

DOG RIVER WATER QUALITY: BEFORE AND AFTER PRECIPITATION

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The Dog River Watershed is an important drainage basin of the Mobile, Alabama area. Since urbanization has changed the natural course of some of the tributaries of the watershed it has become important to monitor the quality of the water. Precipitation can lead to the leaching of contaminants into the water by displacing them from the surface. This could potentially have an effect on the wildlife in Dog River and its use as a recreational source for people. In this paper, I discuss the alterations of water quality before and after a rain event in natural and urbanized tributaries. Water chemistry is essential in the detection of alterations before and after a rain event. These water quality categories include pH, dissolved oxygen, alkalinity, hardness, and turbidity. Identification of changes requires the comparison of these water quality categories which will determine the differences between the urban and natural tributaries to the Dog River Watershed before and after a rain event. The results of the comparison show the effects channelization of the river has had on the watershed and where the most problem areas are.

Keyword: water quality, Dog River, urbanization.

Introduction:

The most important characteristic of life as we know it depends on one thing, accessibility to water. Living organisms require water in order to exist at all. Humans require a high quality, or clean, source of water to exist and carry on with everyday life. Cleanliness of water can be tested using water quality testing methods. Water quality is the physical, chemical, and biological characteristics of a water body (USGS, 2011). By measuring the conditions of water, acceptable levels of specific elements such as pH, alkalinity, turbidity, and dissolved oxygen can be determined based on its intended use. The entirety of the Dog River Watershed can be susceptible to water quality alterations based on the various positions of the tributaries. These streams, either natural or manmade, feed into Dog River which drains portions of the city of Mobile into the Mobile Bay. Since the watershed drains parts of land inside the city limits, it is important to understand the conditions of the water in both urban and rural settings. This is because one city block can generate up to five times the amount of runoff than a wooded area of

the same size (EPA, 2011). Comparing both urban and rural settings will help to determine the areas of the watershed that are most affected before and after a rain event.

A variety of wildlife and humans depend on it for recreational purposes. It is important to ensure safe quality levels of the water for all who may use it. During recent research, it was discovered that there are various levels of turbidity visible within the watershed. Turbidity is essentially the suspension of particles in a body of water which make it less transparent. The causes of increased turbidity levels could be from urban runoff or from natural causes. Turbidity warms water by attracting more sunlight and thus, decreases oxygen levels because warmer water holds less oxygen than colder water (Brown and Clifford, 1995). But what causes the turbidity in the Dog River Watershed? What happens to it after a rain event? Most importantly, does this affect any other aspects of water quality?

Research Question:

How is water quality affected in Dog River before and after a rain event? To determine the answer to this question, basic elements of water chemistry can be applied. Samples from various points in the river can be obtained and tested before and after rain events in order to determine the effects precipitation has on the quality of water. It is important to know these results to show what areas of the watershed are the safest in terms of water quality for wildlife and human recreation.

Methods:

Obtaining the necessary results from the Dog River Watershed using water quality tests would first require a plan. Selecting sites to test was based on the criterion of natural and created creeks as well as accessibility (Fig 1). These four sites were tested once before a precipitation

