# Interactive GIS and Public Engagement of the St. George Rainway

Nathan Eastman, Wayne Jong, William Lusk, Bobbianne Riches, Brian Tai
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Simon Fraser University
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Dr. Tara Holland
Julie McManus, City of Vancouver Green Infrastructure Implementation
Kelly Gardner, CityStudio

# 1. Executive Summary

## Background

St. George Creek, also known as *te Statlew*, was once located on the St. George Street, stretching from Great Northern Way to Kingsway. Due to the infrastructural development back in the early 1900s, the Creek was covered and buried. The idea of St. George Rainway was revitalized and reimagined to create a cost-effective solution to combat climate change related consequences. Problems, like flooding and overflow of combined sewage systems, can be alleviated. Other co-benefits of the rainway, including pollutant treatment and biodiversity enhancement, can also be facilitated in the process of implementing the rainway.

The St. George Rainway Project has been advocated for by the nearby community for more than a decade, involving residents, students, and other local stakeholders. Recently, with the 2013 Mount Pleasant Community Plan Implementation Documents and 2019 Rain City Strategy by the City of Vancouver, the actualization of this project is closer to reality than ever. The City launched and has just ended Phase 1 Engagement to consult citizens about the values and visions for the project. The survey has received significant amounts of interest and concern over different aspects of the project, such as excitement for more greenery space, and other cost-and-benefit factors. Our project will be focused on addressing the varying views of the public and taking into account constructive feedback to improve.

Our goal for this project is to develop an online resource for ongoing public engagement and education on the community about environmental co-benefits of the St. George Rainway implemented through the Rain City Strategy by the City of Vancouver. As we develop this resource, our goals, objectDoce2 g0q0.00000i0o Tm000009Tm4(nd )]nTJETQq0.00000912 0(goa)4(ls, ob)-2(je)-7

# Introduction

The City of Vancouver has adopted the Rain City Strategy, with goals on improving how the city interacts and deals with rainwater and other environmental factors. Some of the City’s goals include capturing and cleaning 90% of Vancouver's rainwater before di

The map's format also allows for easy visual communication and builds a narrative around the history and future of the St. George Street Area.

## Plan and Prototype

Signage around St. George Street and at specific locations of GRI implementation will give citizens information about what is being (our has been built). Those who are interested in learning more can use the link or QR code on the sign to access the website containing the mapping tool. The website will have an interactive map of the St. George street area, showing information such as the location of historic shores lines and streams as well the sites where GRI is (our has been built). By clicking on icons associated with each GRI installation, users can then learn more about the specific piece of GRI and its benefits. The map will also include a historical timeline showing changes in the area as GRI is built.

## Next Steps

As the Rainway is constructed we will continue to update the map resource to reflect the state of construction progress. We can also use data collected on the completed Rainway to add information on exactly how the St. George Rainway is benefiting the community. This could include a decrease in the UHI effect, an increase in biodiversity and more depending on what is monitored. The map can also be updated with GRI exploration challenges or citizen experience surveys. This will help to keep people engaged and learning about GRI in Vancouver and can give people an opportunity to share their opinion on the City's green future.

# 4. Literature Review

## 4.1 - Introduction

Vancouver has been famous for its greenways program in the past, and now its transition into green infrastructure (GI) or green rainwater infrastructure (GRI). The Ridgeway Greenway adopted in 1995 was the first pioneering implementation in the city, accredited by many as it actualized the idea of greenways and successfully contributed into betterment of the landscape, sense of community and aesthetic experience (Erickson, 2006). Greenways were further implemented as waterfront promenades, urban walks, environmental demonstration trails, heritage walks, and nature trails as they provide urban reaction, alternative mobility, better experience with nature, community, and city life (Erickson, 2006). A planning initiative called *Green Infrastructure* in *Metro Vancouver - Facts in Focus*, 2015, directed the development of the *Rain City Strategy* by the City of Vancouver in 2019, whereas GRI focused to improve water resource management, reduce flood risks, and support diverse ecosystems (City of Vancouver, 2019). GI is defined as "an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations" (Benedict & McMahon, 2002) while GRI emphasizes on both engineered and ecosystem-based methods to protect, restore and mimic the natural water cycle (City of Vancouver, 2019). GI has been implemented successfully in many metropolitan cities, like Chicago Wilderness Biodiversity Conservation Plan, Portland, Oregon Metro Greenspace Program, with specific focuses on different ecological or natural resources (Benedict & McMahon, 2002). Vancouver's implementation of GRI undoubtedly focuses on water resources and includes types of GI such as bioswales, rain gardens, permeable pavements, and others (City of Vancouver, 2019).

