

ARMORED DITCH DEGRADATION AND ISSUES WITH EROSION

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When armored ditches fall into disrepair, this can cause problems. The purpose of this project was to show how damaged concrete ditches can increase erosion. This project also showed how ditches with natural vegetation resist erosion, and offers the solution of leaving natural vegetation inside the ditches instead of having it removed. During this project, three different ditches were examined and photographed. One was an armored ditch that was damaged, one was a bare ditch, and another was a ditch with a large amount of vegetation on the bottom. The concrete armored ditch had all of its cracks and broken sections examined for signs of erosion. The other two ditches were also examined for similar signs of erosion. The results showed that the ditch with broken concrete armor did not have many problems with erosion around or inside its cracks. However, a large eroded spot was discovered near a drainage spout. This eroded concrete scoop was worse than any signs of erosion at any of the ditches. The ditch that had natural vegetation did not show as many signs of erosion.

Keywords: erosion, ditches, concrete

Introduction

If anyone were to try and locate the many different headwaters in the Dog River Watershed, they would see that some streams have been armored in order to stop them from eroding quickly. Even though armor requires little maintenance (Skipworth, 1998), some of these armored ditches have not been properly maintained. The armor has not only cracked, but has been split into pieces. If the armor has become cracked, this could cause erosion to get worse. Sediment also gets trapped behind the broken off and cracked pieces of armor, and could cause problems. We all know that soil erodes faster than concrete, which is eroded in very small particles instead of large patches like sediment (Momber, and Kovacevic, 1994). Ditches with splits in their armor and pieces falling off could create tighter channels for water to cut in to. This could lead to worse erosion, and more obstruction of the stream. The costs of repairing broken down ditches lessens if they are treated early before erosion starts to take place (friendsofsanlorenzocreek.org). Even if damage is severe, repairing erosional damage is not impossible. There are also several methods that can be used to prevent erosion from happening in the

first place, from laying down straw to using erosion control mats (Burroughs, and King (1989). In this case however, it would probably be best to simply repair the broken armor.

With some streams, vegetation is so thick that erosion is not much of a problem. These streams are usually not armored, but most streams have some man-made interference. In the case of this study, it is assumed that ditches with less man-made interference do not have as many erosional or sediment accumulation problems. Vegetation is often used to stop erosion. Plant roots hold soil into place, and create a more natural stream bed. This method does not cost much money, and can use local vegetation (Keller, and Sherar, 2003). Drainage ditches that are heavily vegetated also can filter out and lessen some contaminants (Cooper, etc., 2004). If a ditch already has vegetation inside it, then putting armor over it may not be required. If erosion is not present in heavily vegetated ditches, but is present in unarmored and poorly maintained armored ditches, that suggests that lack of maintenance could be the cause of the erosion.

The purpose of this research will be to see if the ditches that have been ignored have more erosional problems than the ditches that have very little man-made intervention or none at all. In this case, ditches without man-made intervention will be focused on both bare ditches, and ditches filled with vegetation. In the past, sediment accumulating in ditches was often attributed to agricultural runoff (www.waterencyclopedia.com). During heavy construction, nutrients can get removed from soil and cause vegetation to not grow well (Grace, 2001). Because of this, it may be better to find very resistant native plants to line ditches. Ditches left bare will erode faster than ditches covered in concrete. This study will look and see if the broken down parts of concrete ditches are more eroded than the bare or heavily vegetated ditches.

Research Question

The problem addressed is whether or not a poorly maintained armored stream causes more

problems, either from erosion or sediment accumulation, compared to a stream with little to no man-made intervention. This research will see if the broken down armored streams are causing, or starting to cause problems, and if the problems need to be fixed or will be worth fixing in the future.

The main target of this research is erosion and sediment accumulation. Concrete lined ditches do increase the amount of water, and also soil, that can lead to erosion from the broken down parts (FEMA Hazard Mitigation Handbook, 2012).

Rip rap is often put in to stop erosion, but what happens when too much sediment clogs it up? If the broken concrete sections from poorly maintained ditches cause more sediment to accumulate, then this could clog up the ditch. If rip rap is in the area, it can be used to see if the broken stream sections act like it does in preventing erosion, just cause sediment to accumulate, or cause even more erosion. The amount of vegetation in the stream will also be taken into great consideration. If the heavily vegetated stream does not show many signs of erosion, it could be more efficient than the concrete armored stream.

Methods

Three ditches were selected, one with broken armor, one with no armor, and one that had some man-made concrete parts, but was mostly filled with vegetation. The ditch filled with vegetation was near the intersection of Grelot and Shillinger Road, the concrete ditch was along Hitt Road, and the bare ditch was just off of the intersection between Cody Road and Cedar Street. All of these ditches were in the city of Mobile Alabama (figure 1).

Each ditch was carefully examined to see how erosion has affected it. The ditch without armor was used as a control. After the ditches were examined, photographs were taken of any signs of erosion, and one general photograph of each ditch for comparison. The only difference in these comparisons was the broken armored ditch. This ditch had the concrete sections that were broken

examined for signs of erosion, photographed, then was compared to photographs of each ditch's erosional signs to see which is worse.

The main focus of this research was the ditch with broken armor, so this ditch's parts were examined very closely for any adverse effects.

While the different ditch photos were compared, certain factors were considered such as how wide the stream was, or how clogged with sediment it was. The different sizes of the ditches were also taken into consideration. The only help needed during this project was directions to the broken ditch, which was found and studied.

