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Grain Size Analysis of Massie's Creek Near Flax Pond and Community Park

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Characterization of Stream Bottom at the Confluence of the North and South Forks of Massie's Creek, Cedarville, OH

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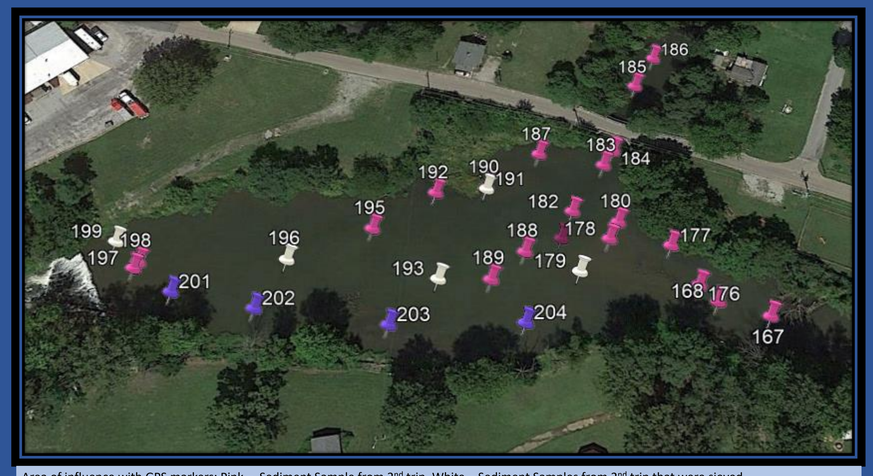
Abstract:

The goal of this research is to better understand the stream bed conditions at the confluence of the North Fork and the South Fork of Massie's Creek next to Community Park in downtown Cedarville, OH. Stream depths as well as sediment types where determined as a result of field work done for this project. The depth data was then used to create a contour map of the pool behind the low-head dam that defines the lower boundary of the confluence area. Sediment distribution is represented on this map based on laboratory particle size analysis and gross particle size analysis done in the field. Field data was gathered during three separate trips in late 2017 and early 2018. Depth data was gathered during the first trip and sediment samples were gathered during the later two trips. Each data point has a corresponding GPS coordinate. A total of 162 depth measurements and 27 sediment samples were obtained. Only nine of the sediment samples were eligible to do a coarse grain particle analysis by sieving. The goal of this process was to see how much sample was retained on the No. 40 sieve (>0.420 mm). No tests were run to characterize fine material. The contour map was created using a program called Surfer 8 while the sediment distribution was drawn on the map by hand. The data shows that a majority of the creek bottom is made up of carbonate mud with deeper areas consisting of boulders and cobble resting on bed rock. Leaf material makes up most of the bottom around the area by where the South Fork of Massie's Creek. The information in this study could help guide authorities in their decision making about when and how to do maintenance on the pool area. It also informs hydrologists about how the material gets distributed across the pool behind the dam as the two streams enter the study area.

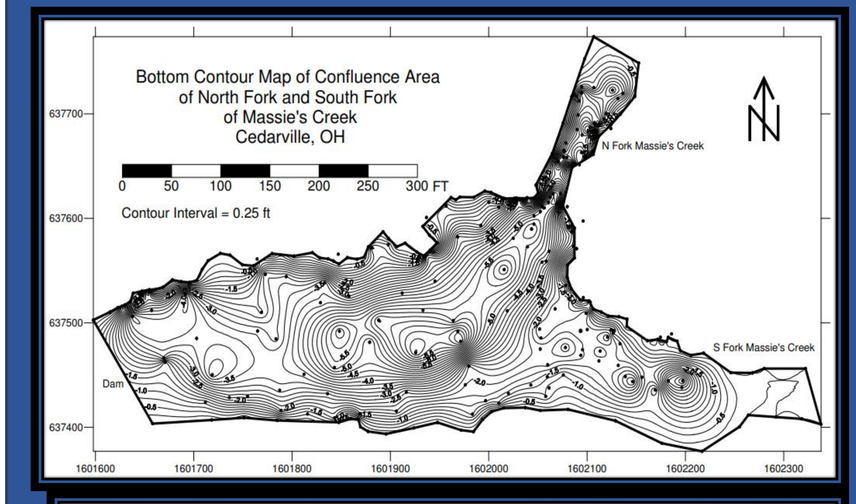
The view from in front of the overhead dam.

