ESLAVA CREEK PARKWAY COLLAPSE THREAT

Zach Warner

Erosion in Eslava Creek has become a hazard in specific localized areas. The city of Mobile has continued to channelize and armor drainage ditches and creeks as the city has urbanized outward from downtown. As the city has grown, there has been an increase in non-permeable surfaces as buildings, parking lots and streets have started to take over. A drainage ditch that enters Eslava Creek east of Bel Air Boulevard has caused large amounts of erosion on the north bank of Eslava Creek where is has not been armored. It appears that the severe localized erosion is not only caused by the speed of water but the abnormal current that is occurring during rain events. This is due to the increase in impervious surfaces, which over all appears to be the reason for the over steepening of the bank. This will be beneficial to the city of Mobile so that the erosion problem can be corrected and prevent future problems in the Dog River Watershed.

Keywords: armor, channelize, impervious surface, over steepened, urbanized

Introduction

Most areas of Eslava Creek have armored banks through the use of stone lined banks, gabions and concrete. While this keeps the banks from eroding quickly it speeds up the water in the creek. The problem with only armoring parts of Eslava Creek is that areas that are not armored suffer the consequences. Increasing impervious surfaces means there is less surface area for water to naturally be absorbed into the ground which means more water has to be drained to keep flooding to a minimum in a rain event. “A smooth, regular channel lining can carry up to three times the amount carried by a channel of similar section and gradient that has its banks covered with extensive weed, reed and other plant growth” (Hockin 1985). The only problem with channelizing streams is that the water moves faster in a rain event with no obstacles to slow down the flow. Speeding up water flow in a rain event can cause the erosion process to speed up as well. In a natural setting a stream would not be linear like Eslava Creek but would meander over time. People have been researching ways to actually make trajectories for river meanders by measuring erosion rates (Hooke 2003). Being that Eslava Creek is in an urban area, meandering

is no longer an option because there are buildings up against the creek banks. The goal is to make sure that unarmored banks are not negatively affected by the existing armored banks in other areas of the Eslava Creek. (Fig. 1)

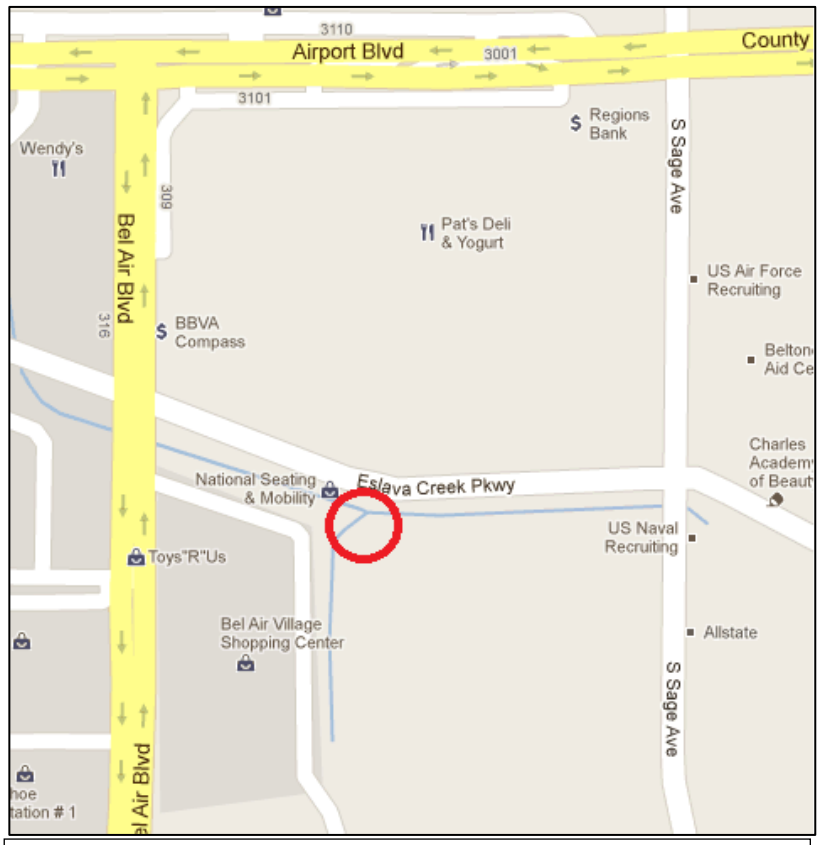

Figure 1.
This map shows the area south of Airport Boulevard and east of Bel Air Boulevard east of Bel Air Mall in Mobile, Alabama. The red circle outlines the study area where the drainage ditch on the east side of Toys 'R' Us, enters Eslava Creek (Google Maps).

