Maintaining and Funding Green Rainwater Infrastructure

Prepared by: Juliet A. Kiester, UBC Sustainability Scholar, 2025

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Alberta Street Blue Green System

City of Vancouver

Land Acknowledgement

The author acknowledges that the work for this project took place on the unceded ancestral lands of the Musqueam, Squamish, and Tsleil-Waututh First Nations.

Home - Musqueam Indian Band, 2025

Disclaimer

This report was produced as part of the UBC Sustainability Scholars Program, a partnership between the University of British Columbia and various local governments and organisations in support of providing graduate students with opportunities to do applied research on projects that advance sustainability and climate action across the region.

This project was conducted under the mentorship of City of Vancouver staff. The opinions and recommendations in this report and any errors are those of the author and do not necessarily reflect the views of the City of Vancouver or the University of British Columbia.

Table of Contents

Executive Summary

This report explores potential approaches for supporting the maintenance of Green Rainwater Infrastructure (GRI) assets in the City of Vancouver's parks and roadways. As the city continues to invest in GRI to meet sustainability, climate resilience, and equity goals, ensuring long-term care and performance of these assets is becoming increasingly important. Drawing on examples from Victoria, BC, Seattle, WA, and Pittsburgh, PA, the report outlines a range of funding tools, governance practices, and program models that may offer useful insights for Vancouver.

The findings were informed by interviews with the city staff from each municipality and stakeholders, as well as a review of municipal documents and public resources. The report highlights several strategies, including dedicated utility fees, in-house maintenance teams, partnerships with workforce development programs, the strategic use of development-related fees, and opportunities for grants and donations. While each city's context differs, a common theme is the value of coordinated planning and stable funding to ensure the success of GRI assets over time.

In addition to funding and governance, public education emerged as a key consideration. Clear and accessible communication about the role and function of GRI can foster public support, encourage stewardship, and reduce unintended damage to these systems.

Rather than proposing a single solution, this report offers a set of ideas to help inform future planning and dialogue. The goal is to support the City of Vancouver in its ongoing efforts to expand and sustain green infrastructure across public spaces.

Section I: Introduction

Research questions

The aim of this research is to recommend sustainable financial and collaborative models to support the ongoing implementation and maintenance of Green Rainwater Infrastructure (GRI) in Vancouver city parks and roadways.

Section II: Vancouver GRI Program

RQ1.1: What are current and future funding challenges regarding implementing and maintaining GRI in Vancouver City parks and roadways?

RQ1.2: What role do government and community collaborations play in maintaining GRI in Vancouver?

Section III: Case Studies by City

RQ2.1: How have other municipalities solved funding challenges regarding implementing GRI in their city parks and roadways?

RQ2.2: What government and community collaborations support GRI mantenance in other municipalities?

Section IV: Recommendations for Vancouver

RQ3.1: What financial models could support the City of Vancouver's (CoV) funding needs for implementing and maintaining GRI in Vancouver's city parks and roadways?

RQ 3.2: What other considerations are important when planning for long-term maintenance of GRI?

Research methods

Literature review: Reviewed relevant peer-reviewed and gray literature on the financialization of GRI. Identified the pros and cons of financial tools implemented by other municipalities and evaluated the suitability of each tool for use by the City of Vancouver (CoV.)

Interviews: Met with GRI stakeholders to discuss their experiences designing, implementing, and maintaining GRI in their respective cities. GRI stakeholders included people with experience working on GRI in the City of Vancouver and other cities with similar situations to Vancouver, including Victoria, Seattle, and Pittsburgh. Synthesized interviews to identify key issues and potential solutions for CoV.

What is GRI?

Rainwater infrastructure includes components of the urban environment that are designed to catch and filter rainwater. Green Rainwater Infrastructure (GRI) specifically uses nature-based

elements either on their own or combined with hardscape components like drains and pipes. Examples of GRI include rain gardens, permeable pavement, restored wetlands, and trees planted in well-draining soil.

Why do cities need GRI?

GRI can tackle multiple environmental, social, and economic goals. GRI catches and filters urban runoff close to where it falls, reducing water pollution caused by combined sewer overflow events. GRI can reduce urban heat amplified by extremely hot weather and droughts, reduce flooding, and buffer sea level rise. Habitat restoration and native plant installation protect urban biodiversity. In addition to the above environmental benefits, GRI also offers opportunities for reconciliation and social sustainability. Inclusive design and conscientious implementation of Green rainwater infrastructure provides opportunities to decolonize both our social and environmental systems and reconnect the two to each other.

Many municipalities around the world are expanding their GRI programs. A critical aspect that is frequently overlooked in these initiatives is the long-term maintenance of GRI assets. Both hardscape and vegetative elements require regular upkeep to ensure they continue to function effectively. This report addresses the importance of incorporating maintenance considerations into program planning, with a particular emphasis on developing sustainable funding strategies to support ongoing maintenance activities.

Section II: GRI in Vancouver

Vancouver, BC, is a rapidly developing coastal city surrounded by (and drenched in) water. Vancouver's western coast meets the Salish Sea; its northern shore is bounded by Burrard Inlet, and the Fraser River flows just south of the city. Vancouver receives approximately 146 cm of rainfall annually (*Coastal BC Rainfall - Science World*, 2020). The natural ecosystem is a temperate rainforest. The city has developed rapidly, and it has the highest land value and population density in Canada, with a population nearing 700,000 over an area of 114 square kilometers (*Mochrie, P, 2022*). Urbanization has destroyed most of the natural streams and expanded impermeable surfaces. Vancouver's sewer infrastructure includes a combined system, which the city is actively working to separate to enhance stormwater management and environmental protection. With a population projected to continue growing, the city urgently needs to implement strategies to manage stormwater runoff and control water pollution.

The City of Vancouver is committed to improving stormwater management practices. The following strategies, among others, document CoV's efforts and plans to improve stewardship of our natural resources:

Relevant legislation/documents in Vancouver

- Rain City Strategy

Adopted in 2019. Outlines goals for capturing, slowing, and filtering rainwater in Vancouver. Identifies GRI as a key tool to achieve goals.

- VanPlay Framework

Approved October 2020. Vancouver's Parks and Recreation Services Master Plan. Vancouverites reported that they want more natural spaces in Vancouver city parks. GRI is one way to achieve that goal while supporting other goals of managing stormwater. The framework also highlights GRI in city parks as a crucial initiative to support climate resilience.

- UNDRIP Plan

Passed October 2022. Partnership between the Musqueam, Squamish and Tsleil-Waututh Nations and CoV. Relevant goals include reducing water pollution and protecting aquatic habitats.

- Vancouver Plan

City of Vancouver's unified land-use plan. Includes a long-term vision that "Restores and expands tree canopy, green space, and parks." All of these components dovetail with GRI in parks and roadways.

- The Climate Change Adaptation Strategy

Focuses on preparing Vancouver for extreme weather events caused by anthropogenic climate change. GRI can help reduce the severity of flooding events, and expanding canopy cover reduces urban heat.

- Healthy Waters Plan

City of Vancouver's 50-year plan to manage rainwater, in partnership with Metro Vancouver, Musqueam Indian Band, Squamish Nation, Tsleil-Waututh Nation, and other government and community stakeholders. The Healthy Waters Plan will aim to reduce water pollution from the sewer and drainage services, increase sewer capacity to accommodate population growth, and mitigate impacts of climate change on the sewer system (City of Vancouver, 2021). The Healthy Waters Plan Implementation Plan is currently in development.

- Liquid Waste Management Plan

A provincial mandate for municipalities to separate combined sewers by 2050 (Metro Vancouver, 2025.)

