Shad Restoration on the White Clay Creek Wild and Scenic River

Introduction

The Wild and Scenic White Clay Creek was the first river in the USA designed as solely a watershed rather than a traditional river corridor. In 1770, shad were in an abundance of 1000 fish per hour. However, since then, the population has declined drastically due to the construction of dams. Shad lack the physical means of jumping over such obstructions, and thus cannot swim upstream to spawn. Only until the Clean Water Act was passed in 1972 did shad return to the White Clay Creek. The research done in this project is a small part in the restoration of the American and Hickory Shad. Field surveying, stream geomorphology, water quality, and rapid bioassessments were completed at six dams along the White Clay Creek. This research provides raw data that will aid in the decision whether or not to remove these dams.

Methods

Surveying:
Using a surveying pole, automatic level, and measuring tape, 10 foot intervals along each cross section were measured and elevation values were recorded. Cross sections were taken at 100 foot intervals up to 500 feet both upstream and downstream of the dam.

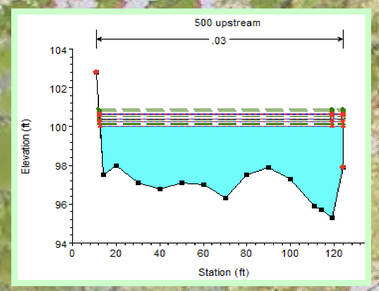
Bio Assessment:
Using predetermined parameters, a score from 0-20 in 10 different categories was determined. Those scores fell into optimal, sub optimal, marginal and poor categories. These were done for both upstream and down stream of each dam. The bioassessment measures the diversity of the stream in terms of suitable habitat for living organisms.

Water Quality:
Using pH, TDS, salinity, and conductivity probes, measurements were taken downstream of each dam once a week to monitor pre-project conditions.

Geomorphology:
The predominant substrate along each 100 foot cross section was recorded and will be used in the Rosgen Stream Geomorphology Classification. This included calculating width-to-depth ratio, sinuosity, entrenchment ratio, water slope, and substrate composition. Taking these numbers, a class was assigned to each cross section of the stream as per the criteria in the chart below.

HEC-RAS: (Hydrologic Engineering Centers River Analysis System)
Surveying data was entered into the HAC-RAS program to model stream characteristics and stream bed topography. The model will then be used to assess the effects of removing or modifying each dam.

Results



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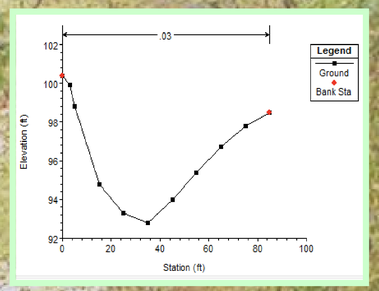

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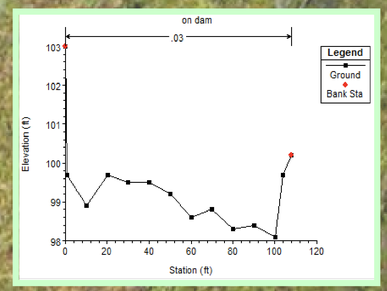

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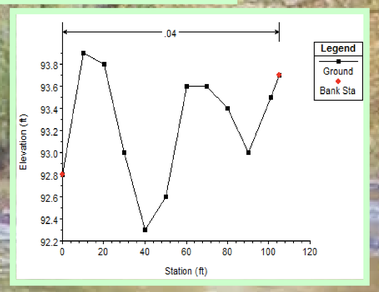

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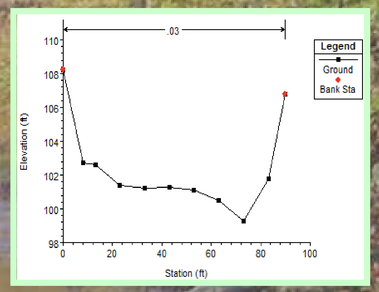

