Green Stormwater Infrastructure in Seattle

Implementation Strategy 2015-2020

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* These organizations provided input on: barriers to GSI implementation, opportunities for GSI implementation, concerns about GSI implementation, and recommendations for aligning forested open space and GSI program goals.

Seattle's waterways are a vital part of our community. They sustain our health and the health of countless aquatic plants and animals.

Yet they are imperiled and we must act now. The science is clear: polluted stormwater runoff from our roadways, parking areas, and roofs is killing our native salmon, limiting where we can fish and swim, and damaging our creeks and lakes, the Duwamish River, and Puget Sound for generations to come.

Addressing this issue requires that we work together. At the government level, Seattle is working with the U.S. Environmental Protection Agency, Washington State Department of Ecology, Puget Sound Partnership, and King County. In the community, we are engaging non-profit organizations, businesses, and community groups. Together, we are: protecting and enhancing our forested open space; physically removing pollutants from our roadways; enforcing water quality regulations; and updating codes to integrate low impact development principles and mitigate the effects of development.

Green stormwater infrastructure (GSI) is a critical component of this work. Seattle is committed to using GSI to manage stormwater runoff whenever possible for two reasons that are core to our values: 1) GSI mimics nature and brings ecological services back into our city 2) GSI makes our neighborhoods greener, safer, more livable, and more resilient.

Seattle has been a national leader in this work for over 15 years. We currently manage over 100M gallons of runoff annually with green approaches but we are aiming much higher. As our city continues to grow, there is no better time to embrace green infrastructure as the norm and step up our commitment. This 5-year plan calls for a four-fold increase in GSI implementation by the year 2020. It lays out our City work plan and budget and challenges us to develop new partnerships. We will chart our progress with biannual updates and adjust our approach as necessary.

Ultimately, meeting our target will depend on engagement and innovation from all sectors of our community, so please join us! Thank you in advance for your work to protect our home waters. **Together, I know we will make a difference.**

Mayor Edward B. Murray
City of Seattle

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Executive Summary

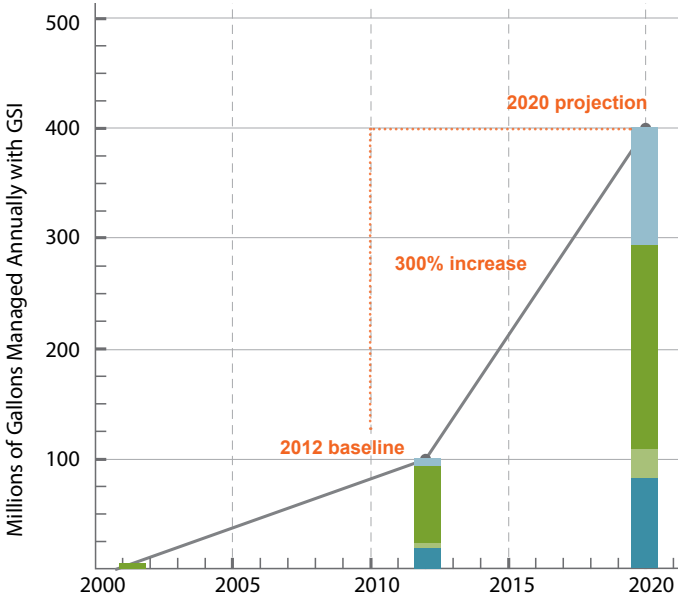
What is GSI?

Green stormwater infrastructure (GSI) is a set of distributed stormwater best management practices that mimic natural systems. GSI is used across multiple scales and site contexts -- including residential, commercial, and in the public right-of-way -- and delivers multiple community benefits in addition to stormwater management.

Policy Context

In 2013, City Council Resolution 31459 established green stormwater infrastructure (GSI) as a critical aspect of a sustainable drainage system and challenged Seattle to rely on GSI to manage stormwater runoff whenever possible. The Resolution and associated Executive Order also set a community-wide implementation target -- to manage 700 million gallons of runoff annually with GSI by the year 2025 -- and directed the Office of Sustainability and Environment to develop a GSI implementation strategy for Seattle.

This 2015-2020 GSI Implementation Strategy sets a 2012 baseline, summarizes early progress toward the target, estimates gallons managed with GSI by 2020, outlines a broad set of strategies for accelerating the adoption of GSI in Seattle across a range of project types, articulates a two-year workplan for City of Seattle departments (2015-2016), and calls for tracking and biannual reporting on progress toward achieving the 2025 target.



2020 Interim Goal: 400M Gallons Managed Annually

To accelerate GSI implementation and drive near-term innovation, Seattle has set an interim goal of managing 400M gallons of stormwater runoff annually with GSI by the year 2020 and is on track to meet that goal. The most significant increases are expected from public realm retrofits and partnerships led and funded by Seattle Public Utilities and King County Wastewater Treatment Division, as well as retrofits on private property, triggered by Stormwater Code and led and funded by project developers. However, to meet the interim target and diversify Seattle's GSI portfolio, additional strategies for integrating GSI into roadway, parks, and parcel-side projects are needed. This Strategy therefore emphasizes approaches for:

1) accelerating retrofits of existing impervious surface particularly at the point of redevelopment or major renovation when the cost/gallon managed is lowest
2) optimizing multiple community benefits achieved with infrastructure investments via integrated design and development
3) removing barriers to implementation across all project types

Beyond 2020

Continuous improvement and adaptive management will help ensure Seattle meets the 2020 interim target and will make the path to the 2025 target more achievable. This Strategy recommends biannual reporting beginning in 2016 as well as the development and release of a follow-up 5-year Strategy in 2020.

- Projects Required by Stormwater Code
- Retrofits Led & Funded by Seattle Public Utilities (SPU) or KIng County Wastewater Treatment Division (WTD)
- Retrofits Incentivized by SPU or WTD (ie: RainWise Projects and Green Grants)
- Retrofits Led & Funded by Entities Other Than SPU or WTD

Why are GSI retrofits needed?

Much of Seattle's road system, parking areas, and building stock was originally developed without mitigating for the harmful effects of stormwater pollution because th ese efffects were not widely understood at the time. And while approximately 1% of Seattle properties are (re)developed every year, and this new and replaced impervious surface is now mitigated via Storwmater Code, these improvements are incremental and slow-paced.

Meanwhile, stormwater pollution continues and has been identified as the greatest threat to water quality in Puget Sound. Actively retrofitting impervious surfaces -- particularly publicly owned pollution-generating surfaces like our right-of-way system -- addresses legacy water pollution at an accelerated rate and delivers additional community benefits like improved pedestrian safety, a greener and more beautiful streetscape for all to enjoy, improved tree canopy and associated benefits like air quality and wildlife habitat, and improved climate resilience.

Summary of Near-term Opportunities to Accelerate GSI Retrofits

Code-Required Projects
Clarify Stormwater Code requirements, align with state standards, and report GSI gains biannually
Improve/refine existing alternative compliance mechanisms, particularly for some roadway projects
Revise development-related City Codes and standards to ensure low impact development is the default mode for site development
Utility-Led and Funded Retrofit Projects
Leverage Federal CSO Consent Decree to address legacy pollution in creek watersheds with a variety of approaches, including GSI. (This requires U.S. EPA approval); When approved, roll out new $30M capital program -- Natural Drainage Systems Partnering -- focused on developing cost-saving GSI partnerships with transportation-related capital programs, parks, private development, and community-based planning efforts in creek watersheds. Also continue parthership development in uncontrolled CSO basins.
Track and report gallons managed biannually and revisit planned investments in next strategic business plan cycle
Continue program-level work to develop and refine standard practices and designs and provide needed training and coordination; Evaluate GSI during options analysis for all large-scale Utility capital projects
Utility Incentivized Projects
Continue engaging community-based organizations as outreach partners and continue leveraging joint-program savings from SPU- King County Wastewater Treatment Division partnership; Track and report gains annually
Evaluate expansion of RainWise to creek watersheds; Evaluate expansion of RainWise tools elgibile for rebates to potentially include green roofs and permeable pavement; Continue to evaluate and implement measures to remove barriers to participation, particularly in low-income communities
Non-Utility Led Projects
Identify and capitalize on most promising GSI integration opportunities aligned with planned investments via Move Seattle and Metropolitan Parks District, particularly neighborhood greenways, pedestrian safety, complete streets, and new park development.
Consider creation of a GSI integration opportunity fund to facilitate point-of-redevelopment retrofit partnerships in areas outside of where Utilities can invest in the 2015-2020 capital budget cycle.
Include street tree and permable pavement sidewalk maintenance budget in Move Seattle package
Pursue external (state, Federal, private foundation) funding for prioritized, integrated capital infrastructure investments
Apply standard protocols to track GSI implementation in all capital departments and share updates with the public biannually

Bioretention Installation for Stormwater Code

RainWise Raingarden Installation

Background

2020 Interim GSI Implementation Target

Seattle City Council unanimously passed Resolution 31459 in July of 2013, establishing green stormwater infrastructure (GSI) as a critical aspect of a sustainable drainage system and challenging Seattle to rely on GSI to manage stormwater runoff whenever possible. The GSI Resolution and related Executive Order also adopted a new implementation target for Seattle:

TARGET:
To manage 700 million gallons of runoff annually with GSI by the year 2025.