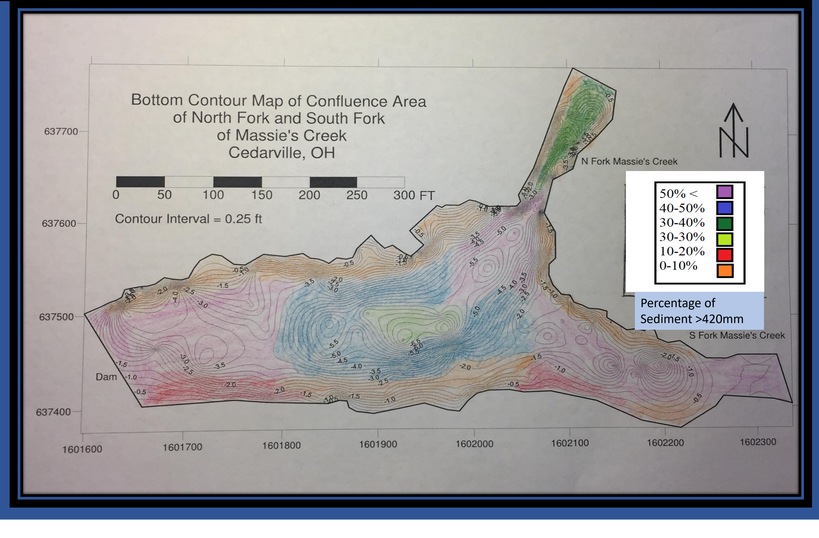
The view from the back of the pool.

Sieves being weighed after the samples have been put through the shaker.



Area of influence with GPS markers: Pink – Sediment Sample from 2nd trip, White – Sediment Samples from 2nd trip that were sieved, Purple – Sediment Sample from 3rd trip that were sieved.





Sample Designtion	Total Mass	Percent >40	Percent <40
Sample 6	293.1 g	22.37%	77.63%
Sample17	161.5 g	15.72%	84.28%
Sample 19	181.5 g	11.62%	88.37%
Sample 21	441.1 g	95.32%	4.68%
Sample 24	228.5 g	15.31%	84.69%
Sample A1	217.6 g	7.00%	93.00%
Sample A2	202.2 g	16.56%	83.44%
Sample A3	132.7 g	13.44%	86.56%
Sample A4	237.0 g	0.68%	99.32%

Samples that were sieved and the weight percentages over and bellow 420 mm. Samples 6-24 are from the second trip and Samples A1-A4 are from the third trip.

Acknowledgements:

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Methods:

The field work for this project was completed during three separate trips. The first trip's focus was on gathering depth measurements with a stadia rod from a kayak. Once a depth measurement was obtained it was recorded along with a GPS location. The second trip's focus was on gathering sediment data using a Ponar grab sampler. Sediment samples were pulled from various parts of the pool and labeled with a GPS location. In the end, only five samples from this trip were suitable for being sieved. The third trip's focus was on gathering four more underwater sediment samples from near the banks. These were added to the earlier set to make a total of nine suitable samples for sieving. These later samples were gathered using a shovel while wading. The collected sediment samples were dried in an oven over night at 110 degrees Celsius. Once a sample was dried, any observed "clumps" of small particles were broken up with a rubber mallet and the entire sample was sieved. Due to the fact that the sample clumps did not break up well, the samples were later "washed through" the number 40 sieve. This is an accepted technique when clumps do not break apart during mechanical shaking. Material that was retained on the #40 sieve (0.420mm mesh size) was dried and weighed. A percentage of >#40 material present in each sample was calculated. This was a ratio of the weight of >#40 material as compared to the total weight of the entire dried sample. The depth and sediment data from the field and lab work were used to create two maps – one showing contours with the sediment distribution throughout the pool and the other showing contours and depth measurement locations.

Conclusions:

Out of the nine samples that were sieved only two samples had more than 20% of their weight attributable to particles that were greater than 0.420mm in size. This means that the majority of the samples were made up of material classified as "fine." In addition, based on field observations recorded in my fieldbook, a few areas of the bottom of the pool were made up of cobbles (>64mm) and boulders (>256mm). This included the area directly behind the lowhead dam and the area where North Massie's Creek enters the pool. With regard to the two samples that had more than 20% of their weight attributable to particles that were greater than 0.420mm in size, Sample 6 (GPS location 179) was pulled from the deepest area of the pool which was about 6.5 feet deep and Sample 21 (GPS location 196) was pulled from the center of the stream a few yards behind the dam. This means that the coarse material is indeed more prevalent towards the middle of the creek while the finer material is more prevalent towards the banks..