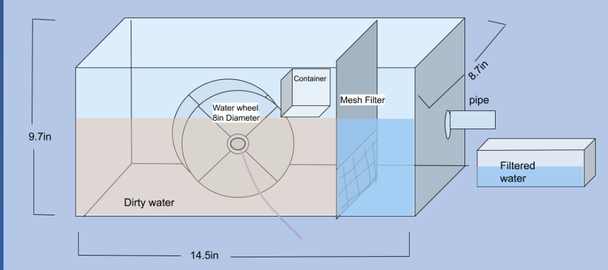
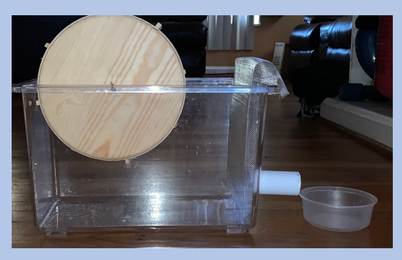
Targeting Water Pollution and Hydroelectricity Potential Within Low-Income Areas

Introduction

A commonly ignored aspect of environmental and sustainable research is the impact on communities. Often environmental gentrification will kick out those who can no longer afford the finances that come along with these clean up efforts. The Anacostia River has a trend of low-quality water and has surrounding low-income communities that have expressed a fear of environmental gentrification. The goal of this research was to design a test of concept device that filters water and generates hydroelectricity. The hydroelectricity generated from the implementation of a scaled version of this device would provide financial and environmental benefits to low-income communities. For the device to be deemed successful it would have had to accomplish the following engineering goals: decrease water's TDS (total dissolved solids) by ~25%, decrease EC (electrical conductivity) by ~15%, have a pH of 6.5-8.5, and produce 15-20V.



Proposed Device Design



Current State of Device

Method

1. Start of Phase 1.
   - Selected water samples were tested for pre-TDS, EC and pH data.
2. Ran selected water sample through device for 5 minutes
3. Retested water sample for TDS, EC, and pH.
4. 10 trails were conducted water per sample. A total of 30 test trials were conducted.
5. Start of. Phase 2
   - Device was modified. The addition of a turbine allowed for the flow of water to produce electricity.
6. 10 trails were conducted with pre-filtered water.
   - Multimeter measured voltage output during water tests.

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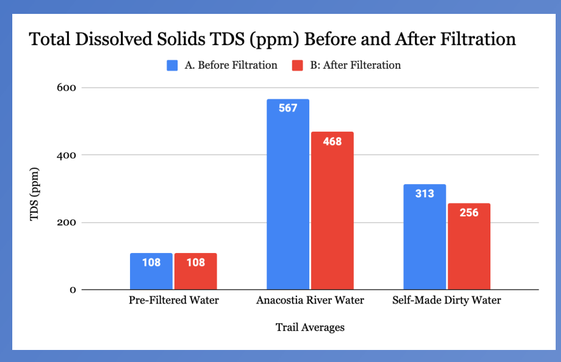
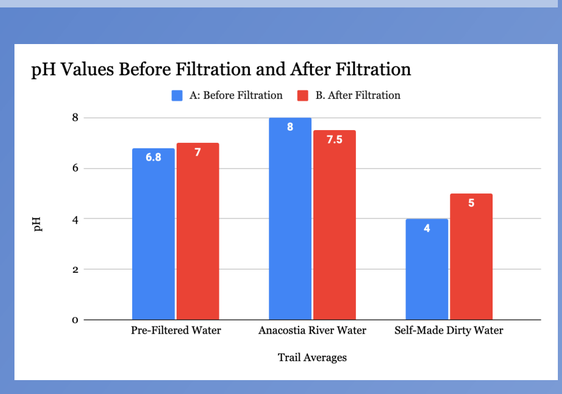
Findings

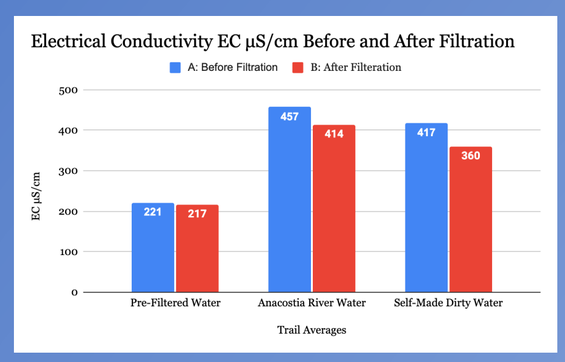
Within the first phase of testing there was evidence of improvement in water filtration data pre and post test. However, improvements were minor and did not fulfill the listed engineering goals. EC showed the least significant change between A and B phases with a decrease of 8% µS/cm on average. TDS shows the most significant changes. The combination of the mesh filter and the water wheel had shown large removal of visible trash. However, the device was less efficient when dealing with smaller scaled contaminants. TDS on average decreased about 18% ppm. Most of the pH data from the trails were in an ideal range (6.5-8) except for Self-Made Contaminated Water A and B. Despite not being in ideal ranges there was improvement from pH 4 to pH 5. Phase 2 of testing focused on the production of hydroelectricity. The average production was 3.97 V which does not satisfy the engineer goal of 15-20V.



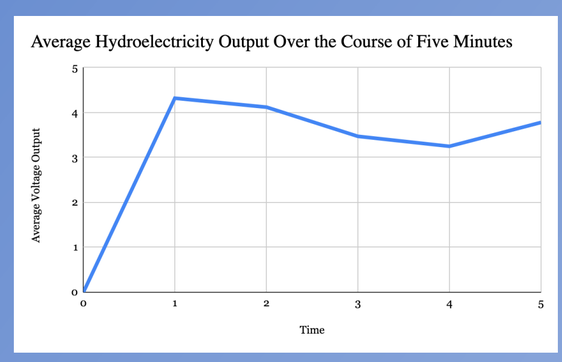
Display of trail averages for TDS data (in ppm)



Display of trail averages for pH data



Display of trail averages for EC data (in µS/cm)



Display of average electrical output within 5 minutes (in V)

Conclusion

Although not all engineering goals were satisfied the device showed immense potential. In order to satisfy engineering goals, design modifications would be necessary. Currently modification are needed for improvements in both water quality and electrical output. Modifications would hopefully lead to the satisfaction of the engineering goals in order to benefit low-income community. Future research would involve hypothetical scaling the device, in order to calculate the amount of electrical production that would be provided to neighborhoods and the amount of financial relief produced.

Acknowledgments

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