The 2013 GSI policy directives tasked the Office of Sustainability and Environment with developing a GSI Implementation Strategy in collaboration with relevant City departments and partners. This document:

- Reports on early actions taken to implement the directives of the GSI Resolution and Executive Order and sets an interim target for Seattle:

INTERIM GOAL:
To manage 400 million gallons of runoff annually with GSI by the year 2020.

- Summarizes current City of Seattle (and King County Wastewater Treatment Division) GSI capital investment trajectories over the next 6-year budget cycle (2015-2020)
- Outlines a framework for achieving the 2020 interim target and details a 2-year work plan
- Recommends ongoing tracking and biannual reporting and calls for a follow-up 2020-2025 5-year plan to be released in 2020.

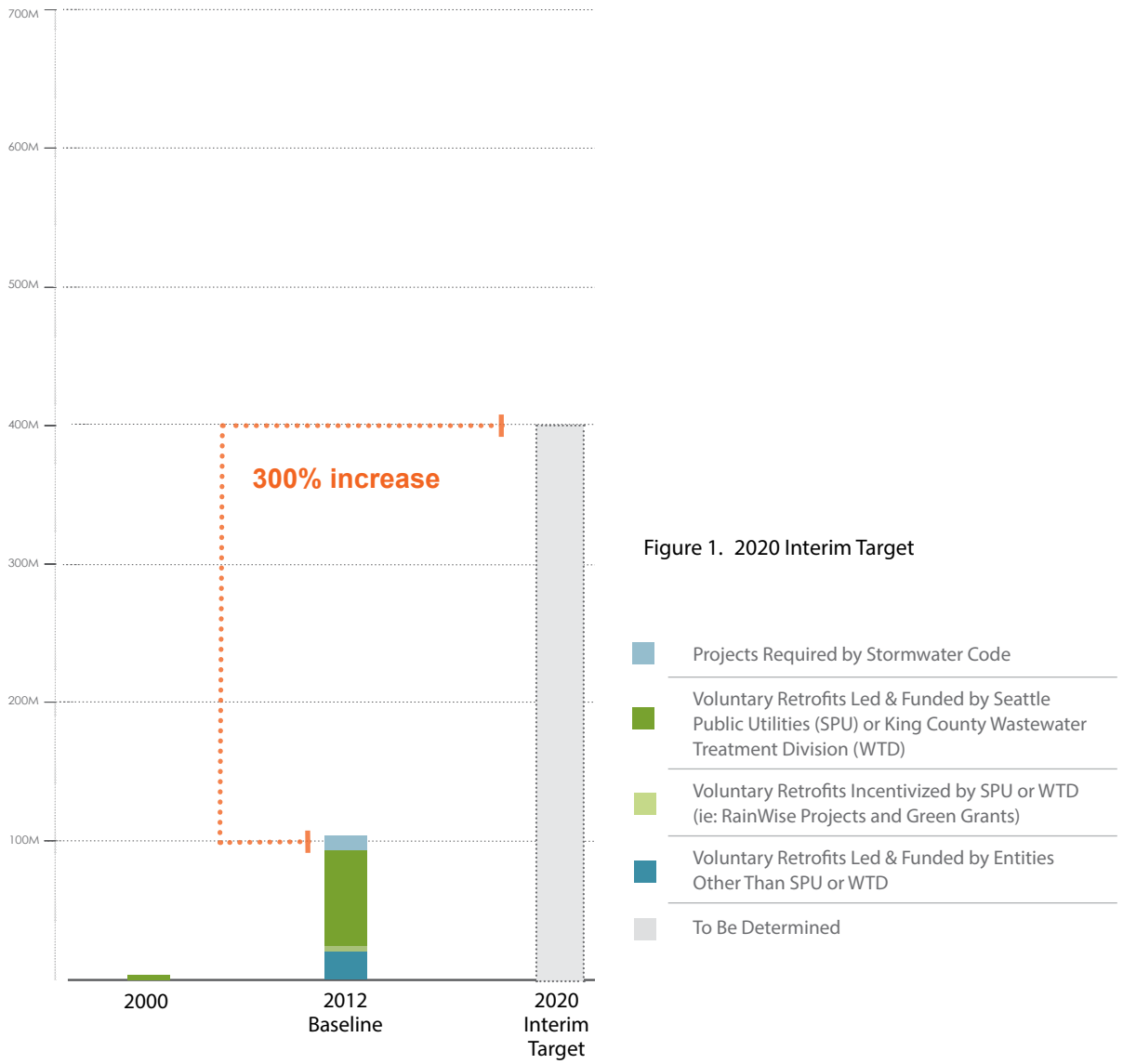


Figure 1. 2020 Interim Target

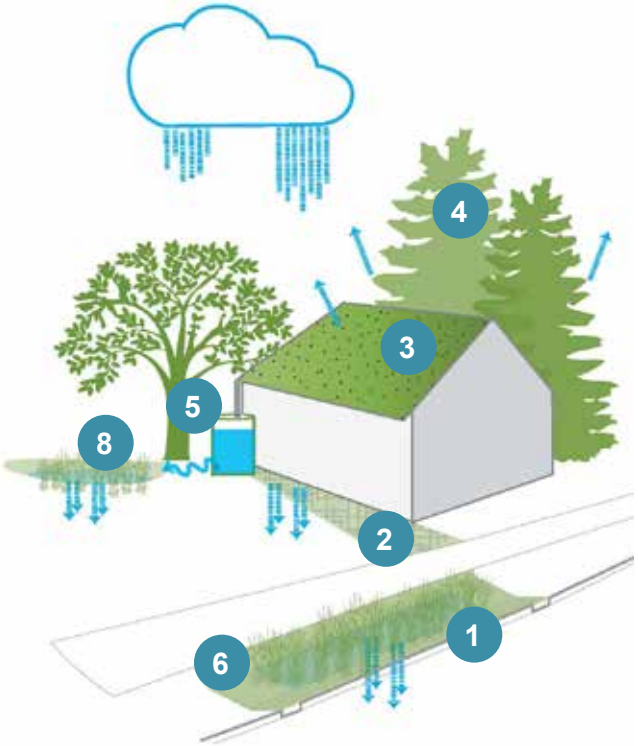
WHAT IS GSI?

A wide range of definitions are commonly used for terms such as "green infrastructure", "green stormwater infrastructure", "low impact development" and "natural drainage".

Figure 2. Green Stormwater Infrastructure Examples
1 Roadside Bioretention
2 Pervious Concrete
3 Vegetated Roof
4 Street Trees
5 Stormwater Cisterns
6 Compost-Amended Soil
7 Biofiltration
8 Residential Raingarden

Throughout this Strategy, green stormwater infrastructure, or GSI, is defined as: A set of distributed stormwater best management practices that use or mimic natural processes to slow, infiltrate, evapotranspire, and/or harvest and reuse stormwater runoff from impervious surfaces, on or near the site where it is generated.

GSI is used across multiple scales and site contexts including residential, commercial, and in the public right-of-way and includes the tools shown at left. For the purposes of this Strategy, the removal of unnecessary impervious surfaces, sometimes referred to as "depaving", is also included as a GSI approach.