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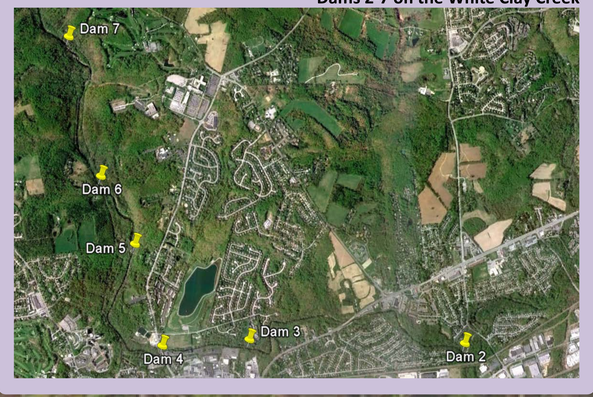
Dams 2-7 on the White Clay Creek



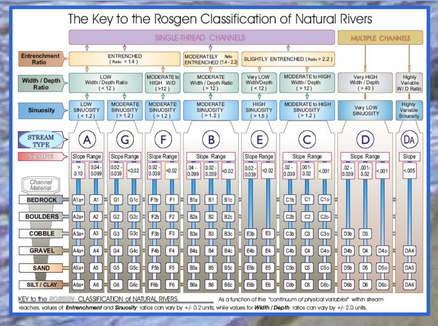
Discussion

This data will be very important when analyzing the dams. The data is inputted into HEC-RAS, which will be used along with Geological Information System (GIS) to render a model of what will happen with the stream flow when the dams are removed. This will determine what the best removal strategy would be so shad can move upstream. The other aspects of the project will help determine the removal of the dams, and continue to be useful later in the project. For example, the Rosgen Geomorphology will help determine the level of restorability of the stream after dam removal. Another issue with changing the characteristics of the stream is the change in water quality. It is important to know all aspects of the creek before the dams are removed in order to determine the effects of the dam removal.

In general, the geomorphology from all of the dams showed that silt and sand were dominant upstream of the dams, while downstream of the dams was cobble and gravel. When applying the data to the Rosgen Geomorphology Classification, it was found that every cross-section was a Class A Stream between A3 to A6. As far as water quality data is concerned, as changes to the stream occur, the water quality can continue to be monitored in order to make sure that the stream remains suitable for shad to inhabit. The optimal spawning temperature for American Shad is between 15-19 degrees Celsius. In the beginning of June, several months after spawning normally occurs, the temperature was about 19 degrees Celsius. The optimal pH for eggs is between 5.5-9.5, and there was an average pH of 8 throughout the summer. The ideal substrate for spawning is cobble and gravel with a depth of 1.5 to 23 feet.[1] In White Clay Creek, there are some areas that are less than 1.5 feet. For spawning the Total Dissolved Solids (TDS) should be less than 1000 mg/L, and the data shows averages between 200 and 250 mg/L. The rapid bio assessment indirectly measures the quality of the bio-diversity of the stream. The range of score of the bioassessment was just below fifty percent to around seventy percent. This means that the biodiversity falls within the “marginal” and “suboptimal” categories. As far as field surveying goes, the general topography of the stream followed a distinct pattern. Upstream of the dam was usually a bowl shape while downstream was more varied with deposits and build-ups creating small islands.

Conclusion

The field work that this project completed was the second year of a five-year long project to allow the shad to get upriver to spawn. It is equally important to keep the integrity of the stream as similar as possible after the dams are removed. Before this summer’s research, the creek was assessed and a feasibility report was written. During the spring of 2011, Dam 1 was surveyed, and all of the techniques to be used in the field were established. Our raw data will assist future efforts of the shad restoration program.



Water Quality Testing

Water Quality

Station	Water Temperature (C)	pH	TDS Mg/L	Salinity (ppt)	Conductivity (µS)
Dam 1	25.6	7.95	235	0.160	350
Dam 2	24.6	8.15	218	0.155	320
Dam 3	24.1	8.04	225	0.160	329
Dam 4	23.7	8.03	226	0.160	330
Dam 5	23.5	8.17	224	0.161	333
Dam 6	27.3	8.54	216	0.145	304
Dam 7	**22.4**	**7.90**	**227**	**0.160**	**338**

Dam 3

Citation

1 Fischer, Steven A., Hall, Lenwood W., Klauda, Ronald J., Sullivan, John A.“American Shad and Hickory Shad.” University of Maryland. http://www.dnr.state.md.us/irc/docs/00000260_09.pdf (accessed August 2, 2011).

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