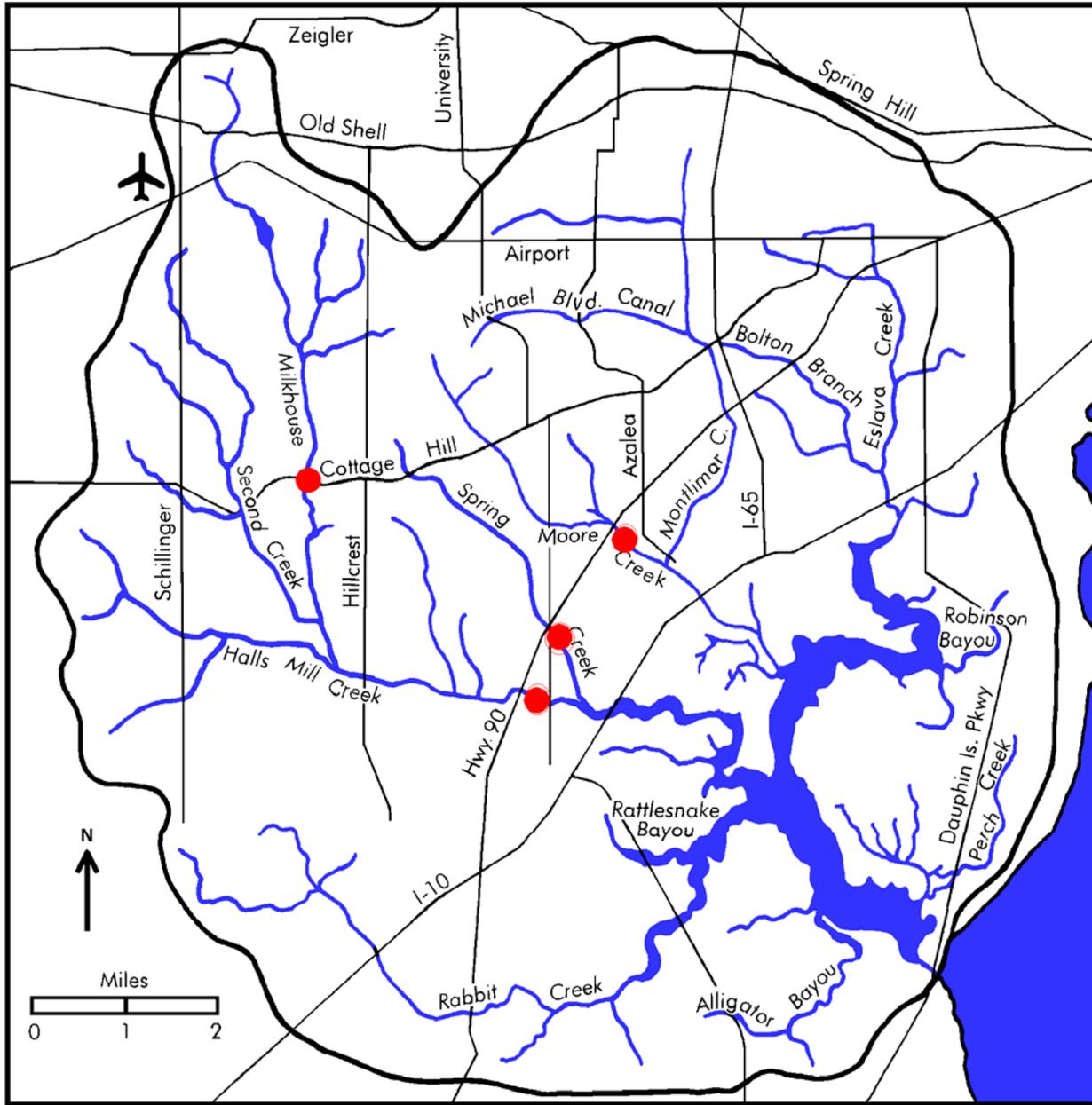


Figure 1: Map of Dog River Watershed with site locations
 Source: Google Earth

event (March 19, 2011), as well as once after a precipitation event (March 23-24, 2011). The first step at a selected site was to safely execute a sample capture with a Lamotte water sampler. The sample was taken from near the center of the stream. Upon lowering the sampler to

submersion the sample was captured. Next, the water sample was unloaded into a small dishpan which was narrow and deep to accommodate the testing actions. The temperature of the sample was taken and recorded for use with the water testing kit. Testing for dissolved oxygen and oxygen saturation was started after this point in order to lessen any environmental contamination as well as because it takes the longest to complete. Two samples were fixed for dissolved oxygen testing as the other tests carried on. After fixing the dissolved oxygen samples, the pH of the water sample acquired was taken and measured to the nearest 0.5 of a whole number according to Alabama Water Watch guidelines (AWW, 2011). The sample then underwent tests for hardness next which required the sample to be recorded in mg/L. After completing hardness testing, the testing for alkalinity was next. The alkalinity test was also recorded in mg/L. At this point, the dissolved oxygen samples were completely fixed and tested based on the amount of oxygen in the sample, measured in parts per million, and the percent of oxygen saturation in the sample. The final test conducted at the site dealt with turbidity. In order to complete this test, a bottle of distilled water was used as a control. Turbidity reagent was added to the distilled water in a 50 ml cylinder in order to compare it to the sample taken. These results were recorded in a notebook accordingly.

Results:

The data generated was tabulated both before (Table 1) and after (Table 2) precipitation events. A difference table was also generated to show any changes due to the precipitation event (Table 3). Additionally, this information is represented graphically before (Fig 2) and after a precipitation event (Fig 3).