Bioretention adjacent to the Bullitt Center

Problem Definition

Polluted Stormwater Runoff from Roadways

Sewer Backup and Flooding

Poor Water Quality and Fish Kill

Before Seattle developed as a city, very little rain ran off the surface of the land as "runoff". Rather, the evergreen forest system that covered most of the Puget Sound Region managed rainfall in a way that slowed down the water, allowed it to evaporate back into the air or soak into the ground, filtered the water through plants and layers of soil, and replenished the groundwater that feeds our salmon-bearing creeks. (See Figure 3, below.)

As Seattle developed, this spongy forest system was replaced with a largely impervious built environment of roads, buildings, walkways, and parking areas; and an underground, piped system was built to carry stormwater runoff away from these new assets. Runoff from impervious surfaces was routed either into a combined sewage-stormwater pipe system or was discharged directly into our waterways. At the time of that early development, the negative impacts of stormwater volume and pollution were not yet understood.

This infrastructure was also originally designed and constructed to serve a much smaller city. Today, roughly two-thirds of Seattle is served by piped drainage infrastructure buried beneath the surface of developed neighborhoods (whether combined or separated). In some areas, those pipes are now at or nearing capacity. In the remaining third of the city, an informal ditch and culvert system is used to manage drainage because no formal infrastructure exists.

Today, we do understand that when rainfall rushes off hard surfaces like roads and parking lots, it carries pollutants with it. It overwhelms our aging piped drainage infrastructure, causing flooding, back-ups and combined sewer overflows. It damages our creeks and threatens our salmon by altering the hydrological function of the land and negatively impacting the health of our freshwater and marine ecosystems. For these reasons, the Puget Sound Partnership identifies polluted runoff from roads, roofs, parking lots, and other paved areas as the largest single threat to the health of Puget Sound. And for these reasons, we are compelled as a city to grapple with how to address this legacy source of water pollution in a context of limited budgets and a highly complex and developed urban environment. GSI is an essential tool in the toolbox.

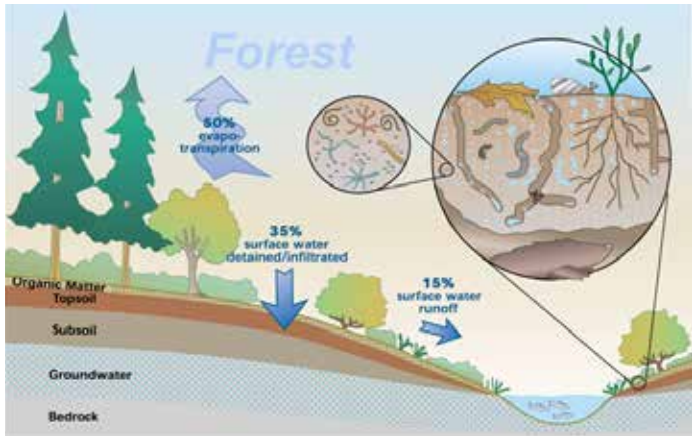


Figure 3. Pre-development Hydrological Function

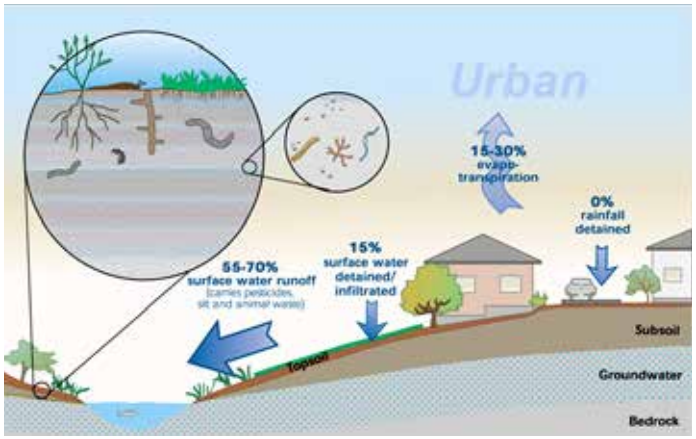


Figure 4. Urbanized Hydrological Function

The context of Seattle's stormwater management challenges include lost hydrological function, legacy pollution from unmitigated development, constrained urban spaces and a growing population, and many demands on limited infrastructure budgets. Within this context, core challenges include:

- Combined sewer overflows of sewage and stormwater at frequencies that exceed those permitted under the Clean Water Act. In 2014, 115.6M gallons of combined sewage and stormwater overflowed into water bodies in 406 separate overflow events.
- Basement back-ups of sewage and stormwater
- Sewer back-ups onto city streets.
- Polluted stormwater runoff flowing directly into water bodies, including creeks. An estimated 13 billion gallons of polluted runoff enters local water bodies annually.
- Localized flooding incidents.
- Degradation of creek, lake and near- shore habitats.

Seattle Public Utilities (SPU) is directly charged with addressing Seattle's stormwater-related challenges and continually prioritizes among these needs to strategically invest finite rate fees. SPU uses a range of approaches, summarized in Table 1. King County Wastewater Treatment Division also has a Federal requirement for combined sewer overflow reduction in some areas of Seattle. These leadership roles notwithstanding, addressing the impacts of over a century of unmitigated development requires broad engagement from civic leaders, transportation and park system managers, planners, designers, developers, businesses, non-profit organizations and community groups, and property owners. For this reason, Seattle's GSI Resolution and Executive Order set a community-wide implementation target and call on all City departments and community partners to rely on GSI for drainage improvements where feasible. The following section outlines additional drivers of GSI retrofits, including non-stormwater related community benefits.

Table 1. Range of Approaches Used to Prevent and Address Stormwater Pollution in Seattle

Protecting and restoring critical ecological services ensures future generations can rely on those services. Numerous studies have shown the benefits provided by in-tact wetlands, vegetated creek and river edges (riparian areas), shorelines, and forested open space to be nearly irreplaceable. These include flood protection, erosion control/creek stablization, wildlife biodiversity, and air quality protection. Once lost, this value cannot feasibly be regained with built infrastructure, particularly in dense urban environments. For this reason, Seattle invests heavily in programs such as the Green Seattle Partnership to protect and restore forested open space areas that provide critical ecological services across our Park system.
Integrating Low Impact Development Principles into development-related codes and standards helps ensure both public and private development projects are sited and designed in ways that preserve native vegetation, minimize impervious surface, and minimize stormwater runoff.
Preventing pollution with practical programmatic approaches means stopping pollution before it starts. Programs such as street sweeping to remove pollutants from heavily traveled roadways, "FOG" education to prevent fats, oils and grease from clogging pipes, and industrial discharge outreach and enforcement to control potential sources of industrial pollution prevent pollutants from ever entering the drainage system or our water bodies. The Plan to Protect Seattle's Waterways recommends includes increased investment in these approaches.
Using smart operational fixes – like adjusting weirs and directing flows strategically – helps the existing drainage system perform as optimally as possible. Operational adjustments can be used to address a range of pipe capacity issues like back-ups, flooding, and overflows. Seattle and King County are investing significantly in inter-agency coordination to increase operational excellence and efficiency.
Enforcing regulations – such as Land Use Code and Stormwater Code – defines limits for site development and ensures new development and redevelopment projects mitigate appropriately for the impacts of new or replaced impervious surfaces.
Investing in new or improved infrastructure – such as the installation of an underground storage tank to address combined sewer overflows, or the installation of roadside GSI to improve conveyance and prevent pollution from entering a nearby creek – helps address a range of persistent, place-specific issues.

WHY GSI?

110th St. Cascade, Broadview

Three Principle Drivers

GSI stormwater management practices address the same stormwater management goals as conventional piped, or "gray", infrastructure and accomplish these ends by mimicking native hydrology. GSI approaches are also designed to meet regulatory requirements, deliver additional community benefits and advance citywide goals for environmental stewardship and equity.

Regulatory Requirements

Stormwater Code

Seattle was one of the first cities in the U.S. to require GSI as part of new development and redevelopment site mitigation. Now, as part of the new 2015 NPDES permit, Washington State Department of Ecology has required the use of low impact development (LID) and GSI statewide, documenting broad concurrence on the ecological and social benefits of these stormwater management practices. Seattle requirements are being revised slightly to align with these new state requirements and are expected to be adopted in January 2016. (For a summary, please see Table 13, page 27.)