Localized severe erosion is a hazard in Eslava Creek, which is a major tributary of Dog River. When observing the Eslava Creek area it is obvious that there is erosion taking place in specific areas. The creek has had a large amount of urbanization around it, including Bel Air Mall. "Increase in impervious surface cover within urban catchments, alters the hydrology and

geomorphology of streams" (Paul 2001). The amount of erosion on the north bank of Eslava Creek just east of Bel Air Boulevard is severe just across from a drainage ditch that enters on the south bank on the east side of the Toys 'R' Us parking lot. (fig. 1) The amount of erosion on the north bank has become hazardous. The north bank has been over steepened to the point where it is nearly vertical. It has also been eroded closer to Eslava Creek Parkway, which runs parallel to this section of Eslava Creek. The result has left less than 12 feet of ground between the edge of Eslava Creek Parkway and a 12 foot vertical drop into Eslava Creek. It is possible to see the structural stability of Eslava Creek Parkway is deteriorating by visible cracks in the road. Erosion in this area needs immediate attention because it could soon become a major safety hazard for traffic on Eslava Creek Parkway.

Research Question

What is causing severe localized erosion on the north bank of Eslava Creek just south of the Mobile Marriott? Could it be caused by stormwater flow from the drainage ditch entering on the south bank?

Methods

Research was conducted in the field in order to find what caused such severe erosion. Markers were placed every five meters along the bank of Eslava Creek and the east bank drainage ditch in order to measure out a 60 meter cross section of each. The drainage ditch and Eslava Creek study area were observed before and during a rain event. In order to see changes that occurred in the stream current, five oranges were thrown in Eslava Creek and five were thrown in the drainage ditch in order to observe the currents in a 60 meter section of Eslava Creek. Video footage was taken of each orange in order to time the orange's speed as it passed the markers on the bank. This was necessary to see the current flows in the stream.

Results

Abnormal current patterns have been caused by the drainage ditch entering by Toys 'R' Us. Orange 1 was thrown in Eslava Creek before the rain event and took 16 minutes to make it from marker 1, 60 meters downstream to marker 2. This showed that until a rain event, there is almost no current in Eslava Creek. After the rain event, it took between 1 and 3 minutes for the orange to make the 60 meter journey down Eslava Creek. After observing the oranges traveling down Eslava Creek, it was obvious that a whirlpool effect was in motion after the rain event at the entrance of the drainage ditch. As the oranges would pass the drainage ditch, they would pass the north bank erosion, then circle back against the north bank in a counter clock wise motion illustrated in Figure 2.

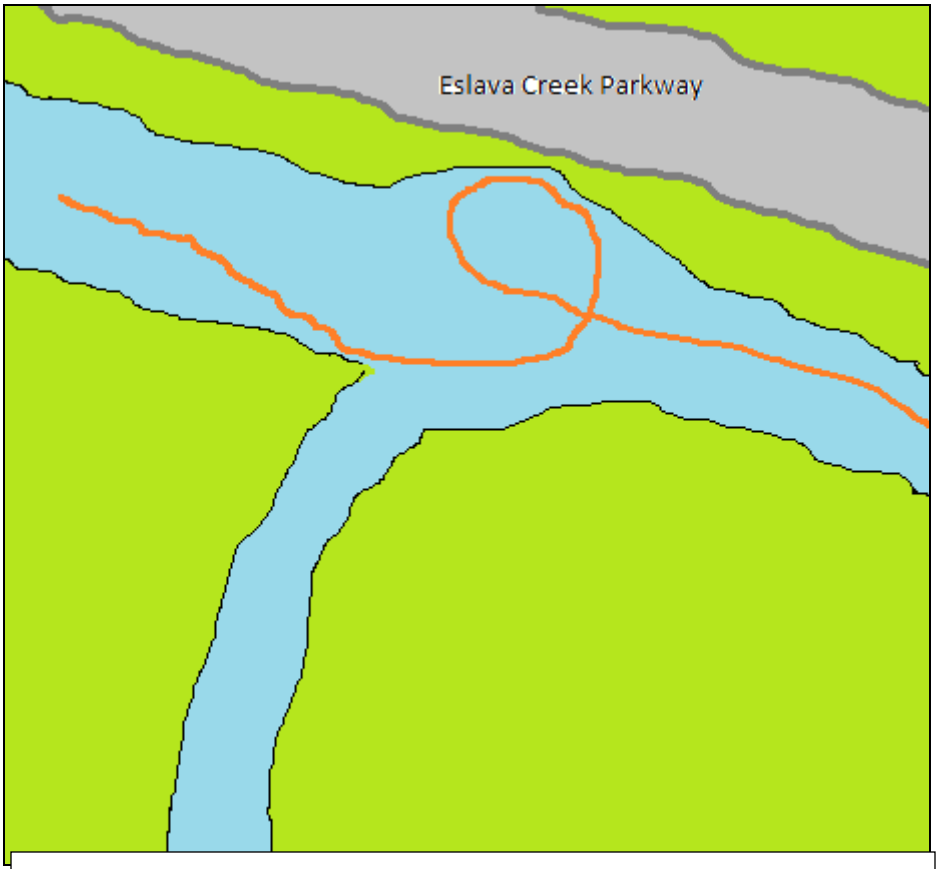

Figure 2.
The orange line represents the orange's path as it traveled down Eslava Creek and passed the drainage ditch entrance. This test confirmed that the current is a main cause of the north bank erosion.