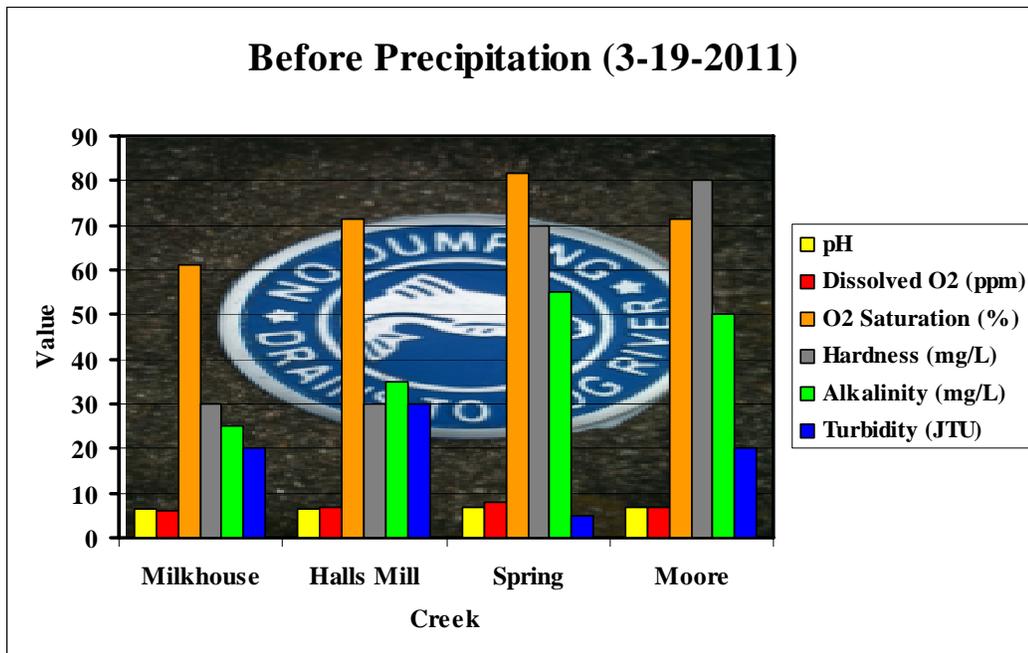


Figure 2: Graphical analysis of water quality before a precipitation event.

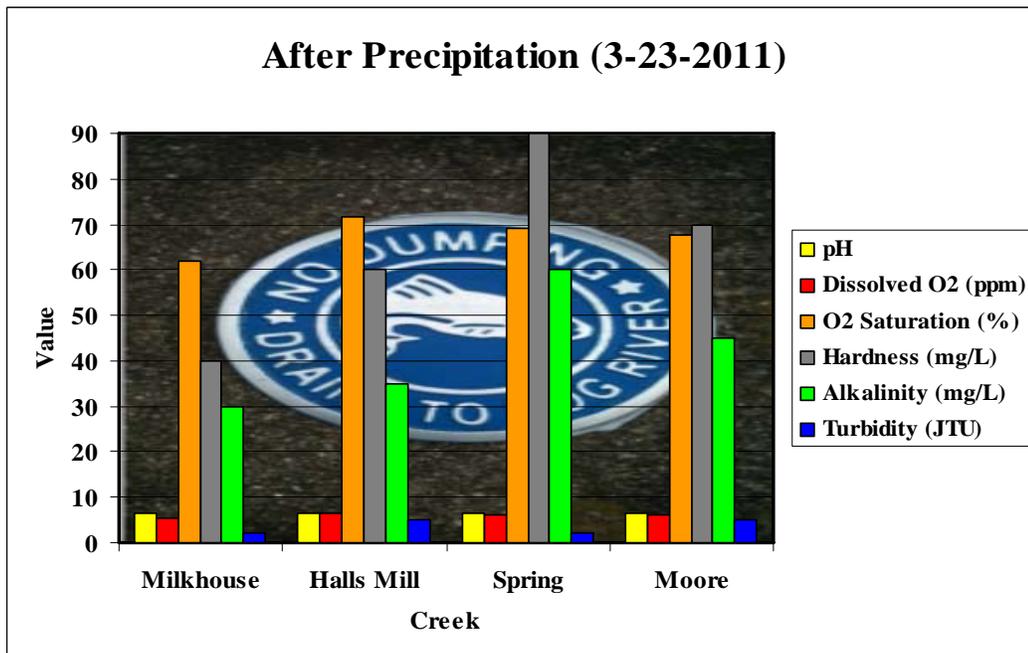


Figure 3: Graphical analysis of water quality after a precipitation event.

