

LAND DEVELOPMENT AND ITS AFFECT ON WATER QUALITY IN HALLS MILL CREEK

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As the city of Mobile continues to grow, so do problems associated with its largest watershed. Water quality in the Dog River Watershed has declined over the years. A major contributor to the decline has been sedimentation in the streams due to storm water runoff. An obvious culprit is construction sites. As land is being developed and cleared, sediment is moved around and left exposed. Eventually, the sediment is carried into streams by rainfall, which Mobile receives an abundance of. If Best Management Practices are in place and adequately used, then the amount of sediment reaching streams should decrease dramatically. Unfortunately, construction sites tend to be poorly maintained. My focus in this study is an area of construction on Hillcrest Road near Halls Mill Creek, one of the cleaner creeks in the watershed. By testing turbidity levels in areas upstream and downstream from the construction, I am able to show differences in water quality resulting from the construction. I can then use the data and see if it provides any evidence of a correlation with the use of BMP's and water quality. The resulting data showed that turbidity was slightly higher downstream but not of a significant increase. Most likely this was due to properly maintained BMP's.

Keyword: sedimentation, Best Management Practices, runoff

Introduction

Mobile County is home to the Dog River Watershed. About 60% of the watershed is located within city limits with the remainder in suburban and rural areas of the county. The river and its tributaries drain most of the city and they function as important recreational waterways (Alabama Water Watch 2004). However, over the years water quality in the watershed has seen a steady decline. Water quality is the physical, chemical, and biological composition of water as related to its intended use (USDA 2003). Contributing factors to its decline in the region include, but are not limited to: storm water runoff, sedimentation, and littering. The U. S. Environmental Protection Agency has recognized the significance of the factors and more closely monitored storm water runoff in a 1997-1998 study. The study concluded that it was an increasing concern

and that the use of Best Management Practices (BMP's) adequately would help increase water quality (EPA 1999). BMP's are defined by the EPA as a "technique, measure or structural control that is used for a given set of conditions to manage the quantity and improve the quality of storm water runoff in the most cost-effective manner" (Center for Watershed Protection 2008). Commonly used BMP's at construction sites are silt fences, brush barriers, rock dams, and sediment basins. There are also many other effective measures for diminishing run off, but none of these practices actually matter unless properly installed and planned according to the specific site.

Storm water runoff and sedimentation are related problems, especially in Mobile. It is the wettest city in the United States with an average of 60+ inches of rainfall per year (NCDC 2000). Not only does the increased rainfall in the watershed degrade water quality, but Mobile's growth in the recent years is also contributing. New roads, subdivisions and businesses are emerging all over the city, especially in west Mobile. The increased development in the areas is resulting in loose soil building up around construction sites. This soil is ultimately being transported by storm water into the creeks and river that make up the watershed. Recently, more and more cases of poorly maintained construction sites are showing up. An article published this February in the St. Petersburg Times discusses runoff from a giant mall project polluting a local creek. The site has been charged twice in the last five months with illegally allowing discharge to muddy the creek, which feeds the counties drinking water supply (Chuin-Wie 2008). If this can happen there, why should Mobile be any different? Hillcrest Road between Cottage Hill and Three Notch is an area of major concern. Ongoing road construction is leading to large amounts of soil exposed that could ultimately make its way into the creek

if not properly maintained. It is not exactly apparent how much soil, if any, is being dumped into the creek or if it is having an adverse affect, but the site should be monitored for BMP's and effect on the water quality.

Research Question

Is construction on Hillcrest road between Cottage Hill road and Three Notch road causing a decrease in water quality in Halls Mill Creek? If so, are poor Best Management Practices to blame?

Methods

To test water quality I measured turbidity levels in the creek. The measure of the water's turbidity, how clear it is, is a good indicator of overall water quality. I used a portable GPS and navigated my way to an upstream portion of Halls Mill Creek. I took a water sample upstream from the construction site to test the water's condition prior to being affected by the construction. I was also able to access sample sites downstream of the construction from over passing bridges. These areas were used to determine the effect the construction site had on water quality. The study area and sample sites are shown in Figure 1 on the following page. Samples were collected from these sites over a five-week period, once a week regularly and after intensive rainfalls. After samples were collected, they were brought back to a university lab and tested using a LaMotte Turbidity meter. The samples were individually processed by the meter multiple times to gain an accurate measure and to exclude any anomalies in the meter's readings. Once I took multiple readings, I figured the median, which was then recorded as the samples turbidity.