Departments involved in GRI in parks and roadways

Designing, implementing, and maintaining Green Rainwater Infrastructure projects in parks and roadways requires collaboration across city departments. The City of Vancouver formed the Green Infrastructure branch ("GI") in 2016, an engineering team dedicated specifically to nature-based engineering projects. Engineering is responsible for planning and delivering assets, including GRI, but land for GRI projects is usually limited to street right of ways.

The Park Board manages rainwater drainage in parks, and has land that can potentially host GRI projects, when there is a common interest. The City of Vancouver currently employs a cross-appointed staff member who is equally funded by GI and the Park Board and functions as both a project manager for the delivery of GRI in parks, and a liaison between the two interests. Engineering needs to communicate with other branches to achieve asset implementation, including electrical, water design, streets, transportation, utilities, urban forestry, and sewers. To reduce miscommunications, GI endeavors to include key stakeholders in asset planning, from inception to installation and maintenance.

Examples of projects

- Hinge Park

Designed for the 2010 Winter Olympics, Hinge Park in Olympic Village was the first GRI project in a Vancouver city park. Rainwater from the streets of this neighborhood is directed to Hinge Park that includes a rainwater wetland designed to capture and filter stormwater before

releasing it into False Creek. No formal maintenance agreement or funding source exists for this combined asset.

- Gibby's Field Park

The land for Gibby's Field Park was purchased by the Vancouver Park Board in 2020. This park was designed to capture and filter local area stormwater and enhance biodiversity. Gibby's Field is an example of a nature park that also functions to reduce water pollution.

- Tatlow Creek

The Vancouver Park Board initiated the daylighting of Tatlow Creek inside Tatlow Park, and this serves to filter the stormwater from the surrounding area. The project was completed in 2024, with the funding assistance of a federal grant described in Table 1.

Challenges of implementing and maintaining GRI in Vancouver

GRI is inherently interdisciplinary, and installing GRI in city parks and roadways involves coordination between multiple municipal branches and the public. Communication between all relevant branches can present challenges, as each branch may have separate goals for the same space. For example, city parks already experience multiple pressures to provide open spaces, recreational facilities, and walking areas, and other goals need to be compromised to create space for GRI. Similarly, roadways also have limited space with competing priorities from parking to electrical infrastructure, and implementing and maintaining GRI in these spaces requires compromise between the public and multiple city branches. Reaching agreements on funding is an additional complex challenge. This is especially true in Vancouver's property value is among the highest in Canada (Canada Mortgage and Housing Corporation, 2025)

Current funding for GRI in Vancouver

The Park Board and GI have notionally/in principle agreed that the Park Board will take over vegetation maintenance of new GRI assets in city parks after the first two years of establishment, but no maintenance agreement yet exists. GI implements (pays for the capital cost of) most GRI assets in Vancouver city parks and roadways. While GI can maintain hard components of GRI projects through their O&M budget, the Board of Parks and Recreation requires additional resources to sustainably maintain the vegetative components. The Park Board does not have sufficient resources to employ and train staff to take care of GRI assets, as their maintenance needs differ from expansive grass mowing. GRI assets require specialized maintenance tasks such as vegetation pruning and invasive species removal. Therefore, a new financial model is recommended to ensure long-term, sustainable care of GRI assets on city park land.

Table 1: Summary of Current Funding Tools in Vancouver, BC (Part 1/2)

Financial Tool	Brief Description	Amount	What it Funds	Benefits	Challenges
Federal Grant	Government of Canada's Natural Infrastructure Fund for rainwater integration projects throughout the city.	$20 million	Gibby's Field Park, Tatlow Creek, and four upcoming projects. Capital funding and first two years of maintenance	Funding assistance for the capital construction costs of multiple new projects	Short-term does not support long-term maintenance. Will soon run out.
Community Amenity Contributions (CACs)	Paid by developers when re-zoning a property to contribute to community amenities, including parks; amount may be negotiable	Varies by neighborhood and type of development. Usually calculated per square meter. Ranges from $1,900/ m².	Currently funding most GRI projects in parks	Money from developers, not taxpayers Can be used for projects in streets and parks Specific to needs of neighborhood	One-time payments (although they may be paid over time,) so not stable income over time as based on rezoning and development Not specific to GRI, nor their operational maintenance
Development Cost Levies	Fixed fees paid by developers for all development projects Revisited every 4 years	Varies by development Category: Usually calculated per square meter. Eg: $254.21/ m² for commercial developments (as of 2024).	Currently funding most Engineering GI projects	Same as CACs	Same as CACs

Table 1: Summary of Current Funding Tools in Vancouver, BC (Part 2/2)

Financial Tool	Brief Description	Amount	What it Funds	Benefits	Challenges
GI Department Budget	GI budget focuses on GRI in right-of-way but also supports GRI in city parks	Capital: ~$40 million/4 years Operational: ~$250,000 at present, may increase	Responsible for design, implementation, first two years of all maintenance in parks, ongoing maintenance of hard/grey components in parks, and all ongoing maintenance in right-of-way	GI can pay for design, implementation, and maintenance of assets Specific to GRI that right-of-way drainage	GRI sites that only manage park runoff are excluded.
Current Utility Fees (not supporting GRI)	Revenue services manages billing and collection of water and sewer utility fees	Typical water and sewer flat rate for single-family home: $1,685 (City of Vancouver, 2025)	Separating combined sewers, wastewater treatment, replace aging infrastructure	Reduce risk. of combined sewer overflow	Does not currently support GRI

Table 2: Vancouver Community Partnerships

Organization	Description	Contributions to Rainwater Management
Seeding Stewardship Program	Volunteer opportunities for community use of space within nature-based solutions	Community building activities in rain gardens, blue-green systems, and pollinator gardens
Green Streets Program	Volunteer opportunity for citizens to start or maintain gardens in traffic circles or between sidewalks and roadways	Planting and maintenance of some rain gardens in traffic circles and sidewalk areas
Stanley Park Ecological Society	Coordinates stewardship in Stanley Park (*Stanley Park Ecology (SPE)*, 2025)	Build capacity and maintains forested parkland, which functions to manage rainwater naturally
Still Moon Society	Organizes community artwork, events, and stewardship activities	Garden maintenance and stewardship including invasive removal (*Still Moon Arts Society – Inspired & Connected*, 2024)

GRI goals in Vancouver

- Goals outlined by Rain City Strategy
    - Long-term goal to capture and clean 90% of rainwater that falls on the city
    - Manage rainwater runoff from 40% of impermeable urban surfaces by 2050
    - Daily capture and cleaning of 48mm of rainwater that falls on roadways, parks, and civic facilities

- Goals outlined by Healthy Waters Plan
    - 43 kilometres of Blue Green Systems
    - 42 kilometres of Green Streets
    - 18 hectares of Floodable Wetlands and Public Spaces
    - 4 kilometres of Waterway Restoration
    - 30 Rainwater Treatment Devices
    - 24mm retention policy

- Additional Goals
    - Maintain existing assets
    - Four Engineering GRI projects in parks are currently in progress:
        - Slocan Park and Beaconsfield Park currently under construction
        - Falaise Park in tender for construction
        - Charles Park in design

Section III: Case studies by City

RQ2.1: How have other municipalities solved funding challenges regarding implementing GRI in their city parks and roadways?

RQ2.2: What government and community collaborations support GRI mantenance in other municipalities?

Case Study #1: Victoria, BC, Canada

Victoria is a coastal city situated on the southern tip of Vancouver Island in British Columbia. Similar to Vancouver, Victoria is coastal, rapidly developing, and faces challenges with aging gray stormwater infrastructure. However, Victoria is smaller than Vancouver, with a population close to 400,000 (canada.ca).