This whirlpool current appears to be the main reason for localized erosion on the north bank of Eslava Creek. The harder the rain event, the faster and harder the orange was pushed to the north bank. Most of the time the orange would make it out of the whirlpool after one turn but some would spiral erratically before moving down stream. None of the five orange thrown in Eslava Creek plunged under the surface as they passed the drainage ditch entrance. Because the oranges in Eslava Creek spiraled it was hard to judge how quickly they were moving. Of the four oranges thrown in Eslava Creek after the rain event, the oranges made the 60 meter journey in 2 minutes 12 seconds, 1 minute 52 seconds, 2 minutes 54 seconds, and 2 minutes 45 second, making the average speed 2 minutes 15 seconds to travel 60 meters downstream. The oranges in the drainage ditch moved much faster and more directly in the ditch until they entered Eslava Creek. It was difficult to see the orange until the last 18 meters of the drainage ditch. The speed of the oranges in the last 18 meters of the drainage ditch was 1 meter per second. The oranges that made it into Eslava Creek plunged as they entered the Creek and resurfaced near the north bank and made the counter clock wise turn before continuing down Eslava Creek as shown in Figure 3.

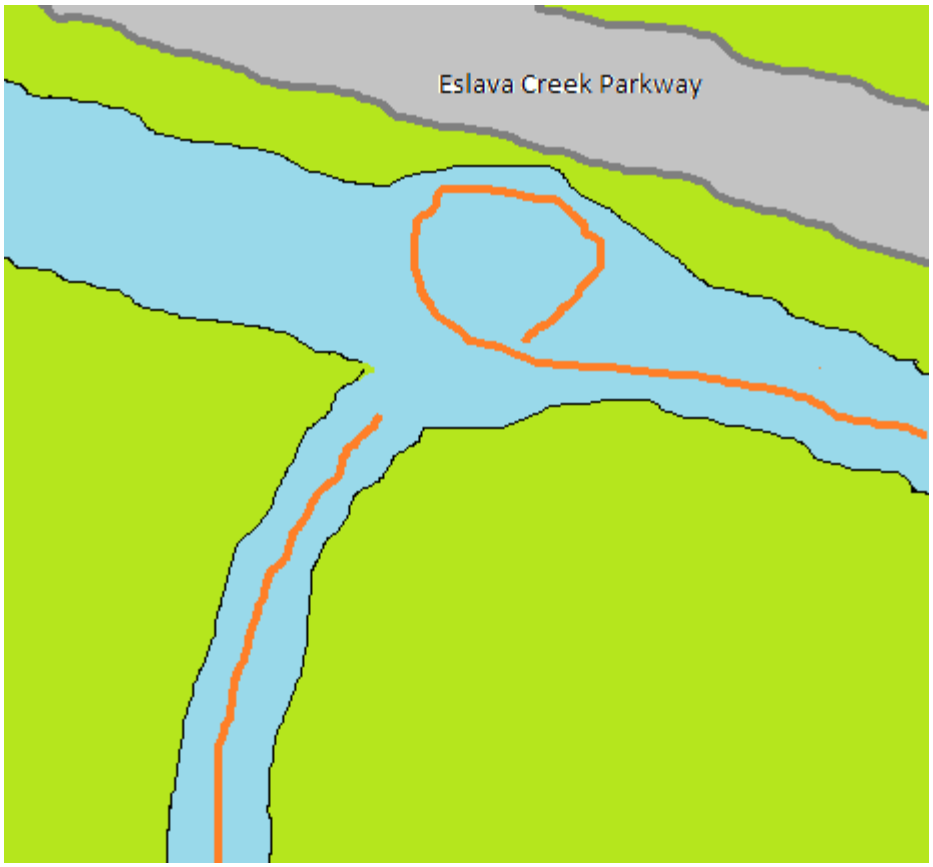

Figure 3.
The orange line represents the orange's path as it moved down the drainage ditch into Eslava Creek. The break in the line represents where the orange plunged beneath the surface of the water and was not visible. Again, the north bank erosion seems to be a direct result of the current pattern.

Discussion/Conclusion

Eslava Creek must be modified in order to break the eddy that is in place. The process of modifying Eslava Creek will be expensive but the cost of doing nothing may be more costly. If modifications are done now, it will be possible to save Eslava Creek Parkway from collapsing from an over steepened bank due to erosion. The road collapsing could end in a costly lawsuit if anyone were to get hurt on the road above. The drainage ditch entrance must be modified before more erosion is done in the next rain event and we can learn to do it correctly from other

people's mistakes (Brown 2006). It must also be taken into account that by modifying the current problem, construction does not affect the creek downstream. Sediment loads are dangerous and during construction, sediment loads can clog streams. "In marked contrast, areas exposed during construction can produce sediment loads in excess of 100,000 t/sq. mi/year. Small channel systems become clogged with sand during this construction period" (Wolman 1967).

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