of the Muskegon Community College Golf Course on the overall health of Four Mile Creek

A class research project

Environmental Science 110 Students

Fall 2010

By: Timothy Brown, David Donselar, Bianca Flores, Miles Glendening, Thomas Gould, Kris Kluting, Ana Ponce, Tiffany Shepherd, Jeremy Sowa, Kole Suchecki, Nicholas Swartz, Derek Tenbrink, Amber Woolf.

Abstract

We conducted a study on Four Mile Creek to see if the Muskegon Community College golf course had an adverse affect on the health of the creek. We assumed that the fertilizer used and other land alterations associated with the golf course, would contribute to high nutrient loading and Ph, and also decreased dissolved oxygen levels. To test this we split our class up into four teams and picked four sites along the creek. One was located upstream to test the quality prior to the golf course, one site was located at the gold course, and the other two downstream. At each of the sites we tested for dissolved oxygen, Ph, water and air temp, stream width, and took invertebrate samples. Ph was relatively consistent throughout each site, with an average PH between 7.6 and 8.1, only a .6 difference. Dissolved oxygen was similar with the golf course and the two sites downstream with an average between 6.3 and 7.7, the highest being directly after the gold course. The site before the gold course had an extremely low D.O. average of 3.4, which could use further research. Also invertebrate samples were fairly similar for all four of the sites. This shows that our original hypothesis was disproven. The golf course does not seem to have a negative effect on stream health that we could find evidence for. Although our research did raise concern for further upstream. Further research and testing of Four Mile Creek upstream is recommended.

Introduction

Out of all of the water on Earth, only a mere one percent is fresh and available for our usage. Even thought this fact is fairly well known, the general populous ceases to acknowledge how precious our fresh water resources really are. Water is extremely valuable for societal and industrial activities. The World Health Organization estimates that about 25 percent of the world's people do not have access to safe drinking water. (Enger and Smith 2010, pg. 335) Water is used in many of our daily activities that we take for granted like washing, cooking, and transporting wastes. Water is heavily used in agriculture and industries as well. Bodies of water also have an overwhelming affect on local climatic conditions that surround the water. Water in the form of streams and lakes also holds a priceless aesthetic value that cannot be easily replaced. Shortages of fresh water are continually being linked to pollution induced by human sources.

Everything is interconnected. In the state of Michigan, the majority of the fresh water sources come from creeks, streams, rivers, lakes and ground water. All of these bodies of water eventually empty into the Great Lakes. Any pollution, disruption of habitat, or outsourcing of the water in these creeks, rivers and lakes will eventually end up affecting the larger spectrum of the hydrological cycle. To prevent further harm to our precious fresh water supplies, we need to limit the negative impact done to our waterways. Research and monitoring of our waterways can aid in preventing and revealing pollution. Four Mile creek begins its flow forty yards east of Sheridan Road and intertwines through many human altered ecosystems along the way to its final destination. Four Mile Creek eventually merges into the Muskegon River which runs into Muskegon Lake which eventually ends up in Lake Michigan. As one could conclude any affect on Four Mile Creek could have a long lasting affect further downstream.

The question raised for the Environment Science 110 class at Muskegon Community College is than; could the surroundings of Four Mile creek have an effect on the ecosystems it

interacts with and possibly alter the water we use? We decided to look into it further. After observing the land uses and environments along the creek near the school, we concluded that the Golf Course which Four Mile Creek runs though, located just upstream from Muskegon Community College, may very possibly have a negative impact on the overall health of Four Mile Creek.

Methods

For our research on Four Mile Creek, we separated into four groups, each testing at a different designated site along the river. The first site was located upstream from the golf course next to a primary school we choose this site as the control for our research. All of the following sites would be our experimental groups for our research. The second site was located at the golf course and was at the bottom of a fairway. The last two sites were both located downstream from the golf course. The first of these was located at MCC in the Kasey Hartz Nature Preserve. The second site was located on the other side of U.S. 31. (See figure 5 for a map of the sites). Each group was responsible for testing important factors in their sector. These included: Dissolved oxygen, invertebrates, Ph, temperature (both stream and air), stream width, and sampling for invertebrates. Each group has gone out and tested their site weekly between noon and two-thirty p.m. To insure accuracy we reproduced the tests the same each time. Our procedures were as follows:

Dissolved Oxygen

At each testing site each team sampled dissolved oxygen content in the water. Dissolved oxygen is important to stream health because different species need an adequate amount of oxygen in the water to survive. Thus, dissolved oxygen reveals the health of the stream. When we tested for dissolved oxygen, each team used a capped glass bottle and carefully filled it underwater and capped it without letting air into the bottle. Then back in the lab, each team conducts the necessary steps in order to get an accurate dissolved oxygen reading. Each team used the essential instructions in the L.A. Mottle Dissolved Oxygen testing kit code 5860.