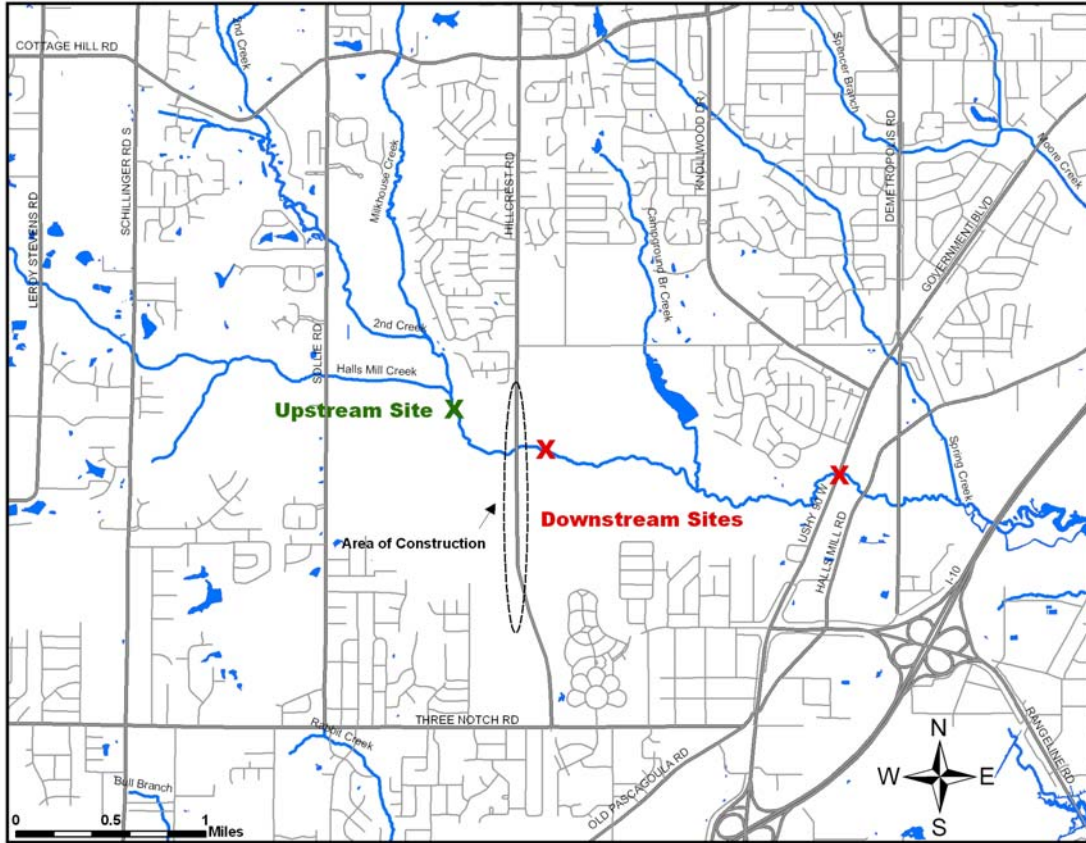


Figure 1: Map of Study Area

In addition, pictures were taken of the sample sites and of the BMP's in place at the construction site. I studied the area before and after rainfalls to see if there was any significant breakdown in the BMP's or if there were any actions that needed to be put in place that were not already there.

Results

The results of the turbidity tests are shown in Figures 2 and 3 on the following page. Turbidity levels did in fact increase downstream, but not that significantly. The average turbidity level in the upstream samples was 3.36 NTU's (nephelometric turbidity

