North Grounds Stream Restoration

Water Technology and The Hydrosocial Cycle: An understanding of the reciprocal nature of Water, Society and Technology

A Thesis Prospectus
in STS 4500
Presented to
The Faculty of the School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Civil Engineering

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November 3, 2023

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Water is an essential part of how people in the world live their lives. It's a necessity in every human being's daily habits. Showering, daily hygiene, hydration, washing clothes, and growing agriculture are examples of just a few. With its importance as a vital resource and a necessity to the very survival of our society, it can be argued that water can be viewed with two separate perspectives. Often people think about water and the technologies that creatively arose because of the problems society was attempting to solve throughout history such as finding drinking water, moving water, and cleaning water. It can also be argued that water has actually shaped history by its very necessity which has weaved how humans have lived their lives. This includes where we choose to live, how they transport items, how they defend themselves, and the production of energy, such as electricity.

Take the historical settlement of Jamestown, VA as an example of water shaping history. Jamestown was founded specifically along the water for the purpose of sustaining life and defending its colonists. The English were specifically looking for a place that would deter the Spanish from attacking them and to allow for sailing and parking their ships closer to the shore. If it were not for the specific hydrography of the inlet, Jamestown may not have been chosen as a suitable settlement as it would not have provided the people with the needed requirements ("Virginia Places").

Instead of creating history, water technologies have also formed history. Take the point above that water technologies are being created because of problems that society must conquer. Water treatment plants, as example, were created to mass produce clean water to a group of

peoples. These technologies revolutionized the way that people live and allowed for further advancements in water technologies.

My technical project is working to assess an unnamed tributary stream to Meadow Creek located in Albemarle County and the city of Charlottesville. This assessment will allow us to compose a design proposal to restore and remediate the erosion, pollution, and stress imposed by nearby human development on the stream. Our research and design will also provide insight into cost and pollution reduction credit opportunities for UVA. The stream itself is 5,000 feet long, running parallel to the US 250/Route 29 bypass, located near UVA's North Grounds, and contains a portion of the Rivanna Trail. These attributes make it an important waterway to protect. Stakeholders include the University of Virginia, VDOT, City of Charlottesville, and the Rivanna Trails Foundation. This project is important because this stream impacts the UVA community in many ways. If construction were to start to remedy this stream the social impacts could be that the trail could be displaced, the aesthetics could suffer at the expense of the stream. The more technical aspects of the stream (flow, water quality, biology) also impact the social qualities of the stream. Thus representing the thoughts of the hydrosocial cycle.

In summary, these two points of view can be described by the two quotes "water resources are a product of history" and "water makes history" (Linton, 2013). Linton makes use of these thoughts in his paper not to further create the divide between these two thoughts, but to describe how they go hand in hand. This introduces the concept of the hydrosocial cycle, which will be further discussed later in the paper. But this is the concept that water and remake each other over and over again. It involves the natural, social, and technological processes of water as

depicted in Figure 1 below. Water (H2O) can form and shape the processes of our social power structure,

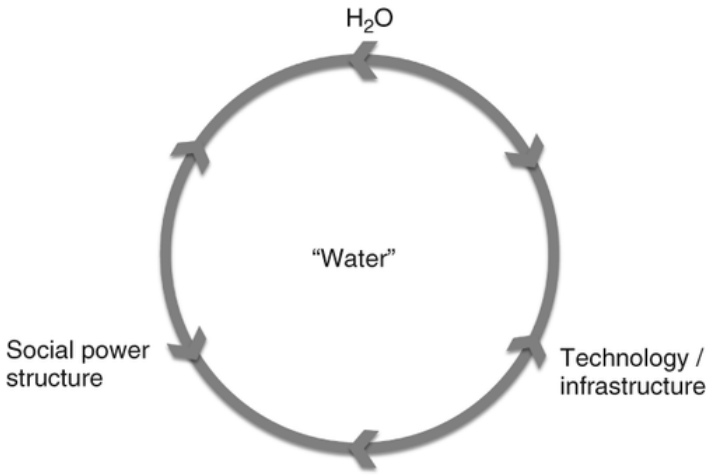

Figure 1. The Hydrosocial Cycle (Linton, 2013)

This prospectus will focus on these two statements: how "water technologies are the product of history" and how "water makes history". These two statements are both true due to the dialectic nature of water and society. Engaging with water with this point of view can provide progressive changes about how to deal with water challenges in society and in the world.