Low Impact Development (LID) Code Integration

Under the new state-issued Municipal Stormwater Permit , Seattle must review, revise, and update its development-related Codes and standards to make low impact development the default approach to site planning and land development. The three key LID principles articulated in the Permit requirement are:

- minimizing impervious surface
- minimizing stormwater runoff
- preserving native vegetation

This broad-reaching requirement is driving changes to documents such as Land Use Code, the Right-of-Way Improvement Manual, the Fire Code, Standard Plans and Specifications, and the Municipal Stormwater Code.

Because GSI best practices are effective strategies for minimizing impervious surface and minimizing stormwater runoff, changes that facilitate GSI implementation by removing barriers or improving siting and design guidance are being developed.

City of Seattle Combined Sewer Overflow Consent Decree

The 'Plan to Protect Seattle's Waterways' is Seattle's comprehensive strategy to comply with a United States District Court Consent Decree obligating the City to take action to reduce combined sewer overflows (CSO's) and improve water quality. Pending approval by the U.S. EPA, the Plan will integrate control of combined sewer overflows with the reduction of pollutants from stormwater-only discharges from the separated stormwater system and will defer lower priority CSO projects beyond 2025.

The Plan includes GSI as an early action in two Ballard-area drainage basins which are among the worst combined sewer basins in Seattle, as measured by magnitude and frequency of overflows and also includes GSI investments to improve water quality in the Pipers, Thornton and Longfellow creek watersheds.

King County Combined Sewer Overflow Consent Decree

Within the areas of Seattle served by a combined sewer system, drainage basins under 1,000 square acres are operated and maintained by the City of Seattle, and the drainage basins larger than 1,000 square acres are operated and maintained by King County Wastewater Treatment Division (WTD). King County WTD and Seattle Public Utilities are active collaborators and critical partners to each other, because the systems operated by each agency are interconnected. Like the City of Seattle, King County is also under a Federal consent decree to address combined sewer overflows associated with these larger drainage basins. King County is investing in GSI to address combined sewer overflows in the basins it manages.

Community Benefits

Seattle's central stormwater management challenges are integrally connected with questions of land use and transportation planning, urban design, environmental policy, and neighborhood livability. When GSI is used to achieve stormwater management goals, the capital infrastructure investment is leveraged to provide additional community benefits (beyond stormwater-related benefits). Stormwater infrastructure investments that deliver multiple benefits have attracted and inspired community partnership in ways that single purpose or inaccessible/invisible drainage infrastructure typically has not. Seattle's early investments in GSI offer several examples of leveraged public investment.

The integrated stormwater management practices included in the GSI toolset address the same stormwater management goals as conventional piped, or "gray", infrastructure and accomplish these ends by mimicking native hydrology. GSI approaches are also designed to deliver additional neighborhood benefits. Depending on the type of GSI tool used, the project design, and the scale of the project, co-benefits vary and include those listed in "Table 2. Water & Community System Benefits".

This means GSI projects deliver additional value for comparable cost. Ultimately, the integration of multiple benefit solution sets into new infrastructure investment invites a shift in decision-making rubrics and funding mechanisms from "lowest cost per single- purpose outcome" to "highest value for resources invested."

Citywide Environmental Protection and Equity Goals

Climate Preparedness

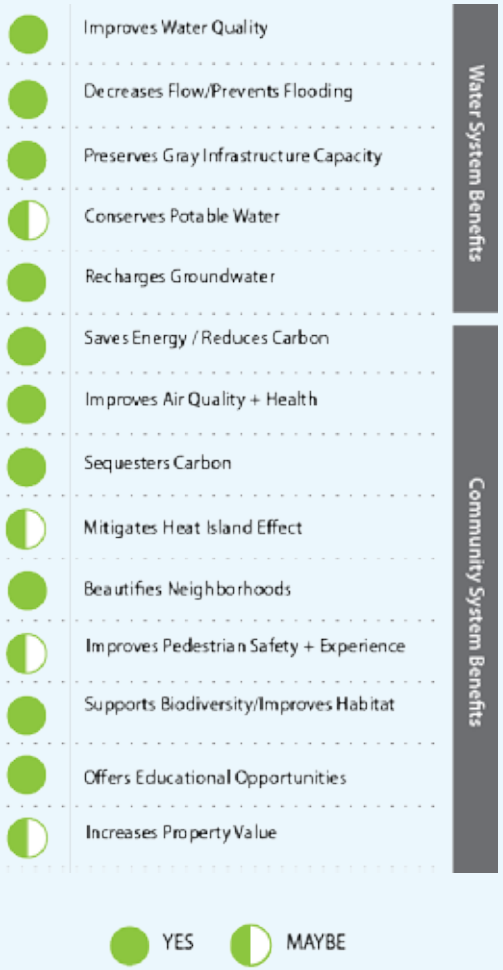
Seattle is currently developing its first comprehensive Climate Preparedness Strategy, which underscores the value of flexible, scalable approaches that allow for adaptive management in the face of climate uncertainties. Distributed GSI installations are one such approach, offering protection against back up risks or other localized pipe capacity issues that are likely to be exacerbated by increased precipitation under climate change. Distributed GSI prevents stormwater from entering the piped system, preserving or enhancing existing capacity. Rainwater harvesting and reuse reduces demand on drinking water supply and may also provide emergency drinking water sources in the case of natural disasters.

Climate Mitigation

Seattle has also set an ambitious goal to be a carbon neutral city by the year 2050 and is implementing its 2013 Climate Action Plan to sharply reduce greenhouse gas emissions across all sectors. GSI implementation supports Seattle's carbon neutrality target in three principle ways:

- GSI installations in combined sewer basins reduce pumping and water treatment demand, saving the associated energy and GHG emissions.
- The use of compost in bioretention soil mixes and all compost-amended soil replacement triggered by Stormwater Code results in a net increase in soil carbon/sequestration.
- Trees planted and retained have direct sequestration value as well as indirect mitigation value via shading.

Table 2. Water & Community System Benefits



Why GSI?

Seattle Conservation Corps Crew

Environmental Equity

Seattle launched the Equity and Environment Initiative in 2015 to advance three goals: 1) All people and communities benefit from Seattle's environmental progress; 2) Communities most impacted by environmental injustice are engaged in setting environmental priorities, designing strategies, and tracking progress; 3) People of color, immigrants and refugees, people with low incomes, and limited-English proficiency individuals have opportunities to be part of and leaders in the mainstream environmental movement. The Initiative will lead a process to develop/adjust practices and programs citywide to improve environmental equity outcomes. As part of this effort, city departments will participate in an environmental equity assessment to establish a data driven understanding of who is and isn't benefiting from Seattle's environmental progress.

In the highest priority stormwater management areas of Seattle, GSI approaches include retrofitting the public realm as well as incentivizing retrofits on private property. The RainWise program provides rebates to install a raingarden or stormwater cistern to manage stormwater on-site. The rebate is paid either to the property owner or directly to the contractor. Strategies currently used to further citywide equity goals within these two approaches include: low-income grants for on-site projects, an advance loan fund to remove the obstacle of up-front expenditures, tailored neighborhood outreach led by community-based organizations, RainWise contractor training, and maintenance of public right-of-way projects by Seattle Conservation Corps.

Green Economy Access

Free contractor training provided via the RainWise program is one strategy Seattle is currently using to build broad access to green economy benefits. Contractor trainings are open to small businesses across the city and region, have been offered twice a year since 2010, and reach an average of 25-30 contractors, per training. Contractors who have participated are eligible to install rain gardens and stormwater cisterns under the program. For public realm projects, Seattle Public Utilities currently contracts with Seattle Conservation Corps to maintain GSI capital improvement projects installed in the public right-of-way. Seattle Conservation Corps offers adults who are homeless or in transition the opportunity to learn and work in a structured, salaried, and supportive program to develop transferrable job skills and deliver accomplish mission-critical for Seattle Parks and other agencies.

Tree Canopy Restoration

Seattle adopted its Urban Forest Stewardship Plan (UFSP) in 2013 with a goal of increasing Seattle's canopy cover from 23% to 30% by 2037, and improving the overall health and longevity of its urban forest. City-improved rights-of-way are the primary nexus point between Seattle's tree canopy restoration goal and the 2025 GSI implementation target. Seattle right-of-way canopy coverage is estimated to be18%, and the UFSP sets a coverage goal of 24% by 2037.