Relevant policies & documents

- 2010: *Re-inventing rainwater management: A strategy to protect health and restore nature in the Capital Region*. Environmental Law Clinic, University of Victoria.
- SANITARY SEWER AND STORMWATER UTILITIES BYLAW, AMENDMENT BYLAW (NO. 12)

Government structure

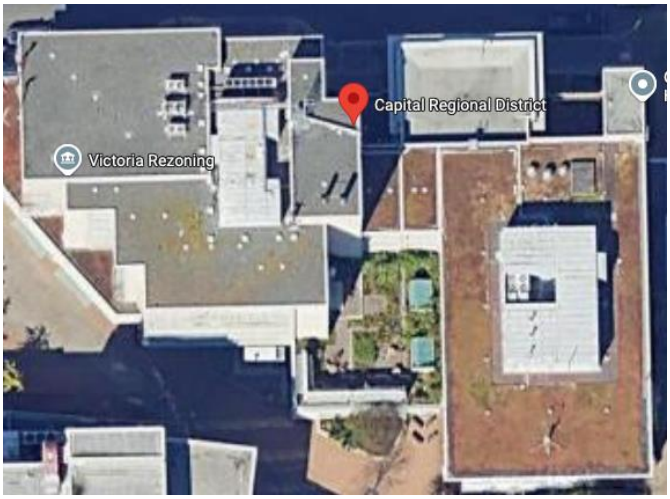
- City of Victoria's Engineering Department oversees Stormwater Utility Program
- Worked with Capital Regional District (equivalent of Metro Van)

Community collaborations

- University of Victoria Environmental Law Clinic
- British Columbia Institute of Technology Centre for Architectural Ecology
- Watershed groups
- Community groups

Victoria Feature Project: Green Infrastructure on Capital Regional District Building

Living Wall on CRD Headquarters, BCIT, 2021



Green Roofs on CRD Headquarters, Google maps, 2025

Description: The Capital Regional District installed green roofs and a living green wall on its headquarters building in 2009. This project was a collaboration with BCIT, who provided design and monitoring services. Plants in the green roof include edible plants, native flora, and drought-tolerant species. The building received a Leadership in Energy and Environmental Design (LEED) Gold certification. (*Green Stormwater Infrastructure | Capital Regional District*, 2025)

Cost information of the CRD HQ green roof project was not available.

Table 3: Victoria, BC Funding Tools Summary Table

Tool	Description	Amount	Benefits	Challenges
Stormwater utility Fee	Property owners billed based on impervious area and land use. City used remote sensing to determine fees for individual lots.	Funds 80% of drainage services (2022) $0.9920/square metre of impervious area	Stable income, properties contributing more to the problem also contribute more to the solution	May not be equitable, may not generate enough income to fully fund GRI needs, does not fund GRI in parks or ROW in Victoria
Research Collaboration with BCiT	BCiT Centre for Architectural Ecology monitors GRI effectiveness	Researched effectiveness of green roof	High-quality quantitative research	Depends on student availability and research funding
Property tax	Property tax funds GRI in roadways because roadways are not included in utility fee	20% of GRI (GRI in roadways)	Consistent	Financial burden on property owners

Additional information on Victoria Stormwater Utility fee

The 2010 report "*Re-inventing rainwater management: A strategy to protect health and restore nature in the Capital Region*" by McGuire et al. at The University of Victoria Environmental Law Clinic motivated the City of Victoria to implement its stormwater utility fee. In preparation for the fee, the city began informing the public about its goals in 2013, emphasizing how it would support climate adaptation and provide sustainable funding. The city organized a stakeholder committee comprised of representatives from the public, businesses, the university, and regional governments. They also hosted 2-3 meetings to consult with groups of each type of property and hosted open houses to educate the public about stormwater and collect data through surveys. The city also communicated to the public that they were not collecting additional money through the fee but rather redistributing how costs are paid. Following the recommendations in the UVic Environmental Law report, the city created a bylaw and finally implemented the utility fee in 2016. (City of Vancouver, 2022)

Victoria's stormwater utility fee is billed at a variable rate based on the impervious area of each property. Impervious areas are defined as hard surfaces, including roofs, roadways, parking, and driveways. Residences are classified into two categories: single-family and multi-family. Non-residential properties are divided into civic/institutional and commercial/industrial. The municipal government used remote sensing data to calculate the specific impervious area of individual properties. This structure is time-consuming for municipal staff and confused the public at first, but it ensures a direct relationship between the amount of stormwater runoff a property generates and the amount it contributes toward managing that runoff. According to Hseih (2017,) the public in Victoria does not have ongoing complaints about the stormwater utility fee.

The City of Victoria offers the following four discount credit avenues:

- Rebates available for homes in low-density areas
- Credits for approved stormwater management in multi-family and business/institutional properties (2-50% discount)
- Sites with existing GRI eligible for credit
- Exemption for properties without storm connection (Hseih 2017)

Lessons learned

- Citizens can accept stormwater utility fee if it is explained clearly before, during, and after implementation

Case Study #2: Seattle

Seattle and Vancouver are very similar. Both cities are surrounded by water and experience frequent precipitation. Under 200 km south of Vancouver, Seattle is in the same ecoregion as Vancouver, also naturally a temperate coastal rainforest. Like Vancouver, Seattle has developed more rapidly than the city's infrastructure can support and now has a high population density. The mean annual precipitation of Seattle is 92.7cm (*ClimateNA_Map*, 2020). Seattle has a slightly higher population than Vancouver, of about 750,000 (*Seattle - Data Commons*, 2025). Furthermore, Seattle continues to experience consequences of the housing and opioid crises. These issues have seriously affected public spaces, especially parks. Seattleites care about the environment and safe access to green spaces.

A key difference between Seattle and Vancouver is policy, as Seattle is a US city while Vancouver is Canadian. Seattle tends to use the term Green Stormwater Infrastructure (GSI) instead of GRI, but they generally refer to assets with similar functions. For consistency, this report will continue to use the term GRI. Seattle's GRI program is older and more extensive than Vancouver's GRI program, as Seattle began documenting its GRI projects in 2001 (City of Seattle, 2015), and now maintains over 1,109 bioretention swales in the right-of-way, 11.5 acres of bioretention landscape in the right-of-way, hundreds of acres of permeable landscape between parks and roadways, and several thousand acres of naturally forested parkland (Seattle Public Utilities, 2019).

Relevant policies/documents

- Clean Water Act (federal)
- Invasive Species Act
- Stormwater code within Seattle Municipal Code

Seattle has a robust stormwater code administered by the Seattle Department of Construction and Inspections. The stormwater code is structured to encourage Green Stormwater Infrastructure (GRI) best management practices as the first option. The code also requires on-site stormwater management when parks are renovated or when new parks are created.

Government structure

Multiple branches of local government are involved in Seattle's GRI programs. Seattle Public Utilities (SPU) collaborates with King County Wastewater Treatment Division (WTD) on GRI projects. There is one jointly staffed position that is equally funded by SPU and WTD. This position is intended to reduce silos and help move GRI projects forward.

SPU manages the stormwater utility dollars. Most of SPU's GRI assets are in the right-of-way, but they also have a floodable park. SPU has an in-house GRI team, and they also contract GRI maintenance work out to Seattle Conservation Corps (SCC) and Dirt Corps (see "community

collaborations" for more info on SCC and Dirt Corps.) SPU plans to develop an additional, new workforce program. The Seattle Department of Construction and Inspections works with SPU to enforce the stormwater code.

The Washington State Department of Ecology maintains a strong focus on water quality and salmon habitat protection. Grants are available for projects that meet these goals, and GRI projects can fit into this category.

All facilities, including GRI assets, built by the Seattle Department of Parks and Recreation are owned and maintained by Parks and Rec.