Technical Section: "Water resources are the product of history"

What is truly meant by the quote "Water resources are the product of history"? Water technologies come out of points in time where society faced problems. Some may argue that society is unable to make progress without this technological advancement. Take the examples of humans falling victim to viruses which in turn spawns the creation of vaccines. The lengthy time to communicate by letter and with no means for mass communication which produced the telegraph and subsequently, the telephone.

The Stream Restoration Capstone Group (SRC Group), in conjunction with Biohabitats, is working to assess an unnamed tributary stream to Meadow Creek located in Albemarle County and the city of Charlottesville in order to compose a design proposal to restore and remediate the erosion, pollution, and stress imposed by nearby human development on the stream. Behind the part of the University of Virginia known as North Grounds, the Stream Restoration Group will provide the research and design using this unnamed tributary to Meadow Creek providing insight into cost and pollution reduction credit opportunities for UVA.

The stream itself is 5,000 feet long, running parallel to the US 250/Route 29 bypass (figure 2), located near UVA's North Grounds and contains a portion of the Rivanna Trail. These attributes make it an important waterway to protect.

Figure 2. Biohabitats Division of Reaches

The EPA has created a method of water quality trading that is meant to combat the increased nitrogen, phosphorus, and sediment in the Chesapeake Bay. Jurisdictions that participate (nearly all the states that have water that flow into the Chesapeake Bay watershed are participants, including Virginia) can earn credits for reducing the loads of the aforementioned

chemicals by trading. Trading allows one source to meet its regulatory obligations by using pollutant reductions created by another source with lower pollution control (EPA, 2023). The SRC team will continuously collect water samples (analyzing total suspended solids, total phosphorus, and nitrate concentrations) in dry weather and wet weather to set a baseline for the site. Samples will be collected within each reach and upstream of each reach in the main stream. In addition, during the winter, the team will analyze chloride concentrations to determine the influence of salting the roads for de-icing on this tributary stream. The UVA Capstone group will focus on two specific reaches for their project: Reach 3 and Reach 5. These reaches were chosen for their biggest credit contributions if addressed.

Using various models and programs, the team will conduct a Hydrologic and Hydraulic (H&H) Analysis on the reaches 3 and 5. We will address the results of the H&H analysis and the water quality levels by developing a restoration design for the degraded outfalls that feed into the reaches. The design components will address the sediment load, nutrient concentrations, salinity level, and embankment erosion concerns. Also, included within the scope, is a restoration design of the Rivanna Trail and rerouting the trail during the construction process. Lastly, there is the calculation of VA Sediment and Nutrient Credits to be allocated to UVA as a result of the restoration of the stream.

In this case the main objective of this project is to reduce the amount of chemicals that float into the Chesapeake Bay (while simultaneously obtaining the most amount of reduction credit possible for UVA). To solve these problems, we have come up with technologies that can help us see where exactly water is flowing, perform simulations for different outcomes of storms,

and simulate how these solutions impact the current environment. Ideally, these problems are then solved and in turn, revolutionize the industry and create important events, including possible advances in technology and historic changes for years to come.