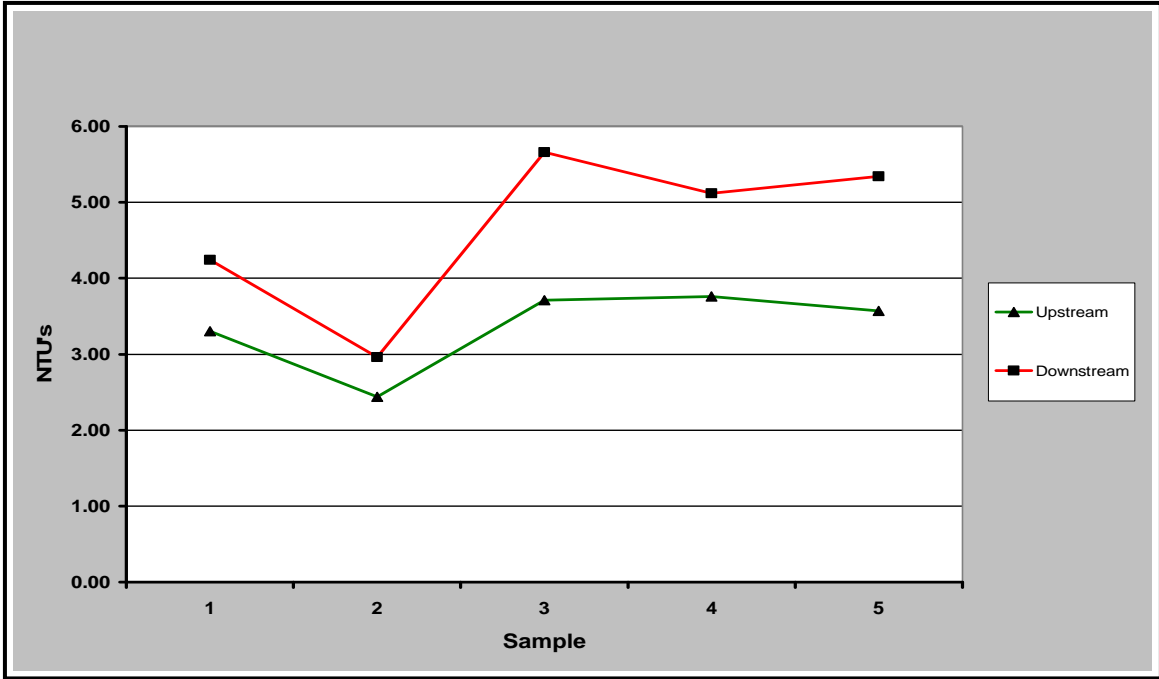


Figure 2: Turbidity Levels in Halls Mill Creek

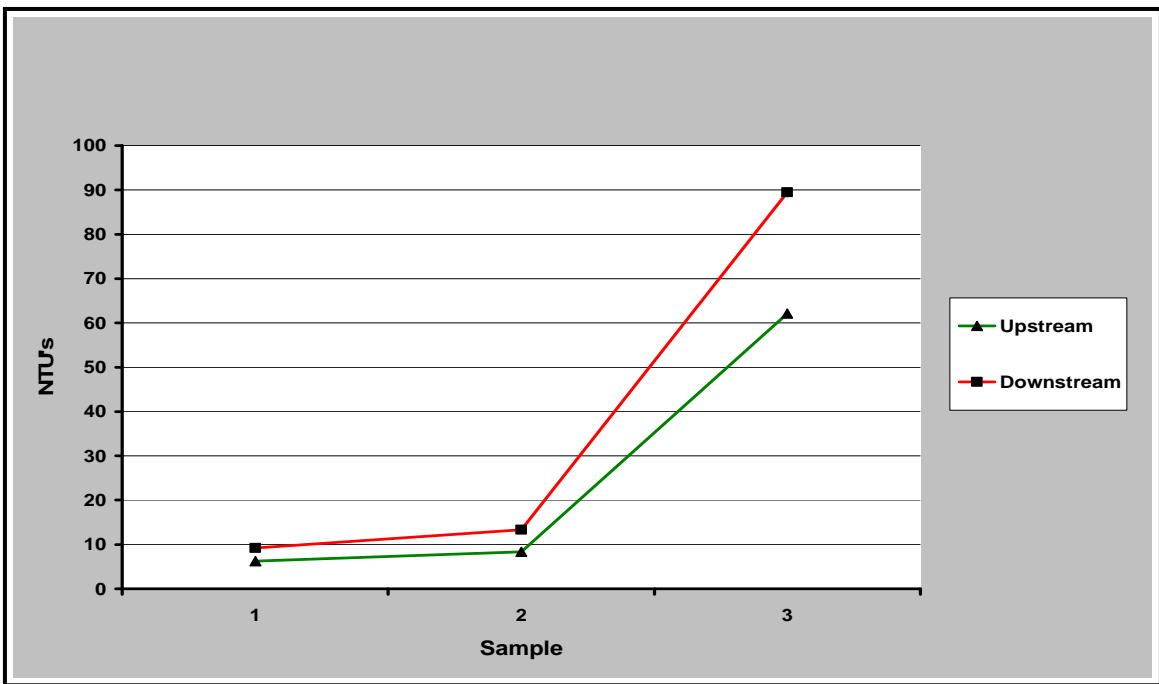


Figure 3: Turbidity Levels in Halls Mill Creek after Rainfall

units), while the average level downstream was 4.66 NTU's .Both of these readings are measures of good water quality. However, samples were also gathered after three significant rainfall events, one that actually caused Halls Mill Creek to flood and forced me to adjust my downstream sample site. The post rainfall turbidity levels were much higher than those taken prior to rainfall events. The average turbidity level upstream after rainfall was 25.56 NTU's, while the downstream average was 37.33 NTU's. The figure below shows the average turbidity levels of all the samples collected.