Separate from Seattle Parks and Recreation, the Seattle Park District was founded in 2015 when voters passed Proposition 1. The Seattle Park District covers the same area as the City of Seattle, but has special authority to collect and manage property taxes for the purposes of managing, controlling, maintaining and acquiring park land. (*About | Seattle.gov,* 2021)

Seattle Parks and Rec has their own GRI workforce comprised of multiple crews:

1. Standard Gardeners Crew

Take care of multiple tasks related to landscaping. Some members also trained in GRI maintenance. The gardeners understand ecological systems and have a passion for ecological benefits. This crew undergoes annual horticultural and landscape training.

2. Drainage Crew

Take care of technical tasks related to hardscape components of GRI.

3. Plumbing and Electrical Crew

Take care of issues relevant to plumbing and electricity.

These crews are primarily funded by the Seattle Park District.

Community Collaborations

- Dirt Corps jobs program. Dirt Corps collaborates with multiple stakeholders, including the King County Wastewater Treatment Division, to provide paid training in green job skills to young professionals. Dirt Corps hires young people with no prior experience and encourages people experiencing marginalization to apply. The program is fully bilingual, with a Spanish-language instructor on staff, and hoping to expand to additional languages. Work includes the design and implementation of GRI, habitat restoration, and GRI maintenance. Dirt Corps crews serve 7-week terms and are required to work a minimum of 6 hours/week, with additional hours available. Dirt Corps employees make $21/hour. Dirt Corps is funded through grants and through its own contracting company (*Seattle Conservation Corps - Parks | Seattle.gov*, 2021). Grants that support Dirt Corps

have come from King County (*Home - 700 Million Gallons*, 2025), City of Seattle (*Healthy Environment - Environment | Seattle.gov*, 2021), and Port of Seattle (*South King County Community Impact Fund Environmental Improvements Program*, 2023). This program is an excellent example of how to advance social and environmental sustainability together. Dirt Corps collaborates with Seattle Parks and Recreation.

- South Seattle College. South Seattle Community College is one of several institutions the City of Seattle has partnered with to design a Green Stormwater Infrastructure Curriculum.

- Seattle Conservation Corps (SCC.) SCC is a workforce development program hosted by Seattle Parks and Recreation. SCC employs people who are experiencing serious life challenges, including homelessness, former incarceration, addiction recovery, and more. Crew work includes watering, pruning, planting, trail maintenance, and other activities related to taking care of city parks, including GRI assets in parks. Crew members serve one-year terms and pay starts at minimum wage. Crew members work 5 days/week and are offered educational and career development opportunities in the evenings. The program is highly successful, with over 80% of crew members finishing their term with stable housing and over 90% finding stable employment directly after their term.

  The annual budget of SCC is about $4 million. 75% of the budget is paid to the organization for municipal work that would otherwise be contracted out. The remaining 25% comes from grants.

- Mid-Sound Fisheries: Mid-Sound is a nonprofit community group. They are currently collaborating with SPU and Seattle Parks and Rec on a floodplain reconnection park.

- Green Seattle Partnership: The Green Seattle Partnership is a group of multiple organizations, including the City of Seattle, and thousands of volunteers who work together to take care of Seattle's forested parks. (*Home—Green Seattle Partnership*, 2025)

GRI Program Features

- Seattle has already met their goal of managing 700 million gallons of rainwater through GRI (City of Seattle, 2023)
- Achieved goal of planting 1 million trees
- Multilingual project—outreach in Spanish, Vietnamese, and Chinese to work with contractors who speak those languages
- GRI maintenance hotline to report clogs, etc.

- Researched floating treatment wetlands

Seattle Feature Project #1: Lake City Floodplain Park

Lake City Floodplain Park

Lake City Floodplain Park is a GRI park currently in the design phase. Formerly a private residence, SPU and Seattle Parks and Recreation purchased the property for this park together. (*Lake City Floodplain Park,* 2018) The location of the property on the northern part of Thornton Creek in the Lake City neighborhood provides a rare opportunity for habitat restoration in a neighborhood with mostly impermeable, hardscaped landscape. This restoration project will reconnect Thornton Creek to its floodplain and allow community members to visit and enjoy the stream. The park will be designed to flood during storm events.

Seattle Parks and Recreation's Green Seattle Partnership, in collaboration with the King County Noxious Weeds Program through the Healthy Lands Project, will provide continued support for on-site invasive weed removal and the maintenance of native plantings.

Lake City Floodplain Park Construction Cost Breakdown:

- 50/50 split between Seattle Public Utilities and Seattle Parks and Recreation
- $4 million grant pulled in by Mid-Sound Fisheries Enhancement group
- $1 million land acquisition
- $400,000 demolition
- Pre-construction site management: $50,000

- Design: $2.4 million
- Construction: $2.8 million

(Environmental Finance Center Network, 2025)

Seattle Featured Project #2: Madison Valley Stormwater Project

Madison Valley Stormwater Facilities | RH2 Engineering, 2025

Description: Seattle Public Utilities acquired land in an area of Seattle that experienced frequent and severe flooding. SPU partnered with RH2 Engineering and Seattle Parks and Rec and others to create a GRI asset that could better manage stormwater in the area. The facility can now store 4 million gallons and prevent local flooding. During the dry season, the park is open to the public. The site is maintained by SPU.

Infrastructure Cost: $34.5 million USD

Table 4: Funding Tools Summary Table for Seattle, WA, USA (Part 1/2)

Tool	Description	Amount	Benefits	Challenges
Real estate excise tax	Property sales tax, contributes to the city's general fund for Seattle Parks and Recreation	Tax rate of 0.50% in Seattle (does not all go toward GRI) (*Local Real Estate Excise Tax Rates*)	Pays for GRI O&M in Parks	Not fully dedicated to GRI, income fluctuates
Stormwater utility fee	Fee calculated based on land use and impermeable area of properties Support O&M of GRI in right-of-way Managed by Seattle Public Utilities (SPU)	Charged annually Ranges from $235.28USD - $929.48 USD/ property (Drainage Rates - Utilities | Seattle.gov, 2021)	Sustainable, relatively fixed –income properties contributing more to the problem also contribute more to the solution	Not enough income to fully fund GRI needs, does not cover GRI in parks in Seattle
Dirt Corps Jobs Program	Paid training in green job skills, including restoration and GRI maintenance	Contracted for some maintenance	Advances both social and environmental sustainability	Not fully dedicated to GRI
Seattle Conservation Corps Jobs Program	Jobs program for adults experiencing homelessness and other challenges, hosted by Seattle Parks and Rec Crews contracted by multiple clients including maintenance of GRI in right of way (not parks)	Annual budget of $4 million, 75% funded through paid work through the city, 25% from grants	Advances both social and environmental sustainability	Not solely dedicated to GRI

Table 4: Funding Tools Summary Table for Seattle, WA, USA (Part 2/2)

Tool	Description	Amount	Benefits	Challenges
King County Waterworks Grants	A portion of money from county funding mostly going toward incentives for homeowners Capital project budget – goes into right of way and parks	Approximately $5 million every two years (*WaterWorks Grant Program - King County, Washington*, 2025)	Available to pay for various projects	Competitive, not sustainable
Partnership with Mid-Sound Fisheries Enhancement Group	Mid-sound fisheries is collaborating with Seattle Parks and Rec and Seattle Public Utilities to design and implement a new wetland park in Lake City neighborhood	Mid-sound fisheries acquired $4 million grant, led the first part of the project, implements community engagement programs	Connect with community in ways the government cannot, brought in grant, expertise	Challenging to align goals across multiple departments and partners
Green Seattle Partnership	Collaboration between multiple city departments, multiple community groups, and thousands of volunteers	Ongoing maintenance of forested park area; forested areas capture and absorb rainwater	Engages a great number of volunteers, builds stewardship and sense of place in communities, maintains and restores forested parkland	Unique to Seattle: few other cities have so many forested parks and so many people with restoration experience
Seattle Park District	A metropolitan park district with the same boundaries as the City of Seattle, has special authority to collect and manage taxes to support park maintenance	Funding supports maintenance teams Reported to fund a maintenance backlog of $270 million (*The Seattle Park District,* 2016)	Voters established the park district to ensure long-term funding of park maintenance	Additional tax burden on property owners