Rights-of-way are typically considered fully ("effectively") impervious, because even unpaved areas like the planting strip have been so heavily compacted over time, they function as if they were paved. Street tree planting and retention is a tool in the GSI toolset that helps address this issue and has multiple benefits beyond stormwater management.

GSI capital projects in the right-of-way routinely integrate tree protection and planting to optimize street tree canopy and stormwater function along project blocks. Tree planting and retention are also recognized on-site stormwater management tools in Municipal Stormwater Code, and are required to be evaluated and implemented, per the Code.

Figure 5. Managing 700M gallons of stormwater annually with GSI *will help approximately 1125 acres of impervious surface in Seattle function more like a native forest.*

700M Gallons In Perspective

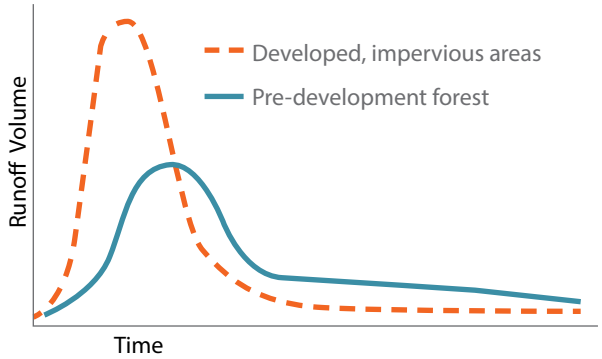
The total volume of stormwater runoff generated in Seattle every year is enormous, roughly 20 billion gallons.

Table 3. 1,125 Acres of Impervious Surface

Managing (reducing or slowing) 700M gallons of stormwater with GSI annually means 1,125 acres of impervious surface will function more like a native forest.
1,125 acres is approximately:
3.6% of all impervious in Seattle
10% of all impervious in the public right-of-way
25% of all impervious area in fragile creek watersheds

How to Do Our Part

In the year 2025, Seattle's population will be approximately 700,000. If every Seattle resident did his/her small part by managing 1,000 gallons of stormwater runoff annually with GSI, Seattle would reach its target.



Managing 1,000 gallons of stormwater annually means managing runoff from about 70sq. ft. of impervious surface. That is about half the size of a typical urban parking spot or the roof of 7' x 10' tool shed. Here are several ways of managing 1,000 gallons of stormwater annually with GSI:

- Installing a 6' x 6' raingarden with sloping sides, 6" deep
- Replacing 90 sq. ft. of asphalt or concrete with pervious pavement or compost-amended soil and mulch
- Installing 140 sq. ft. of green roof
- Installing a 275 gallon stormwater cistern and directing at least 250 sq. ft of roof runoff to it

Tracking Unit: "Gallons Managed"

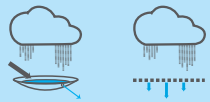
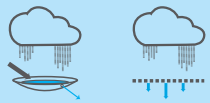
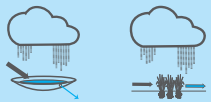
"Managed" stormwater flow equates to the volume of stormwater runoff that is reused (in the case of rainwater harvesting), removed by evaporation or infiltration into native soils, or slowed and cleansed through engineered soil media.

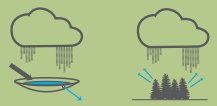
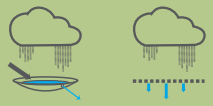
In order to provide a single community-wide GSI implementation metric, and a credible common language for comparing across management approaches and drainage basin types, Seattle has begun to quantify the average annual volume (gallons) managed for both infiltrating and non-infiltrating applications.

The methodology for quantifying "gallons managed" for these different management approaches is summarized in Appendix B.

GSI FACILITY TYPES

Table 4. GSI Facility Types: How They Work and Benefits

GSI Tool	How it Works	Benefits
Bioretention 		• Can manage large amounts of runoff • Can be designed to calm traffic • Adds beauty, habitat, and green space • Protects against future flooding risks due to climate change • Can be used for Green Factor requirements
Rain Gardens 		• Manages runoff from roofs, paths, driveways • Adds beauty and habitat to your property • No technical knowledge is required for routine maintenance
Stormwater Cisterns 		• Easy to design, install, and maintain • During winter, cistern slowly releases water to yard or side sewer to make room for more • During summer, water can be used for irrigation and can reduce overall water use
Dispersion 		• Manages runoff from roof, paths and driveways • Inexpensive in settings with sufficient space
Dry Well/ Infiltration Trench 		• Manages runoff from roof, paths and driveways • Inexpensive in settings with sufficient space
Biofiltration 		• Cleans large amounts of runoff • Can add beauty and habitat to a range of sites

GSI Tool		How it Works	Benefits
Permeable Paving		 SOAKS IN	• Manages runoff and maintains a durable driving surface for cars and people • Can add visual interest/design detail
Green Roofs		 SLOWS EVAPORATES	• Adds more green space to your property • Adds habitat for birds and beneficial insects • Improves air quality • Has potential for LEED™ credits • May be designed for food production
Depaving	 Photo Courtesy of Sustainable Seattle	 SLOWS SOAKS IN	• Frees up underutilized paved space for trees, plantings, and other uses, including GSI • Allows stormwater to soak into the ground where it falls instead of picking up and carrying pollutants into creeks and waterways • Can restore habitats for birds, insects, and other wildlife
Tree Canopy		 SLOWS EVAPORATES	• Tree planting and care is easy and fun • Mature trees improves air quality • Trees offer cool shade in summer and protect against harsh wind in winter • Adds beauty and green space to urban areas
Compost & Mulch		 SLOWS SOAKS IN	• Mulching is easy • Amending soil with compost helps rain soak in and builds healthier landscapes • Saves money by reducing need for irrigation, fertilizers and pesticides

RIGHT PLACE, RIGHT PROJECT

Roadside GSI in shared, public space

Infiltration Potential in Seattle

Using infiltrating GSI is preferable in all settings where it is technically feasible. "Figure 6. Map of Infiltration Potential in Seattle" shows known areas where infiltration is generally not technically feasible in Seattle -- areas where there are steep slopes, underlying bedrock, contaminated soil, high ground water, etc. Where infiltration is not feasible, tools such as biofiltration, bioretention with an underdrain and liner, stormwater cisterns, green roofs, and tree planting are viable options.

Shared, Public Space - Private Space

Additionally, some GSI tools are only appropriate on a parcel. Others may be used either in the public right-of-way or on a parcel. "Table 5. GSI Facility Types: Siting Considerations" on page 13 summarizes which tools can be used where and offers other key project and site considerations.