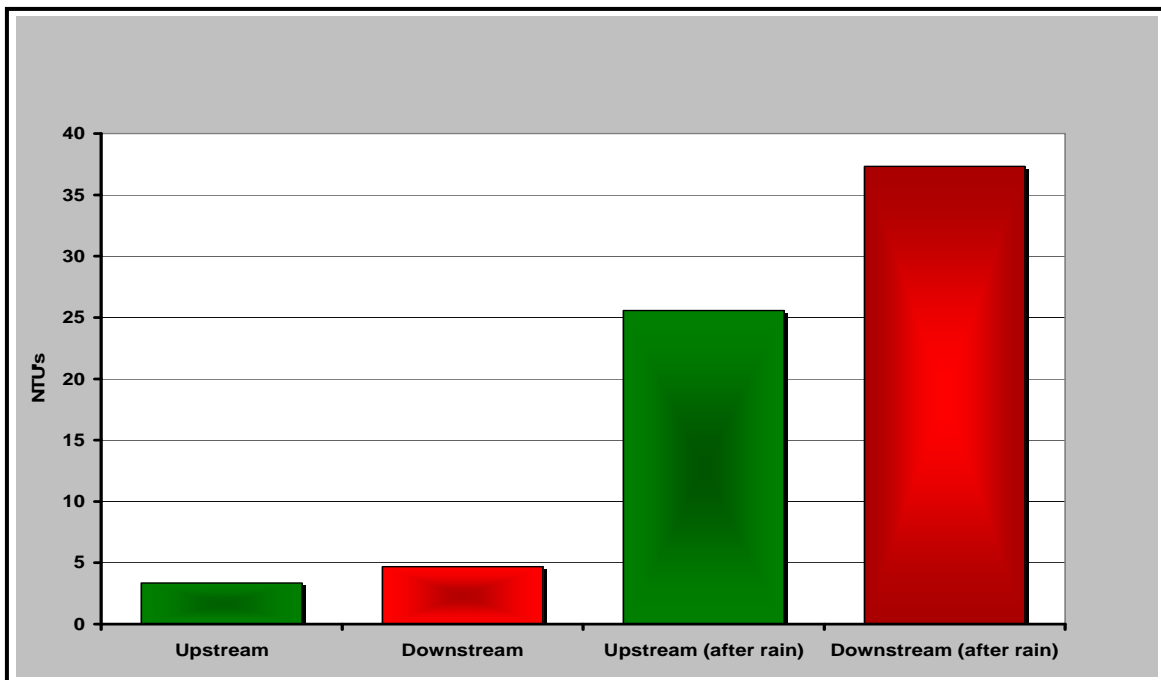


Figure 4: Average Turbidity Levels

By examining pictures and observing BMP's at the construction site I was able to determine that the site was properly maintained. Silt fences, rock dams, erosion cloth and sediment booms were just a few of the runoff control procedures in place. No flaws in planning, poorly installed items or breakdowns from intense rain were ever discovered. In

fact, a few times when I returned to the site, new BMP's were in place that had not been there previously.

Discussion and Conclusions

The data collected clearly shows an increase in turbidity. However, if we examine it closely, it provides evidence that the construction site did not cause major reductions in water quality. The levels of turbidity registered downstream were not at an alarming high. Anything measured under 5 NTU's is considered of good quality and the majority of the samples read close to or under that, even the downstream samples. Although, we did see much higher levels after rainfall we cannot assume that it was completely due to the construction. When we compare the percent of increase in turbidity levels downstream of no rainfall samples to after rainfall samples, the increase is only about 6 percent. Yes, turbidity did increase downstream after rain, but not much more percentage wise than it did with out any rainfall. This is surprising because after an intense rainfall is when you would expect most of the loose sediment to be washed into the creek.

In my opinion, the reason for such low levels of change was the proper use of BMP's. The construction site had silt fences lined in all areas vulnerable to runoff. On top of that, stone channels were designed that fed storm water into the creek. These channels were also designed with stone damns to allow sediment to settle in its pools. Brush barriers were placed in front of all drain inlets, erosion cloth and/or fresh sod was placed on all slopes. A large sediment boom (shown on the following page) was also in place under the bridge on Hillcrest Road that crosses over the creek. Most importantly, all



Figure 5: Sediment Boom in Halls Mill Creek on 4/5/2008

of them were properly maintained and resistant to breakdowns after intense rainfall events. Other small factors could have played a role in the turbidity levels acquired. For instance, more vegetation downstream could clean the creek and cause the levels to lower, but this is unlikely the case. I chose my testing sites carefully according to their environment for that specific purpose.

The evidence here and in previous EPA studies shows that proper use of BMP's can reduce the negative affect storm water runoff has on water quality. Subsequently, I believe sites should be more closely monitored for effective BMP's. I would also encourage federal and local governments to enforce tougher policies on construction site management. Hopefully, that would result in even more efficient use of BMP's and improved water quality.

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