Invertebrates

Each team took samples of invertebrates from the benthic zone of their sites using a D-net. They stirred up rocks and soil at the bottom of the stream and sweeped the net through to collect the invertebrates. We used a white tray to sift through the debris, then identified and counted the insects. We then recorded our findings as perscribed by In Stream Survey requirments. Some of the invertebrates were put in jars and taken back to lab to preserve for further observation, though the majority were released.

PH

Each team used a PH Testr Basic, serial number 1221099, to test the waters pH level. To test for the level we swirled the tester in center of stream for five minutes or until the reading remained stable for a extented time.

Temperature

Each team tested both the air temperature and water temperature at their sites every time we conducted tests. The air temperature was taken with a common Kestel 3000 thermometer by holding in the air until the temperature reading remained stable. We then tested the water temperature with the same instrument by holding it in the water until the reading remained stable.

Soil

This test was only conducted once at each site at the same day and time. Each group used a core sampler to test the soil, no more than 1 foot away from the stream. This entailed pushing the core until it was full of soil to the top. The sample was then brought back to lab for further testing. In lab, the teams took soil tests using designated soil testing kit. We then analyzed and recorded the following; Potash, pH, nitrogen, and phosphorous levels.

Stream Width

Each team used a metric tape measure to measure the stream. One person held the end of the measuring tape at one side of the stream while another waded across to the other side and took the measurements. Test was done in meters (m)

Results

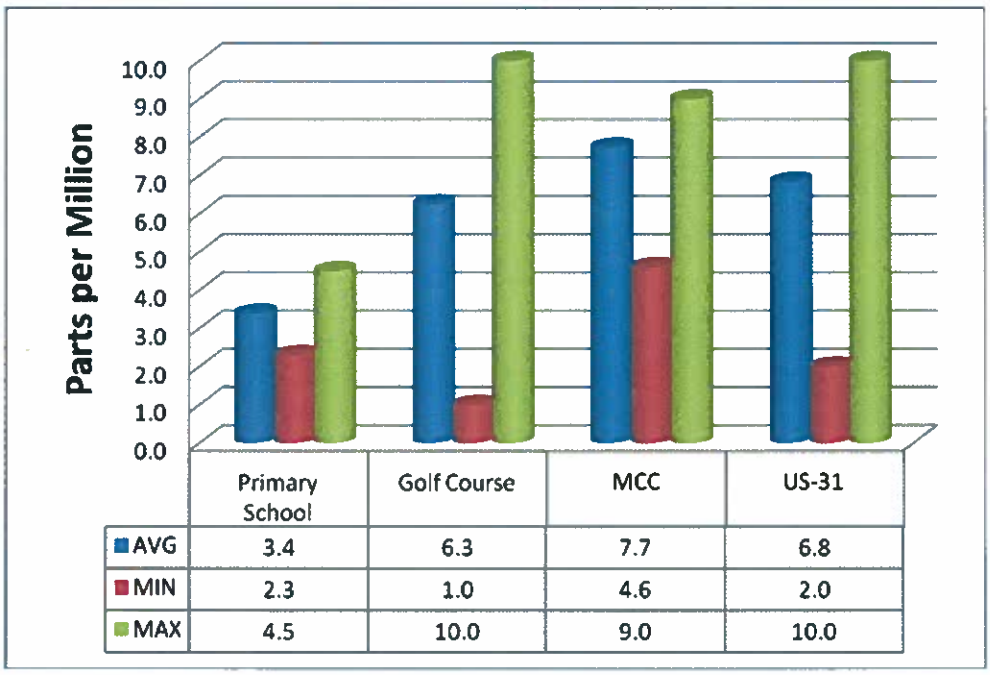
Dissolved oxygen levels changed by 4.3 ppm between the highest and lowest averages. With exception of the Primary school test site, the average D.O. levels were between 6.3 and 7.7 ppm (See figure 1). The Primary school showed unusually low D.O. levels with an average of 3.4 ppm. The MCC test site had the highest average at 7.7 ppm.