Discussion:

After analyzing the results, the facts are somewhat surprising. Some categories had little or no change before and after event while some fluctuated greatly. The measurement of pH either stayed the same or decreased by 0.5 which means that precipitation generally does not contribute to the acidity or basic properties of Dog River. Dissolved oxygen (ppm) slightly decreased at all four sites which accompanied small gains in percent saturation at Milkhouse Creek and Halls Mill Creek, which are both natural creeks. Large decreases in oxygen saturation were recorded at Spring Creek, which is lined with gabions and at Moore creek, which is manmade. Hardness levels increased at Milkhouse, Halls Mill, and Spring Creeks after a rain event while it decreased slightly at Moore Creek. Alkalinity levels stayed the same at Halls Mill creek and increased slightly at Spring and Milkhouse Creeks. The alkalinity level slightly dropped at Moore Creek. The largest difference recorded was that of turbidity. Visibly, the water at all sites was clearer and less murky. After a precipitation event, water would seemingly end up in the creeks from runoff and take any material with it. Surprisingly, turbidity levels dropped across the board at every site visited just twelve hours after the completion of the precipitation event. Rainfall amounts totaled around three quarters of an inch of rain for this event.

Conclusion:

According to these results, it is possible that precipitation does have some effect on the water quality of Dog River. Precipitation seems to affect the hardness, oxygen saturation levels, and turbidity of the water. An elevated hardness level will not have any effect on the environment of Dog River since hard water does not appear to cause any adverse effects on the

health of humans (Smith, 1986). Hardness levels could have increased due to the amount of runoff entering the creeks of Dog River from the urbanization of the land. When oxygen saturation levels drop off significantly, as they had done after the precipitation event in Spring Creek, it could potentially affect the wildlife that are inhabiting it. The lowering of the dissolved oxygen levels could have occurred from the tidal flow of the creek system. Also because of the precipitation event, turbidity levels were also decreased at all four sample sites. Having a lower turbidity level indicates that the water is more suitable for human recreation. It is also more favorable for some types of wildlife that require sunlight in order to grow efficiently (Brown and Clifford, 1995). Turbidity levels could have fallen because of the amount of organic material, such as algae, being removed from the creeks.

These results show some improvement as well as degradation caused by a precipitation event in Dog River. Dog River is able to sustain safe enough water quality levels after precipitation events as compared to the research completed by Smith and Desvougues in 1986. The data also seems to support that natural creeks tend to react different to precipitation events as opposed to manmade creeks. This represents that urbanization of some creeks can be degrading to the overall quality of the water. However, natural creeks seem to be less affected by a precipitation event.

Using the data collected in this research should help the Dog River community in determining where precipitation events will likely cause the most adverse effects on water quality. Being able to use this information should help keep the Dog River Watershed a safe place to enjoy for many years to come.

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Appendix:

Table 1: Analysis of samples before a precipitation event (3-19-2011).

	pH	Dissolved O2 (ppm)	O2 Saturation (%)	Hardness (mg/L)	Alkalinity (mg/L)	Turbidity (JTU)
Milkhouse	6.5	6	61.22	30	25	20
Halls Mill	6.5	7	71.43	30	35	30
Spring	7	8	81.63	70	55	5
Moore	7	7	71.43	80	50	20

Table 2: Analysis of samples after a precipitation event (3-23/24-2011).

	pH	Dissolved O2 (ppm)	O2 Saturation (%)	Hardness (mg/L)	Alkalinity (mg/L)	Turbidity (JTU)
Milkhouse	6.5	5.5	62.06	40	30	2
Halls Mill	6.5	6.5	71.66	60	35	5
Spring	6.5	6	69.04	90	60	2
Moore	6.5	6	67.64	70	45	5

Table 3: Differences between Table 1 (Before) and Table 2 (After).

	pH	Dissolved O2 (ppm)	O2 Saturation (%)	Hardness (mg/L)	Alkalinity (mg/L)	Turbidity (JTU)
Milkhouse	0	-0.5	0.84	10	5	-18
Halls Mill	0	-0.5	0.23	30	0	-25
Spring	-0.5	-2	-12.59	20	5	-3
Moore	-0.5	-1	-3.19	-10	-5	-15