The two main issues that GRI can help address in cities is the urban heat island (UHI) effect and flooding (Derkzen et al., 2017). Grey infrastructure such as buildings and impermeable pavements cause negative impacts such as increased anthropogenic heat, altered natural ventilation, and modified urban heat balance (Bartesaghi-Koc et al., 2020). One of the benefits of GRI is its cooling capacity and ability to mitigate UHI (Zardo et al., 2017; Bartesaghi-Koc et al., 2020). Studies have found that water bodies and tree canopy coverage were most efficient in reducing land surface temperatures (Zardo et al., 2017; Bartesaghi-Koc et al., 2020). Surface wetness and vegetated irrigation also play a significant role in providing effective cooling (Bartesaghi-Koc et al., 2020). The use of impermeable pavements for roads and sidewalks has also resulted in decreased stormwater infiltration and increased surface runoff, which leaves urban areas susceptible to flooding (Jackson, 2003). A desirable benefit of GRI especially in urban landscapes is its ability to provide vegetated drainage ditches and retain stormwater (Derkzen et al., 2017). Due to the infiltration capacities of GI, they can absorb excess storm water and reduce flooding. Additionally, GRI has stormwater filtration capabilities that can remove contaminants or excess nutrients picked up along grey infrastructure and prevent them from entering and polluting waterways (Prudencio & Null, 2017; Hobbie et al., 2017). Implementing GRI can help restore valued ecosystem services such as improved water quality, groundwater replenishment, diverse habitats to increase biodiversity, and recreation (Prudencio & Null, 2017). GRI can also reduce carbon emissions and sequester carbon from the atmosphere to help mitigate the effects of climate change.

**(2) Sociocultural and Human Benefits**

Aside from providing the ecosystem services mentioned above, GRI can also provide sociocultural benefits. This includes educational opportunities, improvements to the built environment, an increase in social capital, and improved landscape aesthetics (Kim & Song, 2019). For example, the St. George Rainway has the potential to increase recreational opportunities along the street and increase contact with nature. This can be used as an educational opportunity to increase public awareness on environmental issues. GRI can also promote community development and is associated with the formation of strong social ties among neighbours, creating a sense of place among residents (Song & Kim, 2019; Kuo et al. 1998). Other sociocultural benefits include an increase in social gathering spaces, cultural expression, and increased physical/mental health (Song & Kim, 2019). Mental health is becoming an increasingly important aspect in today's society, and there is a growing body of gaps, policy, resources, maintenance, coordination, and collaboration. These barriers represent flaws in the planning and outreach stages of GI implementation. Studies recommend bridging the gap between science and policy so GI can be incorporated into law. It is suggested that municipalities create more environmental authority through their bylaws for stormwater management, landscaping, development, and soil management (Tolsma & Hunter, 2020)**.** The papers agree that there are a variety of ways to improve GI implementation including educating the public, including the public in planning stages, and creating more policies for legal implementation. Poor partnerships and incentives are outlined as a barrier to implementing stormwater management in several frameworks (Prudencio & Null, 2017). These studies suggest quantifying the ecosystem services that come along with GI to better inform governments and people of the monetary and ecosystem benefits of GI (Prudencio & Null, 2017). When people are better informed about the value of GI, then they can make a clearer choice on implementing it (Derkzen et al., 2017). If people are more knowledgeable about the positive impacts of GI, then they would be more willing to pay for and support GI implementation projects. A study by education. However, education has its own set of issues and any education plan needs to be carefully planned and implemented in order to positively engage the public.

## 4.5 - Education

It is a commonly held belief in scientific communities that the simple dissemination of information will produce a change in behaviour of less scientifically literate audiences. More commonly referred to as the deficit-model, this model of science communication assumes that in a narrative is one way that environmental science can improve its dissemination and reception. Particularly, tying a scientific issue to a community in a human narrative improves its reception (Crowell et al., 2016; Rigutto, 2017; Wals et al., 2014) though it also can increase the risk of polarization as various ideologies clash. Conservative audiences often respond negatively to the presentation of environmental information, even more so with certain narratives attached to them (Hart et al., 2012). While this can be reduced by framing the narrative locally, there will always be portions of audiences that react negatively to science communication, and a targeted approach to moderate and supportive demographics will be more successful and produce less backlash (Hart et al., 2012). Online mediums provide a unique ability to engage audiences, improving their involvement and understanding (Rigutto, 2017; Wals et al., 2014). Visual media in online platforms especially can integrate with platforms and draw in audiences while communicating complex processes (Rigutto, 2017). Moreover, images can emotionally engage people and with more advanced software can be interacted with, straying from deficit-model education.  While online platforms can reach previously unprecedented audiences, the simplification of contextual information, as is often necessary for education, can create sources of misinformation as individual interpretation varies (Rigutto, 2017). Online visual media provides an excellent opportunity to engage narratively and emotionally with audiences but must be careful to do so with consideration and context to not result in the spread of misinformation and backlash.