Our teams seemed to have not accurately recorded our invertebrate data. Data is missing for over half of the times that we tested. Also the data that our teams did end up with in the end was recorded in various different methods which were not very comparable. As important as invertebrates are as indicators of stream health we choose to disregard this data.

The PH levels were very consistent between the different test sites, with an average PH between 7.6 and 8.1, only a .6 difference (see figure 2). The lowest PH average, being at the MCC site, was 7.6. The highest PH average was at the site directly after MCC and had a level of 8.1.

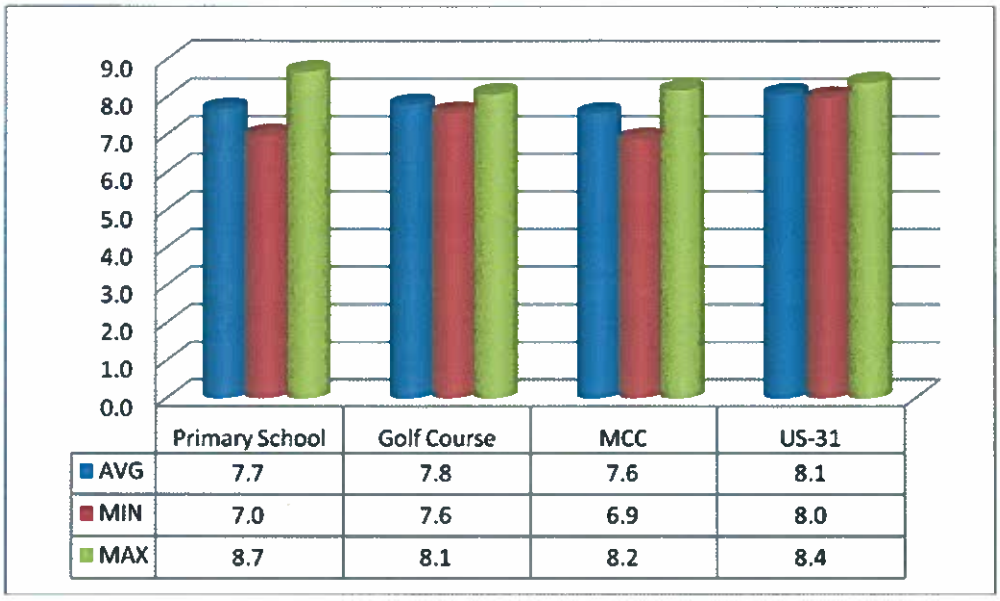
Water temperature also remained very consistent from site to site with an average change of four degrees Fahrenheit (see figure 3). Average minimum and maximum temperatures were also very close to each other.

The following figures show our data compiled into graphs with brief explanations and interpretations included for the reader's convenience.



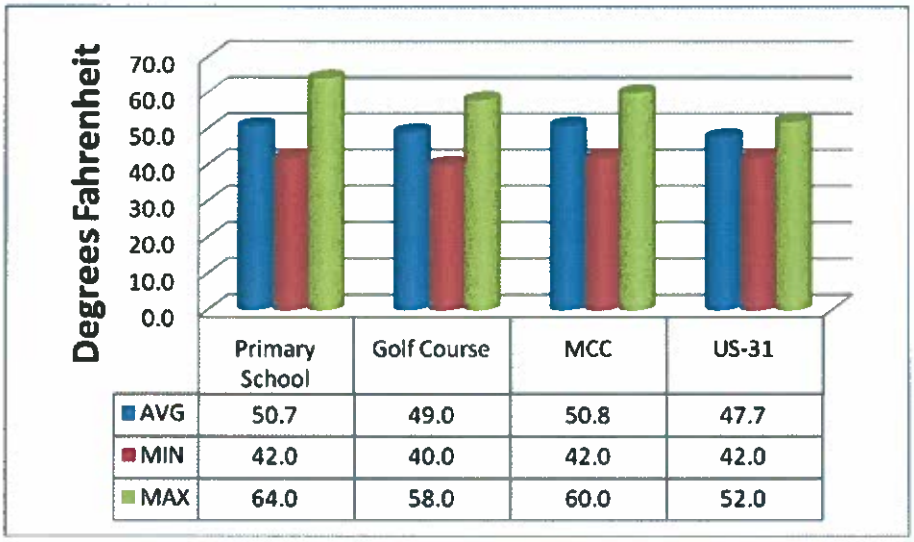
	Primary School	Golf Course	MCC	US-31
AVG	3.4	6.3	7.7	6.8
MIN	2.3	1.0	4.6	2.0
MAX	4.5	10.0	9.0	10.0