Challenges

- Public perception: Some GRI projects in Seattle have not been received well by citizens. For example, rain gardens in the Ballard neighborhood received widespread criticism due to their poor drainage and visually unappealing appearance. On top of the damage to GRI reputation, improving this project was also expensive for the city (Stiffler, 2011). City staff are still worried about public pushback from new projects, including the upcoming floodable park in Lake City.
- The housing crisis has put pressure on public green spaces in Seattle, including those with GRI assets. Encampments of unhoused individuals and communities have moved into public green spaces. In Seattle, the mayor's office takes care of issues related to the unhoused population, and approaches vary from community to community. Unfortunately, public restrooms in parks have been closed due to safety concerns, demonstrating the severity of the problem. These overlapping social and environmental pressures make it difficult to ensure consistent, high-quality maintenance of GRI assets.
- Finding solutions that support both local ecology and social issues continues to be an interdepartmental challenge.
- Voter support, Seattle Park District

Lessons Learned

- Collaboration with community groups helps the city engage more deeply with the public and support funding.
- Aligning the goals of multiple stakeholders helps collaborative projects run more smoothly.
- Public education on GRI is essential.
- Social issues can't be ignored—even if other departments handle social challenges, GRI may be affected.
- Having multiple dedicated crews can benefit GRI maintenance because the. Crews can provide high-quality and specialized services

Case Study #3: Pittsburgh

Pittsburgh is a landlocked city in the northeastern United States. (*City of Pittsburgh, PA*, 2025). Pittsburgh lies at the confluence of three rivers and experiences frequent precipitation with a mean annual precipitation of 93.8cm (*ClimateNA_Map*, 2020).

Pittsburgh and Vancouver face similar stormwater challenges. Both cities have frequent precipitation. Both cities have buried most of their natural streams and now face flooding concerns. Pittsburgh also has 75% combined sewers.

A key difference between Pittsburgh and Vancouver is policy, as Pittsburgh is a US city while Vancouver is Canadian. Pittsburgh also has less than half the population of Vancouver; its population is approximately 303,000. A unique geologic feature of Pittsburgh called red beds predisposes hillsides to landslides, especially during rainstorms, complicating GRI implementation and maintenance.

Relevant policies/documents

- Clean Water Act (federal)
- Clean Streams law (state)
- Multiple levels of stormwater development permits
- Stormwater Design Manual
- Stormwater First Policy for Capital Planning: PWSA adopts a "Stormwater First" approach in capital planning to ensure that stormwater management is a primary consideration in transportation, utility, and public works projects. This policy prioritizes integrated GRI when planning or retrofitting roadways and other public infrastructure.
- Stormwater Management Code: In Pittsburgh, the "Stormwater-First" policy is embedded in local legislation through Title 13 of the City's Stormwater Management Code. Specifically, § 1303.01.h(2 F) mandates that developers "incorporate green infrastructure methods described in the City of Pittsburgh Stormwater Design Manual," effectively prioritizing green stormwater infrastructure (GRI) over conventional gray infrastructure. Additionally, § 1303.04.d(1) establishes incentive payments for rate control systems that exceed standard requirements—further encouraging the use of GRI to meet regulatory benchmarks (City of Pittsburgh, 2022).

Government structure

- Environmental Protection Agency (federal)
- Pennsylvania Department of Environmental Protection (PADEP) (state)
- Pittsburgh Parks and Recreation
- Pittsburgh Department of Mobility Infrastructure
- Pittsburgh Department of Public Works
- Pittsburgh Department of Permits, Licensing and Inspections

- Pittsburgh Water and Sewer Authority
- Pittsburgh City Planning

Community Collaborations

- Watershed nonprofits, e.g., Upstream Pittsburgh
- Community-based organizations: The city generally reaches out to local community organizations when they have projects in specific neighborhoods.
- Landforce Jobs Program: Landforce is a jobs program that provides employment opportunities for marginalized individuals, including those who have been formerly incarcerated, unhoused, or affected by generational poverty. Participants receive professional development and hands-on training, and an impressive 92% secure employment directly after their term. The Landforce crew works on a variety of environmental projects, including stormwater and green rainwater infrastructure (GRI) maintenance. Their responsibilities include installing projects, watering plants until they are established, and maintaining both living components (e.g., weeding, plant care) and nonliving components (e.g., clearing catchments). Additional work includes habitat restoration tasks such as trash cleanup, invasive species removal, and native plant installation and upkeep. The program generally runs from May through November (*Land Stewardship Work We Do - Landforce*, 2024). Landforce is funded by a combination of grants and loans. (*Landforce - REDF*, 2025)

GRI Program Features

- Currently managing 50-60 assets
- GRI assets in parks
- Roadway projects to reduce flooding
- Upcoming program to turn vacant lots owned by the city into GRI projects
- In-house maintenance crew includes maintenance manager and two staff
- Maintenance guidelines: Ongoing maintenance is essential for the success of GRI. According to the City of Pittsburgh Stormwater Design Manual (City of Pittsburgh Department of Mobility and Infrastructure, 2022), systems should be inspected frequently in the first year—weekly or monthly—to support successful establishment. After that, inspections are recommended at least every three months, as well as after any rainstorm exceeding one inch. It's also important to check systems during or after major storm events, such as a 10-year storm, to identify early signs of failure or wear.

  The manual outlines routine inspection tasks that focus on both the living and structural elements of the system. This includes checking for sediment buildup, assessing plant health, removing weeds or invasive species, and ensuring pipes, inlets, and outlets are

functioning properly. Maintenance might involve mulching, pruning, emergency watering during droughts, and small repairs like erosion control or patching concrete. More significant repairs require professional equipment and expertise. To support accountability and planning, crews are encouraged to write inspection reports after each visit (City of Pittsburgh Department of Mobility and Infrastructure, 2022).

Pittsburgh Featured Project: McKinley Park Community Grove

McKinley Park Community Grove plan, City of Pittsburgh

The updates to McKinley Park will include stormwater management. According to the McKinley Park Master Plan, smaller GRI projects could include rain gardens and slope stabilization and can be implemented by Landforce or the Student Conservation Association. This park area also has potential for larger-scale stormwater management of up to an inch and a half of runoff from surrounding streets (Pittsburgh Parks Conservancy, 2017).

McKinley Park Community Grove Cost Breakdown

- Construction: $464,000
- Design and Management: $196,000
- Funded partially by a $330,000 allocation from the City of Pittsburgh Parks tax fund
- Charities supporting the project:

- Pennsylvania American Water
- The American Water Charitable Foundation *(McKinley Park Community Grove | Pittsburgh Parks Conservancy*, 2024)

Table 5: Funding tools Summary Table for Pittsburgh, PA, USA

Tool	Description	Amount	Pros	Cons
Stormwater Management Fee	Calculated based on Equivalent Residential Units (ERU,) Calculated using random samples	Used to improve existing systems, clean and repair drains, sweep streets Also used to build new GRI assets Funds maintenance manager and staff	Dedicated funding source: citizens pay and benefit	Not enough to pay for all GRI and sewer maintenance
Landforce Jobs Program	Employment opportunities for marginalized citizen	Stormwater and GRI maintenance May-November	Advances both social and environmental sustainability	GRI with the city is one of many projects they work on
Redevelopment permit fees	Various permits required under federal and municipal regulations Developments that disturb >10,000 ft^2 of land or create >5,000 ft^2 of impermeable surface need permits	Fees calculated based on the amount of stormwater discharged onto private and public land	Balances land disturbance and expansion of impermeable surfaces with restoration and GRI	Dependent on development projects, not specific to GRI
Stormwater Trust Fund	If developers cannot meet permit requirements, they can pay into the stormwater trust fund	Feeds into capital budget and O&M for stormwater projects in the same watershed as the development(s)	Funds earmarked for stormwater projects	Only funding projects in the same watershed as the development has limited flexibility
Grants	Federal, state, and foundation grants	Varies Support restoration, GRI, vacant lots reclaim program, land acquisition	Many options of varying amounts, can support a variety of projects	Competitive, one-time payment (not sustainable)

Challenges

- Public communication: The public does not have a deep understanding of stormwater issues and the value of GRI and nature-based solutions.
- O&M Funding: The maintenance crew is not able to complete all maintenance tasks with the current time and resources available.
- Physical challenges with red bed geological features increasing risk of landslide.