## 4.6 - Public Engagement and Other Cities' Strategies

Getting people interested in civic projects, especially concerning the environment is not an easy task. Our goal is to educate the public and gain support in the community for the St. George Rainway Project. To achieve this, it's important that we understand not only how to

understanding of the public's knowledge and perception of GI both before and after they use our resource (Bonney et al., 2009). Unfortunately, again like with our choice of methods to engage the public; metrics of success that can be measured will be limited by cost and time constraints. Considering our goals for our engagement resource and our target audience we suggest using two methods to measure success. Random polling of Vancouver residents on their opinions regarding the St. George Rainway Project and perceived GRI knowledge before and after use of our educational resource. When combined with site statistics measuring visitation count, we should be able to accurately judge the success of our project (Bonney et al., 2009; UCL, 2017).

## **4.8 - Conclusion**

With the St. George Rainway project soon approaching its implementation phase, this literature review synthesizes our research thus far to aid in en servlyopm-3(e)4(mt rf our)4( prblic-3(ec4( )] TJET

Previous GRI projects have utilized brochures, tours, and youth education to promote public engagement, however due to current circumstances, this might not be a feasible option. As an alternative, using signage around St. George street to direct people to our resource is a more suitable and cost-effective solution. Lastly, measuring the success of our resource will depend heavily on our target demographic. We will utilize both qualitative and quantitative measures to gauge the success of our resource.

# 5. Proposed Plan

## 5.2 - Proposed Plan and Prototype

GIS is defined as a framework for gathering, managing, and analyzing data (esri GIS definition). For our preliminary demonstration and prototype, we utilize the open and free access platform, MapHub, to give us a sense of how this interactive mapping system can be implemented and actualized in real world settings (link to the prototype mapping program in the appendix). Despite this being a one-way communication method, there are many options for us to adopt interactive options to make the tool appealing and interesting. Users would firstly walk physically around the St. George Rainway and come across preexisting and newly-established signages. Those signages would provide a link or QR code to directly on the map with additional information such as a simple user guide. Throughout the interactive map, users can explore geographical information and features in different component layers:

- Historical water features, such as historic shoreline and historic creeks of Vancouver
- Related major infrastructure, like combined sewage systems
- Visualized timeline of the St. George Rainway Project with pictures for each project stage
    - Pre-construction/ existing look of St. George Street
    - Completed GRI items
    - Projected changes with embedded mockup/rendered pictures

engagement, users will be able to communicate with representatives from the City of Vancouver working under the St. George Rainway GRI project through our resource. However, this feature is not available on our preliminary prototype as Mabhub does not support this function, however it is common among other GIS mapping software such as ArcGIS Online.