Figure 1. Dissolved oxygen averages including minimum and maximum levels. We tested for D.O. at each of the sites to get an idea of stream health. Dissolved oxygen is produced from photosynthesis and must be at least 4ppm to support life. We found that the first site has a dangerously low dissolved oxygen level, but the other three were relatively close, with the site after the golf course having the highest average level. This showed an increase in dissolved oxygen after the golf course.



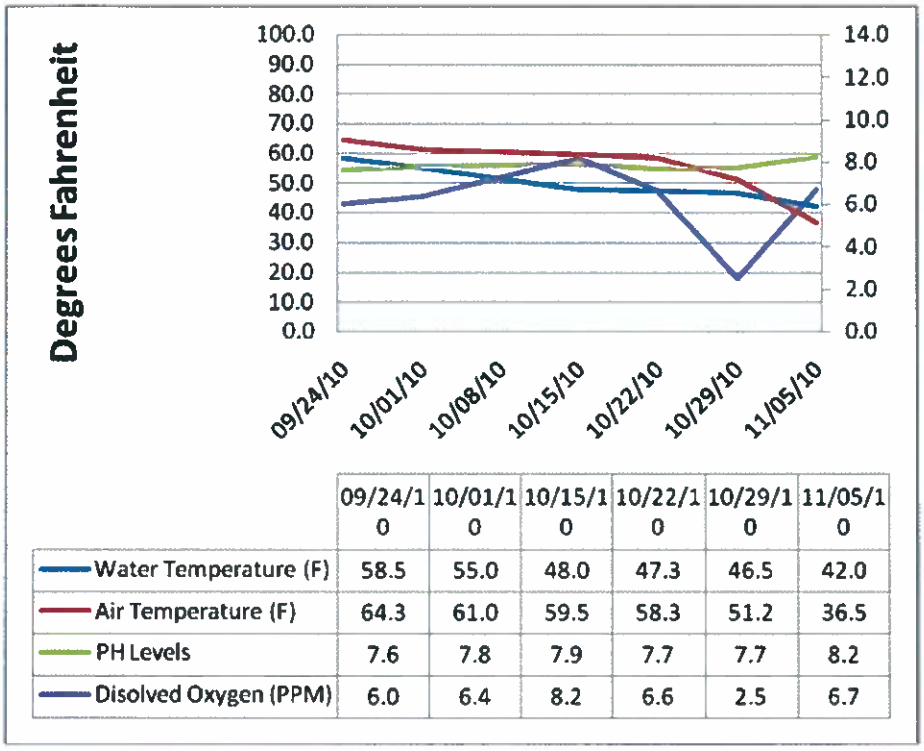
	Primary School	Golf Course	MCC	US-31
AVG	7.7	7.8	7.6	8.1
MIN	7.0	7.6	6.9	8.0
MAX	8.7	8.1	8.2	8.4

Figure 2. PH averages including minimum and maximum levels. The PH level of a stream is important to see how basic or acidic the water is. Freshwater organisms can't live in water that is too basic or acidic. Our tests found that each site had an average between 7.6 and 8.1. This shows a good PH level that is consistent for all four of the sites.



	Primary School	Golf Course	MCC	US-31
AVG	50.7	49.0	50.8	47.7
MIN	42.0	40.0	42.0	42.0
MAX	64.0	58.0	60.0	52.0

Figure 3. Water temperature averages including minimum and maximum levels. Showing the water temperature gives us an idea as to what the dissolved oxygen levels should be at. Colder water should be able to hold more dissolved oxygen than warmer water.