Lessons Learned

- Invest in GRI O&M early and consistently
- Work to educate the public and continue programs during and after project implementation
- A common misconception is that green infrastructure is maintenance-free; in reality, GRI requires ongoing care and maintenance like traditional hardscape infrastructure.
- Whenever possible, involve maintenance personnel in the project design phase to incorporate their expertise on future maintenance considerations such as site access and specialized equipment needs.

Section IV: Recommendations for Vancouver

RQ3.1: What financial models could support the City of Vancouver's (CoV) funding needs for implementing and maintaining GRI in Vancouver's city parks and roadways?

Key findings that could support Vancouver's GRI program, in order of priority:

1. **Stormwater utility fee**

Findings: All municipalities selected for case studies, and many others, use a stormwater utility fee to support GRI. A stormwater utility fee provides a stable, long-term funding stream. A few municipalities in BC, including Victoria, North Vancouver, Delta, and Coquitlam, have already gone through this process and can provide guidance. The cities of Seattle and Pittsburgh utilize fee structures that would be suitable for Vancouver. Stormwater utility fees can be added as a separate line item on existing sewer/water utility fees or as a separate fee billed by the Engineering Department (Hsieh 2017.) The funding from a specific stormwater utility fee can be earmarked specifically for GRI maintenance.

Discussion: If CoV GI and the Park Board work together on implementation, part or all of this fee could be earmarked specifically for GRI maintenance in public spaces. Note that the Park Board can only levy user fees like swimming pool access and parking, but Engineering could collect a stormwater utility fee, and the Park Board could bill the Engineering department for maintenance work.

The financial burden on marginalized citizens could be reduced through discount credit options for low-income households, households with more permeable landscapes, and other special considerations. Businesses can also reduce their fees through public education programs or installation of rainwater infrastructure on their properties.

2. **Consider Funding GRI Maintenance Through Development Permits**

Findings: In Pittsburgh, development permits play a key role in long-term green infrastructure (GRI) maintenance. The city's Stormwater Management Code (Title 13) requires developers to submit a Stormwater Management (SWM) Site Plan that includes not only stormwater control strategies but also a plan for how maintenance will be handled over time. This includes details like who is responsible for upkeep, how often maintenance is needed, estimated annual costs, and how that work will be funded (City of Pittsburgh, 2022). In addition, the code provides incentives for developments that go beyond the basic requirements, further encouraging the integration of green infrastructure in new projects.

In British Columbia, municipalities can use Development Cost Charges (DCCs) to fund capital infrastructure—such as stormwater systems, roads, water, sewer, and parks—but current regulations prohibit using those funds for operations and maintenance (Government of British Columbia, 2025). While Vancouver can collect fees for growth-related infrastructure needs, this

limitation presents a challenge when it comes to securing sustainable funding for the long-term care of GRI projects.

Discussion: As Vancouver continues to grow its GRI network, it may be worth exploring whether development-related tools could help support maintenance needs. For example, while DCCs must be used for capital costs, there may be opportunities to design complementary strategies—such as permit conditions or voluntary contributions—that help cover routine upkeep.

The idea would not be to shift all responsibility to developers, but rather to consider whether certain types of projects—particularly those that trigger significant increases in impervious surfaces—could contribute in a small way to long-term care of shared green infrastructure. This could take the form of maintenance plans attached to permits, modest fees linked to GRI-related benefits, or other creative models tailored to Vancouver's legal and policy context.

These concepts would need careful review, and any new tools would require collaboration across city departments and guidance on what's possible under the Local Government Act. Another downside of using development fees for funding is the inconsistency of development projects over time. Still, looking at how cities like Pittsburgh are embedding maintenance funding into the development process may offer inspiration as Vancouver looks for ways to grow its GRI program sustainably.

3. Vancouver Sustainability Bond.

Findings: CoV can borrow money through the Vancouver Sustainability Bond Framework. The 2025 framework allocates $1,000,000 to Emerging Climate Adaptation Priorities and $100,000,000 to Sewers and Drainage, both of which apply to GRI maintenance. The bonds can fund new or existing projects.

Discussion: The Vancouver Sustainability Bond Framework is relatively low risk, but it is not direct revenue, and using this tool will not guarantee greater environmental benefits than other funding tools. Before implementing a bond, GI and Parks should create a financial plan for how to pay back the bond over time. For example, the city could use the bond to fund a maintenance manager and seasonal maintenance crew while in the process of implementing the stormwater fee. Once the stormwater fee is implemented, that money can help pay back the bond.

4. Nonprofit partnerships

Nonprofit partnerships are an excellent way to connect more deeply with community members. Seek partnerships for specific projects and align goals early in the process. Nonprofit partners

can support funding through grant applications, as seen in the City of Seattle's partnership with Mid-Sound Fisheries Enhancement Group. Another valuable model from Seattle is the Green Seattle Partnership, which connects multiple groups and volunteers to restore and maintain publicly owned natural areas.

5. **Grants, Volunteers, and Donations**

Findings: Grants, volunteers, and donations can each play a meaningful role in supporting Green Rainwater Infrastructure (GRI) programs. Both Pittsburgh and Seattle have successfully secured grants to fund GRI projects. In Seattle, volunteers involved in the Green Seattle Partnership contribute significantly to the maintenance of forested parklands. Additionally, private donors and charitable organizations may be interested in supporting GRI-related efforts, particularly when projects align with environmental or community values.

Discussion: While not always consistent or predictable, grants, volunteers, and donations can provide important contributions to GRI implementation and stewardship in both park and right-of-way contexts. These approaches are often most impactful when combined with other stable funding mechanisms. Volunteer capacity can grow meaningfully over time but requires thoughtful investment in recruitment, training, and coordination. Likewise, seeking donations and applying for grants demand time and administrative resources. Together, these components can complement more reliable funding sources as part of a diversified funding strategy for long-term GRI success.

RQ 3.2: What other considerations are important when planning for long-term maintenance of GRI?

Key findings that could support Vancouver's GRI program, in order of priority:

1. **Public awareness campaign**

Findings: Many municipalities emphasize the importance of clearly communicating the many values of GRI with the public before and during program expansion.

Discussion: The City of Victoria launched a successful public awareness campaign, focusing on communicating the importance of climate resilience and explaining to citizens that the stormwater fee would be redirecting finances rather than generating additional money for projects. Although this will not directly bring in funds, it is essential to garner public and political support for future projects and ongoing asset care.

2. **A robust, GRI-first policy for stormwater operations and maintenance.**

Findings: As part of establishing stormwater utilities, municipalities have enacted legislation to embed stormwater priorities in their planning processes. While Seattle and Tacoma, WA, have strong stormwater codes, Pittsburgh goes further by adopting a "stormwater-first" approach in capital planning—ensuring stormwater is a primary consideration in transportation, utilities, and public works. This policy helps prioritize integrated GRI in infrastructure upgrades.