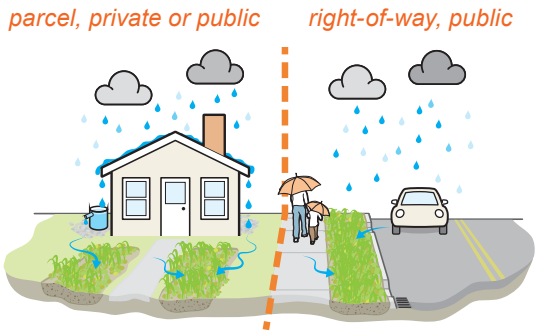


Figure 7. Private Space vs. Public Space

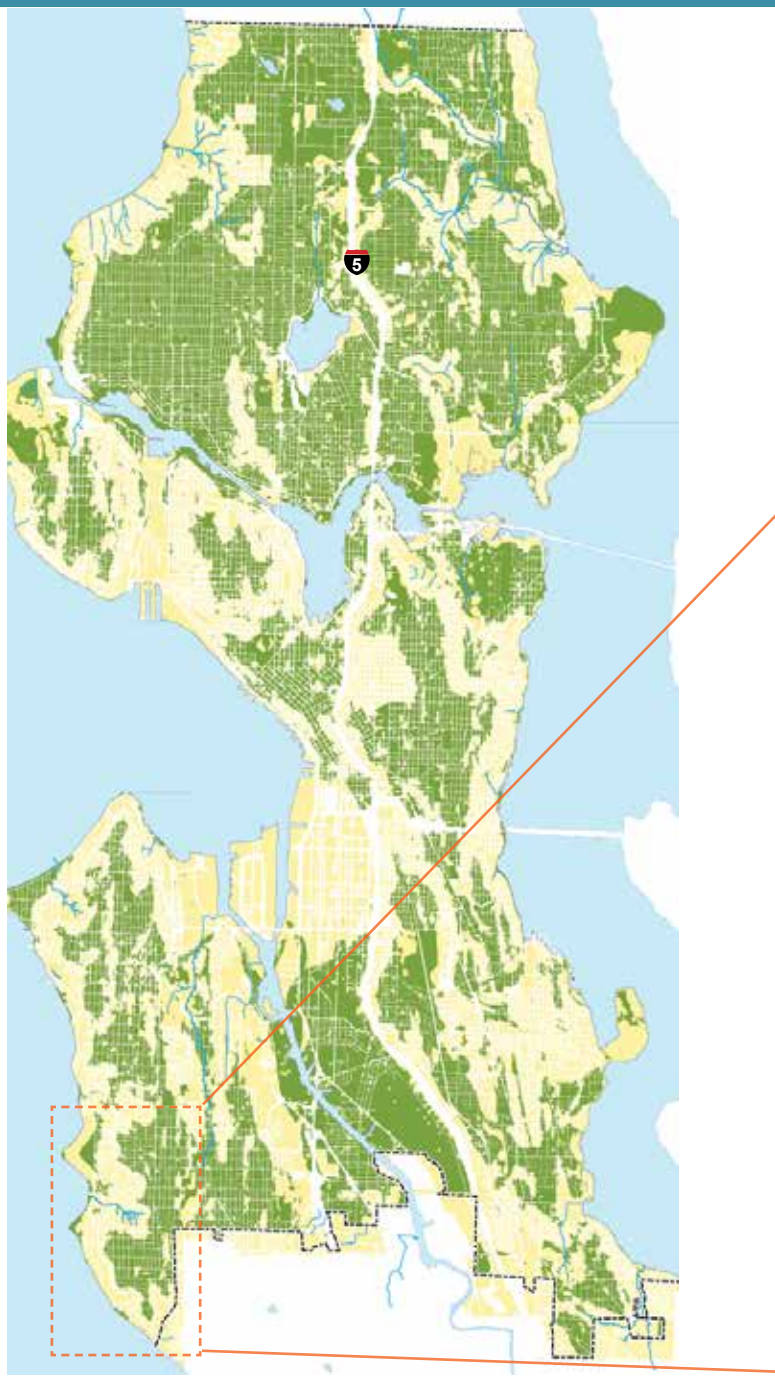


Figure 6. Map of Infiltration Potential in Seattle

- Areas potentially suitable for infiltrating GSI approaches like bioretention.
- Areas NOT suitable for infiltration.

Spotlight on Southwest Seattle

When it rains in the southwest corner of Seattle, stormwater runoff from roofs and roads can overwhelm the capacity of the combined sewer system and trigger overflows of polluted stormwater mixed with sewage into Puget Sound. GSI installations help prevent these overflows by intercepting runoff from impervious surfaces and allowing it to slowly infiltrate into the soil, instead. King County WTD manages the combined system in this part of Seattle. King County WTD is using a two-pronged GSI approach:

1) Installing 93 roadside bioretention facilities in the Sunrise Heights and Westwood neighborhoods, to capture and manage runoff from the road. These areas were chosen because they contribute significantly to the overflow problem and have planting strips that can accommodate a GSI retrofit. 2) Encouraging property owners to voluntarily manage runoff from their roofs, walkways, and driveways by installing a raingarden or cistern. RainWise rebates are available to cover up to 100% of the installation cost.

Roadside bioretention captures runoff from the road in the Sunrise Heights and Westwood neighborhoods

A rain garden at the Fauntleroy School captures runoff from the roof and adds an educational landscape feature

Community Engagement

King County WTD coordinated an extensive community outreach effort during the design phase of the roadside bioretention projects (2011-2013) that included: 6 community meetings, 24 block-level meetings, 2 surveys, 4 neighborhood briefings, 2 rounds of neighborhood canvassing, 6 project updates and newsletters, and nearly 700 email, phone or street conversations with more than 500 residents and stakeholders.

Multiple Community Benefits

When fully constructed, the GSI systems in this area of southwest Seattle will reduce combined sewer overflows into Puget Sound from an average of 4 per year, (spilling more than one million gallons of sewage and stormwater into Puget Sound), to no more than one overflow per year on average. In addition to helping meet this critical stormwater management goal, GSI also offers these benefits:

- Improved street tree canopy
- Improved streetscape aesthetics
- Reduces heat island
- Reduction in energy use to pump stormwater
- Preserved pipe capacity/climate resilience
- Carbon sequestration through composted soils
- Recharged groundwater and improved flows to Fauntleroy and Longfellow Creek
- Educational value

Figure 8. Southwest Seattle GSI Examples

Table 5. GSI Facility Types: Siting Considerations

GSI Tool		Space Efficiency	Use in Shared Space	Use in Private Space	Use where infiltration is restricted?	Considerations
Bioretention		These approaches can manage runoff from an area of impervious surface many times larger than the facility.	✓	✓	Only with a liner and an underdrain	• A street slope of less than 6% slope is preferable • Bioretention requires consistent long-term maintenance • Designs may affect street parking and underground utilities • If an underdrain is needed, this requires careful layout and design • Bioretention usually requires geotechnical study and engineering • Avoid difficult-to-maintain areas like medians and arterials
Rain Gardens			✓	✓	✓	• Requires a level space (up to 5% slope) • Requires site be free of big tree roots and utilities • Requires a way for stormwater to flow into rain garden • Requires an overflow design
Stormwater Cisterns			✓	✓	✓	• Requires an outdoor location at least 5 feet from property line • Requires a level location and a solid base • Requires a an overflow design
Dispersion			In parks, yes; In the ROW, no.	✓	✓	• Requires a minimum 50' flow path to be viable, so opportunities to use this approach in a dense urban setting are very limited
Infiltration Trench/ Dry Well			✓	✓	No	• Requires a native soil infiltration rate of 3"/hour, which is uncommon in Seattle
Biofiltration			✓	✓	Only with an underdrain	• Requires a minimum 200' flow path, so opportunities to use this approach in a dense urban setting are very limited

GSI Tool		Efficiency	Use in Shared Space	Use in Private Space	Use where infiltration is restricted?	Considerations
Permeable Paving		These approaches manage (or prevent) runoff from an area about equal to their own size. THIS IMPERVIOUS AREA MANAGES ITSELF	Only for Code	✓	Only with a liner and an underdrain	• Requires a near level space (up to a 5% slope is okay) • Professional installation is recommended for driving surfaces
Green Roofs			✓	✓	✓	• Requires a structure that can support a green roof • Low-pitched roofs are more easily installed and maintained • Irrigation may be required, especially in the first three years
Depaving	 Photo Courtesy of Sustainable Seattle		✓	✓	With Caution	• Some paving, such as concrete with steel reinforcement will require professional removal • Decompact the top 12" of uncovered soil and amend with 2-3" of compost to help restore permeability • If your project will remove an acre or more of impervious surface or if it will install 2000 square feet or more permeable paving, a Grading Permit from the City of Seattle is required
Tree Canopy		These approaches manage runoff from an area smaller than their own area/size THIS TREE MANAGES RUNOFF FROM THIS AREA	✓	✓	✓	• Ensure design has sufficient space for trees to grow to maturity • If proposed project area is in the public right-of-way, refer to the Seattle Department of Transportation list of approved species • All newly planted trees must be irrigated during the summer for the first 3-5 years after planting • Choose evergreen trees wherever possible
Compost & Mulch			✓	✓	✓	• Mulch should be replenished annually for best effect • Arborist wood chips is the preferred mulching material for weed suppression, water retention, and slow-release of nutrients to soil


Mature Street Tree Canopy

Measuring Efficiency

Two key approaches for assessing the efficiency of a given GSI approach are the amount of space it takes up per gallon managed and the capital plus long term operations cost and value per gallon managed.