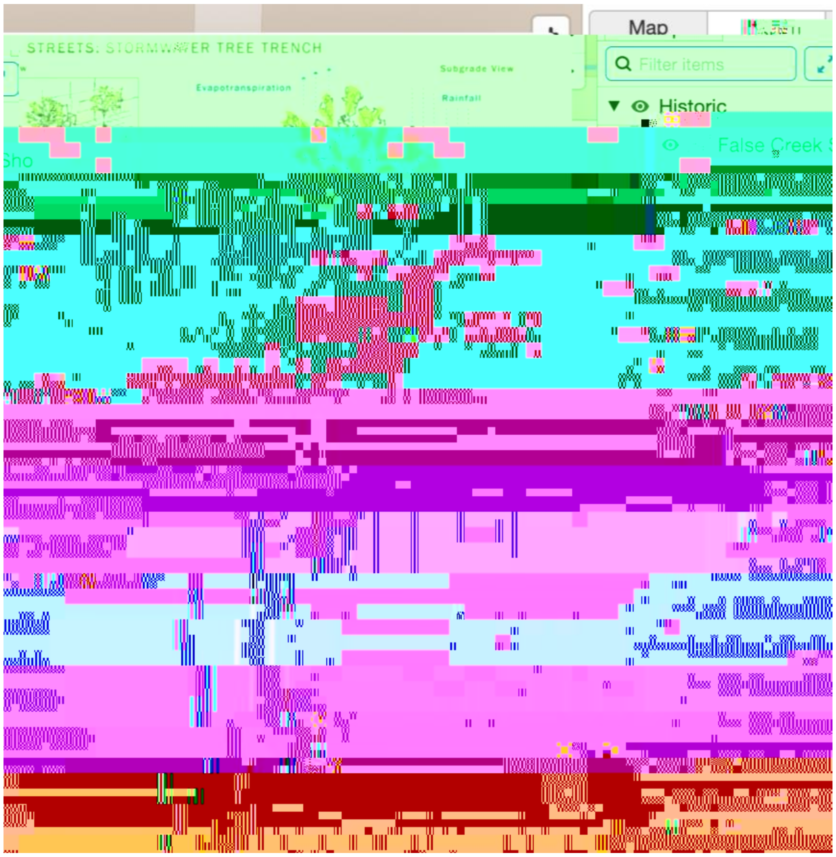


Figure 1. Screenshot of our St. George Rainway Interactive Mapping prototype

## 5.3 - Next Steps

As the construction of the St. George Rainway takes place, information on the development of the Rainway will be continuously updated to mirror the real-time progress. In addition to physical data, collaboration with data monitoring proposals can enrich the variety of information available to the public. Particularly, biodiversity changes could be framed as a narrative progression for the public's enjoyment as the project is implemented. To maintain constant engagement in the future, other interactive experiences, challenges, and surveys can also be embedded into the map. This allows residents to take up an active role in shaping their living environment and would help garner further support on the implementation of the Rainway. With our St. George Rainway Interactive Mapping Campaign, we hope to shift the perception and remedy the misconceptions of GRI. Collaboration among multiple parties, public acknowledgement and approval, as well as, long-term monitoring can be achieved with further expansion of this project if it is adopted. Lastly, we also present our three-phases implementation plan for the interactive mapping campaign:

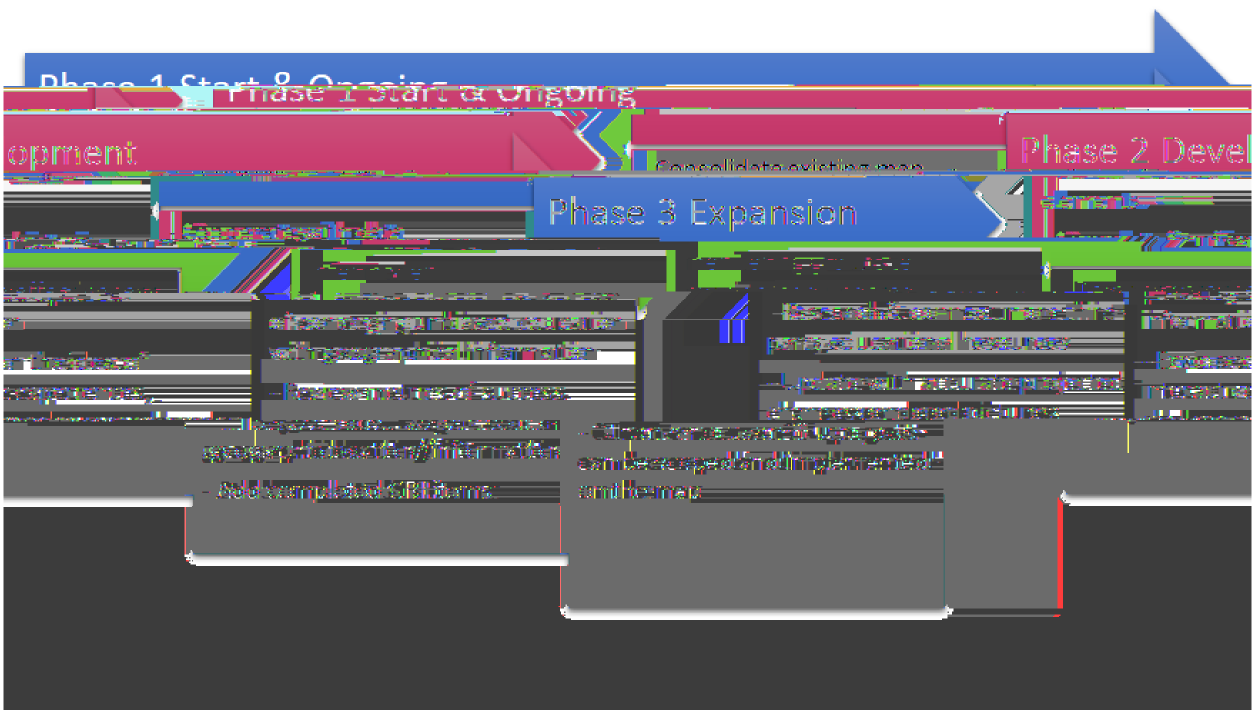


Figure 2.Three-phases implementation strategy for the interactive mapping campaign

## 5.4 - Limitations

With everything else being said, the interactive mapping campaign would still have flaws and

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# Appendix A

Link to preliminary prototype: https://maphub.net/BrianTai/St.-George-GI/