Discussion: Building on this model, Vancouver could adapt a stormwater-first lens not only in capital budgeting, but also in operations and maintenance (O&M) planning. Establishing interdepartmental coordination—especially among Engineering, Parks, and Planning—can ensure that O&M budgets consistently support the upkeep of existing GRI assets. This shift would help protect past capital investments, extend infrastructure lifespan, and reinforce the city's commitment to integrated water management.

3. **Partner with workforce development programs to deliver seasonal maintenance.**

Findings: Collaborating with workforce development organizations supports both environmental goals and social sustainability by creating job opportunities for underrepresented communities. Nearly all cities reviewed in this report have successful examples of such partnerships.

Discussion: While Vancouver may not yet have enough GRI assets to support full-time, year-round maintenance positions, many municipalities have successfully partnered with workforce development programs to meet seasonal maintenance needs. This model is well-suited to Vancouver's current scale, allowing GRI maintenance to be one of several contracts managed by such programs. For more information on workforce development models and GRI, please refer to *Exploring alternative models for green infrastructure maintenance* (GCS Report No. 2019-55) by A. Kingdon.

4. **University research collaborations**

Findings: University collaborations can provide high-quality research data on GRI projects. Collaborating with professors and students will also introduce more people to GRI and build capacity. British Columbia Institute of Technology (BCiT) already conducted research with the Capital Regional District on the GRI of their headquarters. BCiT offers degrees in environmental restoration, chemical and environmental technology, and architectural ecology, all relevant to GRI. University of British Columbia's Biodiversity Research Center, faculties of Forestry, Geography, Integrated Studies in Land and Food Systems, Integrated Water Management, Land and Water Systems, Planning, Resources, Environment, and Sustainability (iRES), and Urban Design all have high potential for research collaborations related to GRI.

Discussion: Setting up collaborations with universities can be challenging, as professors tend to be very busy and receive thousands of emails per day. CoV could utilize contacts in the UBC Sustainability Scholars program to help find specific departments and people who are looking for research opportunities. Since BCiT has already collaborated on GRI with CRD, they would likely be open to also working with CoV.

5. **Curriculum design with schools and universities**

Findings: Scaffolding curriculum for students of all ages is important to build public understanding of and support for nature-based solutions that care for water. Such education cultivates a future workforce, fosters community stewardship, advances equity through green job pathways, and strengthens collaboration across sectors. By helping the public understand both the issues and the solutions, curricula can build political will and indirect funding support for Green Rainwater Infrastructure (GRI)

Discussion: UBC's faculty of Curriculum Studies is a potential collaborator that could help with relevant curriculum development. Other education-based nonprofits in the area could also support this endeavor.

6. **Plan to allocate funds for an in-house maintenance crew and workforce development program.**

Findings:

Seattle and Pittsburgh both maintain in-house green infrastructure (GRI) crews. Pittsburgh recently established its first dedicated team, while Seattle supports three in-house maintenance crews. These teams are known to provide consistent, high-quality care, offer more flexibility in responding to issues, and tend to retain experienced staff over time. (Durocher & Fox, 2024)

Discussion:

The City of Vancouver's Green Infrastructure (GI) branch has expressed interest in developing its own in-house maintenance crew. As the city continues to expand its GRI network, having a dedicated team with specialized training could help ensure consistent care for both vegetation and structural components. Collaborating with the Vancouver Park Board, particularly for assets located in parks, may also support more seamless and integrated maintenance efforts.

While building such a team would require resources and coordination, examples from cities like Seattle, Pittsburgh, Philadelphia, and Atlanta suggest that this model can be a strong foundation for both environmental stewardship and workforce development. For further insight into workforce-based maintenance models, see *Exploring Alternative Models for Green Infrastructure Maintenance* (GCS Report No. 2019-55) by A. Kingdon.

Future Directions

General:

- Have other municipalities accessed corporations to fund GRI maintenance?

Victoria Case Study:

- How does the City of Victoria pay for GRI assets in parks and roadways?
- What does the stormwater utility fee pay for in City of Victoria?

Other relevant cases:

- Raleigh, North Carolina: Utility fee billing and inter-departmental allocation (recommended by Robb Lukes, CoV.)
- Portland, Oregon: Hires workers that split tasks between drafting and GRI maintenance. (Recommended by Madeleine Wilson, CoV.)

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References

About. (2021). *Seattle Parks District*. https://www.seattle.gov/seattle-park-district/about

BCIT. (2021, October 25). *Research infrastructure – BCIT*. https://www.bcit.ca/centre-for-architectural-ecology/research/research-infrastructure/

Bigger, P., & Millington, N. (2020). Getting soaked? Climate crisis, adaptation finance, and racialized austerity. *Environment and Planning E: Nature and Space, 3*(3), 601–623. https://doi.org/10.1177/2514848619876539

Canada Mortgage and Housing Corporation. (2025, February). *Housing market outlook: Canada highlights* (Issue 02-2025). https://www.cmhc-schl.gc.ca/

City of Pittsburgh. (2022). *Title 13 – Stormwater management code*. https://ecode360.com/45512890

City of Pittsburgh, PA. (2025). *Pittsburghpa.gov*. https://www.pittsburghpa.gov/Home

City of Seattle. (2015). *Green stormwater infrastructure strategy: Managing wet weather with clean solutions*. Seattle Public Utilities. https://www.seattle.gov/utilities

City of Seattle. (2023). *Green stormwater infrastructure (GRI) by the numbers* (Version 10).

CITY SERVICES PART II. (2025). https://vancouver.ca/files/cov/2025-final-budget-city-of-vancouver-city-services.pdf

Seattle Public Utilities. https://www.700milliongallons.org

City of Vancouver. (2025). *Flat utility rates*. Vancouver.ca. https://vancouver.ca/home-property-development/flat-rates.aspx

City of Vancouver. (2021). *Healthy Waters Plan*. https://vancouver.ca/home-property-development/healthy-waters-plan.aspx

City of Vancouver. (2022, May 18). *Summary of select drainage utilities*. Development Water Resources Management, Engineering Services Department.

City of Vancouver. (2025, June 24). *Debenture program 2025 (Sustainability Bond) – RTS 17790*. https://vancouver.ca/your-government/contact-council.aspx

ClimateNA. (2020). *ClimateNA Map*. https://climatena.ca/mapversion

Cousins, J. J., & Hill, D. T. (2021). Green infrastructure, stormwater, and the financialization of municipal environmental governance. *Journal of Environmental Policy & Planning, 23*(5), 581–598. https://doi.org/10.1080/1523908X.2021.1893164

Dirt Corps. (2021). *Community-based ecological restoration, green stormwater infrastructure, and urban forestry*. https://www.thedirtcorps.com/

Drainage rates – Utilities. (2021). *Seattle.gov*. https://www.seattle.gov/utilities/your-services/accounts-and-payments/rates/drainage

Durocher, R., & Fox, A. (2024, March 14). *Green stormwater infrastructure: Maintenance service delivery models* [PowerPoint slides]. City of Portland Environmental Services. https://www.portland.gov/bes

Environmental Finance Center Network. (2025, July 17). *The power of partnerships for green infrastructure* [Video]. YouTube. https://www.youtube.com/watch?v=7IMuhJHIaQ0

Government of British Columbia. (2025). *Development cost charges*. https://www2.gov.bc.ca/gov/content/governments/local-governments/finance/local-government-development-financing/development-cost-charges

Green stormwater infrastructure. (2025). *Capital Regional District*. https://www.crd.ca/environment/stormwater-watersheds-harbours/stormwater/green-stormwater-infrastructure

Green Seattle Partnership. (2025, July 10). *Home*. https://greenseattle.org/

Healthy Environment - Environment | seattle.gov. (2021). Seattle.gov; https://www.seattle.gov/environment/climate-change/climate-justice/duwamish-valley-program/duwamish-valley-action-plan/healthy-environment

Hsieh, J. (2017, February). *Stormwater utilities and other finance tools: A preliminary review*. Sustainability Group, City of Vancouver.