STS Section: "Water makes history"

The hydrosocial cycle is what describes the dialectical cycle between water and society. Water, society, and technology have continuously remade each other over time (Figure 1). One of the versions of the hydrosocial cycle stems from the thoughts of Bruno Latour. Latuor's states that water is not solely natural or social. Water has agency and acts upon humans just as much as humans act upon it (Latour, 1993 as cited in Schmidt, 2014) The viewpoint that water agency has impacted the United States is emphasized by the thoughts of W.J. McGee. McGee, an anthropologist in the position of director-in-charge of the Bureau of Ethnology, held the viewpoint that active force upon water creates landscapes that enable life. This has obviously been proven to be true throughout history as humans have organized their societies around different sources of water and waterway. Humans, as McGee has stated, "adjust internally and externally to the environment" in which they choose to reside (McGee, 1894 as cited in Schmidt, 2014).

The hydrosocial cycle has also weaved its way into how the distribution of water is managed. This concept that displays how this is done is called a hydrosocial territory. A hydrosocial territory is a socially, naturally, politically constituted space that is created through the interactions of human practices. Historically, these territories are produced through the interfaces of society, technology, and nature. As water flows through cities and landscapes, it

shapes how humans interact within their territory and other territories. Additionally, water is how we form geographic boundaries across the world. This organization can often lead to the empowerment of some territories and the disempowerment of others (Hoogesteger, 2016).

The hydrosocial cycle has also shifted how water is managed. Jamie Linton states that because of the hydrosocial cycle we have shifted into water governance instead of water management. Water management is an idea that isolates water from the reciprocal relationship with society. Water governance is the idea that involves the complex relationships between water and people. Contemplating the term "modern water", it implies that water and society are fundamentally distinct (Latour, 1993). But the hydrosocial cycle implies that water has never been modern, because of the way that we connect water and our societies together, leading to water governance. The relationship between water and society could also be described as reciprocal. Donald Worster describes nature (water) "as participating in an unending challenge-response-challenge, where neither nature or humanity ever achieves absolute sovereign authority, but both continue to remake each other…". Water is a product of social relations and reciprocally social relations are mediated by water. For instance, public drinking fountains sustain water as a public good. However, water can be easily diverted into private channels through means such as a vending machine. It could be argued that people who acquire private water supplies would be less willing to fund public water infrastructure through their taxes (Linton, 2011).

When water management (the separation of social and biological components) is applied in real-world practices it has shown to lead to ineffective decision making as compared to water

governance (the accumulation of social and biological components). In the years 2003 to 2008, a study was conducted by the University of Prince Edward Island about how the St. Francis Watershed Committees conducted its duties in response to the Quebec Water Policy (2002). The Watershed committee that represents St. Francis committed to trying to improve socio-spatial representation. However, when data was collected for the watershed analysis report it failed to consider the social aspects that concern the watershed and instead chose to focus on the biophysical (Bardati, 2009).

Additionally, there is the topic of funding. Instead of spreading the funds equally across watersheds, areas should consider the biophysical needs of each watershed and the demographics. Equal funding across all organizations creates bias and disadvantages larger watersheds over smaller ones. Although their methods were ineffective, a lesson is still embedded within this case study: The understanding of the hydrosocial cycle is necessary to make more effective and informed decisions (Bardati, 2009).

To further explore the reciprocal nature between water and society, I will be doing a comparison of water and its social impacts in Charlottesville versus water and its social impacts in places with high amounts of tourism. Specifically, places with high amounts of tourism where there is a disparity in the quality and the quantity of water received between tourists and locals. The findings of this comparison will show how water consumption and quality impacts the life of locals. The study will show a comparison of how Charlottesville distributes its water to its constituents and other industries versus how it is done in places with high tourist volume. In

doing so, I hope to highlight the impacts that disparities can have on locals and their environment.

Conclusion

Obviously, the quotes “water technologies are the product of history” and “water makes history” are both true statements. As shown by the examples above, both statements emphasize the fact that water not only shapes society but produces the technologies that make history. The impacts that this will have on technology. In terms of the technical project that is being done, how we choose to fix this stream will determine the social impacts in the UVA community surrounding this stream. Conjunctionally, the stakeholder will also impact the technicals of the stream. The importance of including the social, technological, and biological aspects into planning projects such as this one will create solutions that have more longevity in the future.

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