Space per Gallon Managed

"Table 5. GSI Facility Types: Siting Considerations" on page 13 summarizes the amount space required per gallon managed for a range of commonly used GSI approaches. This efficiency metric is particularly relevant in places with tightly constrained space, like the public right-of-way or urban parcels in high-density settings.

Cost per Gallon Managed

Cost and value per unit of stormwater function (gallon managed) are difficult to standardize across GSI facility types and project-specific applications. GSI strategies like bioretention and permeable paving are designed to meet variable, place-specific stormwater performance targets by adjusting design components such as the facility's depth. Bioretention is also designed to upgrade the overall level of drainage service -- by providing conveyance where it is lacking, for example – and this added level of service is not reflected in an average annual volume managed accounting unit. The value of co-benefits -- such as traffic calming achieved with a bioretention design that uses a curb bulb – is not easily accounted for.

Best practices such as tree planting and retention have relatively fixed stormwater performance and do not provide other drainage services like conveyance, but offer a wholly different set of positive co-benefits, such as air quality improvement, enhanced wildlife habitat, and improved urban livability.

For all best practices, the "gallons managed" by the install is also basin-specific because performance targets vary by basin type.

These challenges point to the need for an integrated approach to functional landscape design, particularly in the space-constrained public right-of-way. The most successful projects achieve an optimal mix of total stormwater gallons managed, improved overall drainage level of service, improved or protected tree canopy volume, and improved streetscape aesthetics, safety, and social function.

Nonetheless, cost per average annual volume removed is one important reference point for evaluating which practices to use where and why. "Table 6. Cost Per Gallon Managed in the Public Right-of-Way" below summarizes the cost per gallon managed for two GSI strategies used commonly in the public right-of-way, bioretention and tree planting.

Please refer to Appendix E for additional detail.

Table 6. Cost Per Gallon Managed in the Public Right-of-Way

	Capital Investment cost/gallon managed	Operations + Maintenance cost/gallon managed
Bioretention	$.50 - $1.30*	$.009 - $.012
New Street Trees	$2.78**	$.76

** Low end of range is cost of bioretention only. High end of range includes other improvements, such as conveyance upgrades, sidewalks, ADA compliance/curb ramps, roadway reconstruction, etc.*

*** Includes capital costs and three years of establishment-related maintenance*

Case Study: Integrating Street Trees and Bioretention in the Right-of-Way

Designers working to implement GSI in the public right-of-way use an iterative design approach to ensure the best possible combination of stormwater performance and tree canopy improvement in the streetscape. "Figure 9. Bioretention and Street Tree Siting" is an example of an in-process design drawing, showing trees slated for protection, transplantation, replacement, and new planting.

Figure 9. Bioretention and Street Tree Siting

The iterative approach includes these steps:

- **Existing Conditions Assessment** -- Walking the entire proposed project area with a Seattle Department of Transportation landscape architect and assessing the current condition of every street tree. Established trees are flagged for protection. Diseased or poorly planted trees are marked as potential opportunities for replacement with a healthier or more suitable species. Immature trees are noted for possible transplantation if necessary.
- **30%, 60%, 90% Design** -- Different aspects related to optimizing stormwater performance and tree canopy improvements are examined as the design becomes more detailed. At 30% design, for example, proposed general locations for new street trees may be identified. These will be solidified at 60% and finalized at 90%, when species selection will also be finalized. This is typically done with significant input from community members.
- **Construction/Planting and Long Term Maintenance** When the project has been designed and built, both the bioretention facilities and new street trees are recorded and mapped as public assets. Seattle Public Utilities maintains the bioretention cells and Seattle Department of Transportation maintains the street trees.

Table 7. Example Tree Canopy and Bioretention Optimization
Ballard Roadside Bioretention Phase II (excerpt)

Trees removed (diseased or poorly planted)	4
New trees planted	44
Trees retained/protected (established trees that were designed around)	33
Trees transplanted in project area or given to interested property owner	4
Approximate gallons managed with new + retained trees	17K
Approximate gallons managed with bioretention	1.5M

Bioretention and Street Trees Integration

GSI Project Types and Funding Sources

Project types 1and 4 are not funded with drainage rates. Project types 2 and 3 are funded with drainage rates.

1 Projects Required by Stormwater Code

These projects are required when public or private land is redeveloped. Project requirements are defined by Municipal Stormwater Code, and projects are developed and funded by the developer. The developer may be a private entity or a public agency, such as Seattle Department of Transportation. Roughly 1% of Seattle's land is redeveloped every year, according to the Department of Planning and Development.

Figure 10. Roadside bioretention installed on 55th Ave. NE
Installed by Seattle Department of Transportation

Figure 11. GreenFire Campus in Ballard
Cistern and bioretention installed for Stormwater Code

2 Retrofit Projects Led and Funded by Seattle Public Utilities (SPU) or King County Wastewater Treatment Division (WTD)

These high priority capital improvement projects on public land are developed and funded by local drainage and/or wastewater utilities. These projects most typically retrofit the public right-of-way to manage stormwater runoff from the road system. Projects are designed to improve water quality, prevent sewer overflows or back-ups, prevent damage to creeks, and/or improve conveyance. These projects are also designed for neighborhood co-benefits .

Figure 12. 110th St. Cascade
Led by SPU to protect Piper's Creek

Figure 13. Swale on Yale
Led by SPU in partership with Vulcan, Inc. to protect Lake Union

Figure 14. Rainwise Installation, New Hope Academy + Mosque
Funded by the RainWise program

Figure 15. Depave Effort at Highline Community Center
Funded by King County Green Grant and facilitated by Sustainable Seattle and Stewardship Partners

Figure 16. Raingarden retrofit at Discovery Park
Led by Stewardship Partners & Seattle Parks and Recreation, with support from Wells Fargo

Figure 17. Ballard Corners Park
Installed via partnership between Seattle Parks and Recreation & Friends of Ballard Corners

3

Retrofit Projects, Incentivized by Seattle Public Utilities or King County Wastewater Treatment Division

These voluntary retrofit projects are developed by property owners and incentivized by SPU or WTD, via rebates or grants, within high priority areas. These projects are funded with drainage rates, like project category 2.

Examples include RainWise incentives as well as King County's Green Grants program in the Duwamish River watershed.

4

Retrofit Projects Non-Utilitiy Led and Funded

These voluntary projects on private or public land are developed and funded by entities other than Seattle Public Utilities or King County Wastewater Treatment Division. Funding sources include private foundations, private developers, state or federal grants, and local agency funding via the Municipal or County budget. Examples include voluntary projects funded and built by Seattle Department of Transportation, Metropolitan Parks District, private developers or community organizations.

2012 BASELINE

Seattle's efforts to intentionally manage stormwater runoff from impervious surfaces using GSI began in earnest in 2001. "Table 8. 2000-2012 Implementation Baseline" summarizes known green stormwater infrastructure intentionally built (and planted or retained, in the case of street trees) to manage stormwater runoff from impervious surfaces in Seattle from 2001-2012. The baseline is based on best-available data from these sources: City project records, Code-related plans and data, RainWise program data, and partner-reported data. Historic data were normalized to annual average volume (gallons) managed following the methodology outlined in Appendix A and represent best available estimates.

The 2012 baseline does not inventory rainwater infiltration and evaporation provided by all vegetated shallow depressions, informal gullies and ditches, all pervious or semi-pervious surfaces, mulched soil cover, vegetated riparian areas, wetlands, and forested open space areas within Seattle. These existing components of pre-development natural systems provide many ecological (and social) services. Although the value of this function has not been calculated for Seattle, this type of ecosystem services study has been conducted for larger and less urbanized watersheds or for specific landscape components (such as Seattle's urban forest) and has demonstrated enormous value. Seattle would face even greater stormwater management challenges were existing natural systems further degraded or not present at all. For this reason, the protection and enhancement of our urban creeks, wetlands, soil, and forested open space are also high priorities for the City of Seattle.

Please refer to Appendix C for a more detailed discussion of Seattle's GSI implementation from 2000-2012.

