Thesis Project Portfolio

University of Virginia North Grounds Campus Rivanna Stream and Trail Restoration Project with Biohabitats, Inc.

(Technical Report)

Social Acceptance and Feasibility of Household Water Treatment Technologies: Implications for the MadiDrop in Rural, Low-Income Communities

(STS Research Paper)

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

The contamination of drinking water is a multilayered problem with several contributing factors and fewer reliable solutions. Contaminated sources of water are the biggest contributions to the struggle for finding clean drinking water. Water sources can be contaminated by sediment, pathogenic microorganisms, or chemicals released from point sources. One of the best ways to mitigate the pollution of water at the source is to maintain the cleanliness of the source itself. In this technical thesis, my capstone group spent the year working to restore the ground water stream located on North Grounds of the University of Virginia campus. This stream is a Rivanna River tributary and has several reaches with eroding conditions. These conditions have directly contributed to the issue of high turbidity in the drinking water, as well as higher loads of nutrients in the effluent water of the stream. The goal of our technical project is to design a new stream system that limits the eroding potential of the water by implementing energy dissipating pools as well as riffles to accommodate the drop in elevation along the reaches. Several programs were used to simulate storm events, surface water levels at various conditions, and the resulting impact on turbidity and nutrient levels for the water.

My STS thesis ties into this project regarding the issue of water quality. An alternative approach to purifying drinking water is to address the problem before consumption. There are products called household water treatment (HWT) technologies that work to purify the drinking water at the household level directly before consumption. Rather than address the contamination at the source of water (like a stream restoration design would do), HWT relies on consumer intervention to work properly. HWT technologies often focus on reducing the load of pathogenic microorganisms in a supply of water, but there are several technologies that also focus on reducing turbidity or eliminating unwanted chemicals from the water.

The HWT technology that my paper focuses on is called the MadiDrop. It is a ceramic water tablet that releases silver in low doses to provide an antimicrobial effect to the water. Silver works best against bacteria but has been shown to improve the viral reduction as well. Eliminating pathogenic microorganisms for drinking water reduces the instances of waterborne diseases, especially in vulnerable populations. Diarrheal diseases contracted from drinking contaminated water is one of the leading causes of death for children under the age of five (WHO/UNICEF, 2021). The goal of the MadiDrop is to eliminate waterborne diseases in an easy, inexpensive way that has proven to be effective. My work in this thesis is identifying ways in which the MadiDrop can improve their design to be more socially acceptable, especially in low-resource regions that could use the technology the most. Factors like preconceptions about water quality, community support, or personal preference all play huge roles in whether or not a technology is adopted into a household. By working to improve these design criteria, I aim to increase the MadiDrop's usage globally and promote the technology in new areas of the world.