Results

The results of this project were somewhat unexpected. All the ditches were compared, and the ditch filled with vegetation was not nearly as eroded as the ditch that was almost bare. The ditch without much vegetation was fairly deep, narrow, and had problems with local trash accumulating inside it. The ditch also had problems with sedimentation. Nearly bare ditches that are missing vegetation do not get better over time, and extra water flowing through the ditch will make these spots get worse over time (www.fairfaxcounty.gov). The ditch selected with heavy vegetation had grass almost three feet off the ground. This ditch was fairly wide, but was not eroded. The erosion was difficult to study closely because of the grass, but because of the very low dip the grass had, it could be determined to not be nearly as eroded as the bare ditch.

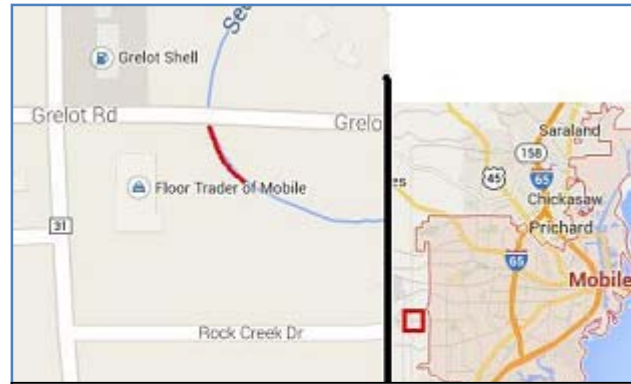
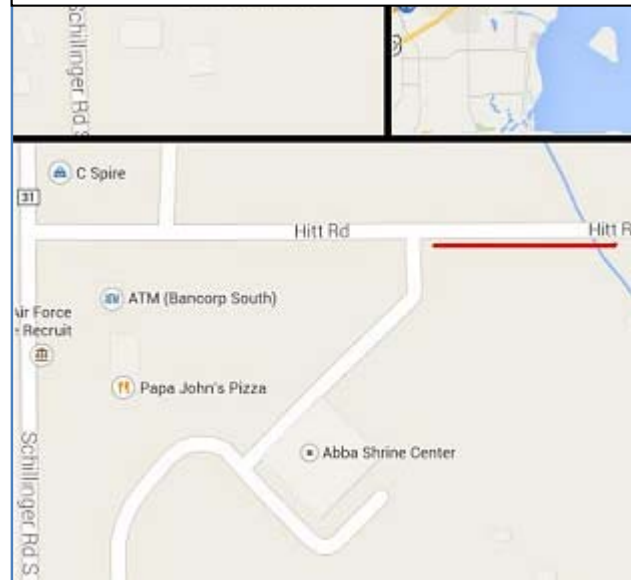


Figure 1. This map shows the study area. Source: Google Maps)



The concrete ditch was examined very closely, at least half of its length. It was discovered that the damage along most of the ditch was fairly minor. Most of this ditch's problems were from small cracks, possibly caused by concrete expanding. The most severe cracks had almost been “lifted” up, but each crack the ditch had was only horizontal. No sections were broken off, and the lifted up cracks were usually stuffed with leaves, leaving little sediment accumulation. This ditch was deeper than the bare ditch, but the concrete kept it from eroding any more. During a heavy rain, water possibly just shot underneath the concrete, and was assumed to have caused erosion under the ditch. For most of the ditch's length, these were the only problems.

If the small horizontal cracks were the only problems the broken armored ditch had, this ditch would have had even less examples of erosion than the heavily vegetated ditch. This was not the case however. About half way along the length of the ditch, where the armor merged with a concrete drain, there was a huge problem. The armor where the drain came out into a pipe had been dug out from erosion. Water had eroded around the concrete, then continued to erode until this formed a massive scoop. Although the exact size wasn't measured, the scoop was large enough for a person to crawl inside.

The only thing put in place to help stop the erosion was a small cluster of rip rap stones. Based off the still huge size of the scoop, the rip rap wasn't stopping erosion well. The stream that followed the drain was filled with sediment, possibly sediment eroded from the scoop. Rip rap was laid down heavily in this area, but sediment was still accumulating. To compare all the ditches, the bare ditch was eroded, but not nearly as bad as this. The ditch filled with vegetation also did not have erosional problems as bad as either the bare ditch or the concrete section.

Discussion and Conclusions

The concrete scoop was a prime example of erosion from disrepair, and was worse than any of

the ditches examined. The main concrete ditch did not have erosional problems by itself. The cracks it had could have had some erosional issues, but they could not be seen directly. In the case of this study, the concrete made the erosion worse. If there was no concrete armor near the ditch's drainage spout, then the water would not have come to a quick stop and would not have eroded so much sediment. The ditch that was bare had been eroded deeper, but it was not as bad as the concrete scoop.

This research showed that problems like this that are ignored can be just as bad, or worse, than simple ditch erosion. If the ditch was not armored, the erosion would not have been as severe. It is unknown if the city knows about these problems, but the erosion underneath the concrete scoop was so bad it could possibly cause the concrete to fail and break off completely in the future. When ditches are armored in this way they increase stream flow. This causes any problems, like the scoop that was found, to erode faster than without concrete. Because of this, the city needs to become active in finding these problems and attempt to repair them.

If this project was done again, more areas would be studied instead of only three. Not being a native from mobile made this project somewhat difficult because the ditches had to be tracked down. If done again, ditches at equal depths, with some being a set of three deep ditches and some a set of three shallow ditches would be compared to see if this made a difference. Heavily vegetated ditches would be examined more closely. Special clothing would be worn to allow closer examination of the ditch's stream bed. Different types of disrepair could also be found with armored ditches, then cataloged.

The Dog River Watershed has problems with both trash and sedimentation. The city puts down concrete armor in order to keep erosion at a minimum because of Mobile's tendency to get heavy rains. If there are problems in these armored ditches that the city does not know about, then this could lead to erosional issues and defeat the purpose of having armored. To further expand upon the results of this research, the city could be contacted about the findings of this study, and any signs of disrepair that are discovered in the future.

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