Key directions for the Healthy Waters Plan. (2025, February 3). *City of Vancouver*. https://vancouver.ca/files/cov/key-directions-for-the-healthy-waters-plan.pdf

Lake City Floodplain Park. (2018). *Online Open House*. https://www.lakecityfloodplainpark.com/project-background

Lake City Floodplain Park. (2021). *Seattle.gov*. https://www.seattle.gov/utilities/neighborhood-projects/lake-city-floodplain-park

Landforce. (2025, January 13). *REDF*. https://redf.org/ese/landforce/

Local real estate excise tax rates (Effective April 1, 2025). (2025, July 22). *Washington State Department of Revenue*. https://dor.wa.gov/sites/default/files/2025-03/84%200013_April25.pdf

Madison Valley Stormwater Facilities | RH2 Engineering. (2025). RH2 Engineering. https://www.rh2.com/projects/madison-valley-stormwater-facilities

McGuire, G., Wyper, N., Chan, M., Campbell, A., Bernstein, S., & Vivian, J. (2010, February). *Re-inventing rainwater management: A strategy to protect health and restore nature in the Capital Region*. Environmental Law Clinic, University of Victoria. https://www.elc.uvic.ca/publications/re-inventing-rainwater-management/

McKinley Park Community Grove. (2024, January 12). *Pittsburgh Parks Conservancy*. https://pittsburghparks.org/mckinley-park-community-grove/

Mochrie, P. (2022, February 28). *City of Vancouver 2021 Census Population and Dwelling Counts and Metro Vancouver Growth Projection Update* [Memo]. https://www12.statcan.gc.ca/census-recensement/index-eng.cfm

Pittsburgh Parks Conservancy. (2017). *McKinley Park master plan: A framework for transformation*. Pfaffmann + Associates, Andropogon, & Meliora Design.

Science World. (2020, June 12). *Coastal BC rainfall*. https://www.scienceworld.ca/resource/coastal-bc-rainfall/

Seattle Conservation Corps. (2021). *Seattle.gov*. https://www.seattle.gov/parks/about-us/plans-and-reports/seattle-conservation-corps

Seattle Data Commons. (2025). *Datacommons.org*. https://datacommons.org/place/geoId/5363000

Seattle Park District. (2016). *Fixing and maintaining our parks* [Video]. Seattle Channel. https://www.seattlechannel.org/the-seattle-park-district?videoid=x67836

Seattle Public Utilities. (2019). *Green stormwater infrastructure: 2019 progress report*. https://www.seattle.gov/utilities

South King County Community Impact Fund Environmental Improvements Program. (2023). Portseattle.org. https://www.portseattle.org/programs/environmental-improvements-program

Stanley Park Ecology (SPE). (2025, May 30). Stanley Park Ecology (SPE). https://stanleyparkecology.ca/

Stiffler, L. (2011, April 22). Ballard's rain gardens: A green experiment gone wrong. *Seattle Post-Intelligencer*. https://www.seattlepi.com/local/environment/article/ballard-s-rain-gardens-a-green-experiment-gone-1345766.php

Still Moon Arts Society – Inspired & Connected. (2024). Stillmoonarts.ca. https://stillmoonarts.ca/

WaterWorks Grant Program. (2025). *King County, Washington*. https://kingcounty.gov/en/dept/dnrp/about-king-county/about-dnrp/grants-partnerships/waterworks-grant

Appendices

Appendix A: People Consulted

Heidi Horlacher — Senior Environmental Geoscientist, Green Infrastructure, City of Vancouver

Jamie Huang — Senior Engineer, Healthy Waters Plan, City of Vancouver

Kyla Prendergast — Senior Environmental Planner, City of Pittsburgh

Madeleine Wilson — Planning Assistant III, Green Infrastructure, City of Vancouver

Sylvia Spraakman — Senior Engineer, Green Infrastructure, City of Vancouver

Additional interviewees participated in this project but chose not to have their names listed.

Appendix B: Stormwater Utility Fee Structure Options

Structure	Brief Description	Pros	Cons
Tiered Flat Rates	Properties grouped into discrete categories based on indicator variables such as impermeability, property area, or land use category	Admin simple Connection between problem contribution and solution contribution Adaptable (number of tiers flexible)	Group all properties in same tier together, despite intraspecific variation (Equity concerns) Doesn't inherently incentive action
Variable rate based on impervious area	Municipal gov uses data to calculate impervious area of individual properties	Equitable in regards to stormwater contribution/solution Cost incentive for property owners to reduce impermeable area	Complicated, requires periodic data collection Issues with accuracy, may require additional staff Concerns for low-income households (not everyone has a choice in the permeability of their property)
Variable rate based on property size and runoff/development coefficients	Uses mathematical formula to calculate fees with intensity of development and/or amount of runoff as coefficients Intensity of development factor: Lots that are fully developed given a value of 1.0, lots with lower percentage developed given <1 Runoff: Values range from 0-1, single family homes have a lower rate eg 0.4, industrial properties with more impervious area given higher rate, e.g., 0.7.	Relatively easy to calculate once coefficient values are assigned to properties	Challenging to communicate to property owners, unequitable for intraspecific varation in lots of the same category (like tiered fees)
Combination (including ERU)	Flat (sometimes tiered) rates for smaller residential properties, variable rates for larger non-residential properties	Only need to measure impervious surface on larger non-residential properties; cost incentive for those properties to reduce runoff	Not equitable for intraspecific variation within each category; residential owners not incentivized to reduce impermeability

Hsieh, J. (2017, February). *Stormwater utilities and other finance tools: A preliminary review (Draft.*) Sustainability Group, City of Vancouver.

Appendix C: Stormwater Utility Fee Discount Credit Options

- Volume reduction
- Runoff reduction
- Water Quality Treatment
- Specific Green Infrastructure
- Specific Land Uses
- Low-income residents
- Educational programming
- Pollution Prevention

City of Vancouver. (2022, May 18). *Summary of select drainage utilities (Draft*.) Development Water Resources Management, Engineering Services Department.

Appendix D: Meeting Discussion Points

Interviewee name:

Job title:

Company/organization:

Location:

Introduction

1. How I came across your name and what I have reviewed about your work.

2. What I've learned about stormwater challenges faced in your region. Anything you'd like to add?

GRI Program Overview

3. Can you tell me a bit about the history of your GRI (Green Rainwater Infrastructure) program?

- When did it start, and what were the main goals?
- How is the management of GRI structured in your organization?
- What legislation or policy documents apply to GRI in your jurisdiction?
- How is GRI implemented in your jurisdiction?
- Do you collaborate with other departments, nonprofits, or institutions on GRI projects?
- What kind of community engagement and planning have you implemented for your GRI projects?

4. Are there any ongoing or recurring challenges you face with GRI projects generally or with their implementation and ongoing maintenance?

GRI Program Funding

5. What are the typical costs associated with your GRI projects?

- How do costs break down between planning/design, implementation, and maintenance?

6. What financial tools or funding mechanisms have you used to support GRI projects?

- Could you briefly describe each tool? Is it private, public, from taxes, a bond, etc.?
- What was the process to get the funding source implemented?
- What stakeholders did you work with to get this tool implemented?
- Approximately how much funding has each tool brought in?
- What are the pros and cons of each tool?

7. How frequently are you able to maintain your GRI projects given the funding you receive?

- What key tasks are involved in the maintenance?
- How is maintenance funded? Is it funded separately from other components?

Closing

What successful funding strategies do you recommend?

9. Is there anything else you think is important to understand about running or funding GRI projects in your region?

10. Would you be open to a follow-up if I have additional questions later on?

St. George Rainway, City of Vancouver 2025