	09/24/10	10/01/10	10/15/10	10/22/10	10/29/10	11/05/10
Water Temperature (F)	58.5	55.0	48.0	47.3	46.5	42.0
Air Temperature (F)	64.3	61.0	59.5	58.3	51.2	36.5
PH Levels	7.6	7.8	7.9	7.7	7.7	8.2
Disolved Oxygen (PPM)	6.0	6.4	8.2	6.6	2.5	6.7

Figure 4. Shows average water temperature, air temperature, PH, and Dissolved Oxygen for all groups for every day field tests were conducted. Showing that PH remained consitant throughout the entire test time, and evrything else varied greatly as the season wore on. Both the drop in water and air temperature was to be expected but not the random drop in dissolved oxygen.

Figure 5.

Discussion

Our studies on four Miles Creek showed that it was a relatively healthy creek when it runs through Muskegon Community College's campus and after it. Our research also found that the creek was not negatively affected by the golf course. They could employ better land use tactics around the golf course to help with runoff, but overall it doesn't seem to have a negative effect on dissolved oxygen, Ph, air/stream temperature or invertebrate samples. This disproves our hypothesis that the MCC golf course would adversely affect the overall health of Four Mile Creek.

The golf course had an average Ph of 7.8, an almost neutral reading. This shows good health in being neither strongly acidic nor basic. Also the Ph remains relatively consistent after the golf course showing that the golf course isn't sending lots of detectable chemicals downstream. The dissolved oxygen levels were also adequate at the golf course with an average of 6.3ppm. The D.O. level even goes up at the next testing site possible showing that the golf course area has a positive contribution to the streams dissolved oxygen levels, promoting life.

Our research did raise some concern to the low dissolved oxygen average for the Primary School testing site. With an average of 3.4, it shouldn't be able to support any aquatic life. The Ph readings for this site were on target, but with such a low levels of D.O, the creek could be in crisis further upstream. If we were able to conduct another experiment on this creek in the future we would move further upstream and try to figure out what contributes to that site having such a low D.O. and see what the stream health is like. From this research it would be easy to conclude that the stream is less healthy further upstream and is almost filtered by the stagnant flow of the golf course.

Our data from the first week is possible skewed because it was our first time out in the field and many of the team members were inexperienced with the equipment. Also one team initially was testing at a different site and had to relocate after the first week because of a change in the focus of study.

On October 29th every team reported an extremely low D.O. level that should have killed all

life in the stream. We are still not sure what caused the sudden drop in D.O. We have further hypothesized that perhaps the drop in D.O could have been caused by the overcast weather, or perhaps from the leaves being dropped at this time. This would be a good subject to research in the future; how the leaves and weather affect the water environment. Additionally our teams lost or did not accurately record our data on invertebrates. This lost data could have given us a wealth of evidence as indicators of stream health that could have possibly altered our results and conclusion. Furthermore, we would recommend longer testing time period, and perhaps have two people do the same test to ensure greater accuracy.

Conclusion

We initially hypothesized that the golf course would have a negative effect on the health of Four Mile Creek. Our results accordingly denied our hypothesis. Our results actually revealed the opposite of our hypothesis; that the golf course actually seems to have a positive effect on the health of Four Mile Creek. We mainly based this conclusion on the trends of D.O and PH levels. Further downstream from the golf course at each of our testing sites revealed to be in better health than upstream from the golf course which we tested at.

Literature Cited

Enger, D. Eldon, Smith F. Bradley. 2010. *Environmental Science; A Study of Interrelationships. (12th ed.) New York, NY: McGraw-Hill Companies Inc.*

Enger, D. Eldon, Smith F. Bradley. 2000. *Field & Laboratory Excercises In Environmental Science. (7th ed.) New York, NY: McGraw-Hill Companies Inc.*

Kentucky Water Watch Volunteers, Palmer, Joanne. (10/26/10). *Kentucky Water Watch.* *http://www.state.ky.us/nrepc/water/wcpdo.htm*

United States Geological Survey. (12/13/10). http://ga.water.usgs.gov/edu/earthwherewater.html