Figure 18. GSI Examples with Funding Sources

Funded via drainage rates & fees

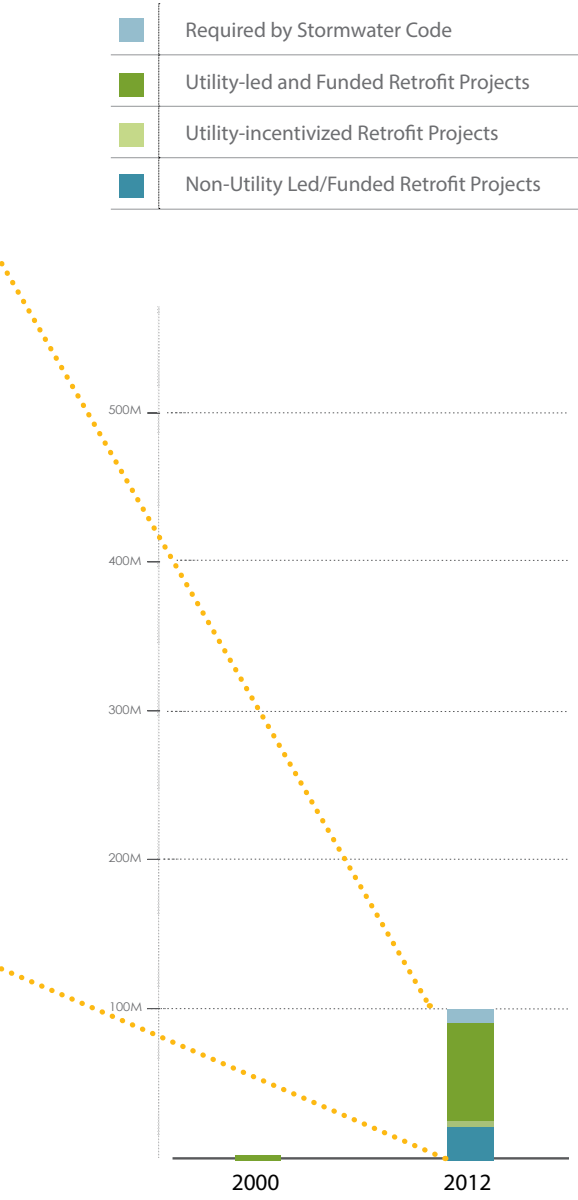
Funded via means other than drainage rates & fees

Table 8. 2000-2012 Implementation Baseline

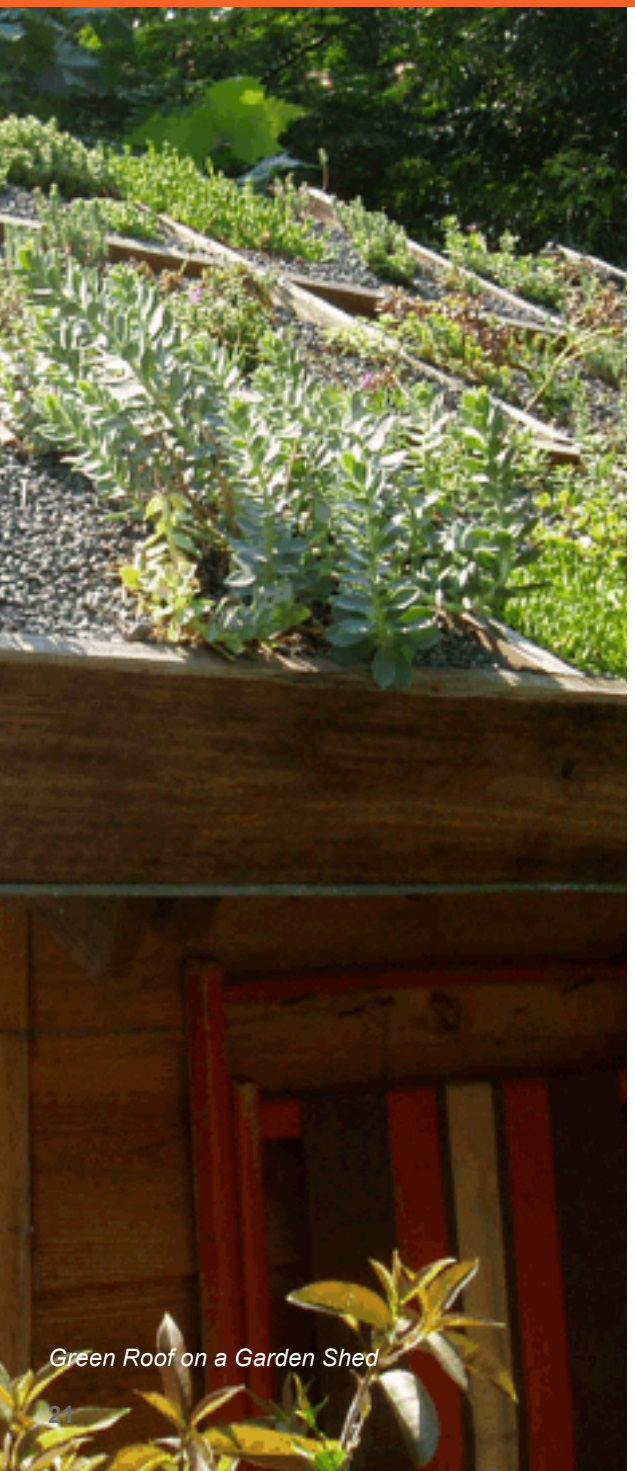
GSI Baseline 2000-2012	gallons managed
1) Required by Stormwater Code	
Single family; parcel-based; right-of-way; trails and sidewalks;	8.7M
2) Utility-Led & Funded Retrofit Projects	
Seattle Public Utilities SEAStreets; Carkeek Cascade; Broadview Green Grid; Pinehurst Green Grid; Highpoint Redevelopment; Ballard I	67M
3) Utility-Incentivized Retrofit Projects	
Seattle Public Utilities RainWise; ReLEAF street tree planting	2.5M
4) Non-Utility Led/Funded Retrofit Projects	
Seattle Department of Transportation Street tree planting & retention; permeable pave sidewalks not installed for Stormwater Code	1.9M
Seattle Parks & Recreation Capital projects & street tree-equivalent planting and retention[a]	10M
Community-Led Projects Voluntary green roof installations; projects led by community groups, businesses, or other non-profit organizations (not funded by SPU or WTD)	10.4M
Total	100.5M

[a] This was estimated based on best-available tree count data on Parks development and redevelopment projects realized from 2001-2012. Due to lack of historic tracking of these data, it is likely under-reported.

Figure 19. 2000-2012 Implementation Baseline



Barriers and Opportunities



Green Roof on a Garden Shed

Seattle made significant progress on many of the directives of the GSI Resolution and Executive Order from mid-2013 through 2014. These are summarized in the following pages and outlined in more detail in Appendix D.

Despite these gains, however, Seattle will fall short of its interim 2020 target (400M gallons of runoff managed annually with GSI) without additional investment and/or innovation. Throughout 2014, the Office of Sustainability and Environment, in collaboration with Seattle Public Utilities and King County Wastewater Treatment Division, conducted a series of staff-level and executive-level interviews to query agency practitioners on barriers and opportunities for accelerated GSI implementation. Additionally, three focused listening sessions were convened to gather input from a broader array of stakeholders, including neighborhood-based organizations, non-profit organizations, professional designers, developers, and interested residents.

The core opportunities and challenges identified via these interviews and listening sessions are summarized in "Table 9. Summary of Major Barriers by Project Type" and "Table 10. Summary of Major Opportunities by Project Type". They inform the investment assumptions and recommendations laid out in this section and point to a fundamental need to diversify Seattle's GSI portfolio by embracing a more broadly shared approach.

Table 9. Summary of Major Barriers and Challenges by Project Type

Required by Stormwater Code
Lack of clarity about minimum requirements and viable design approaches
Legal constraints limit options for alternative compliance approaches for Stormwater Code
Tension between regional environmental benefits of density and community-wide values of greenspace and local stewardship
GSI tracking currently aggregates all facility types
Utility-Led and Funded Retrofit Projects
Tension between the value of multiple community benefits and civic engagement and cost/gallon "efficiency"
Rate pressure & legal requirements limit investment potential
Legacy pollution from first century of unmitigated road and parcel development is difficult and costly to resolve with drainage rates alone
Lag time between advancements in GSI policy and design guidance and uptake by City and private sector designers
Utility-Incentivized Retrofit Projects
Participation rates directly relate to soft costs. That is, consistent outreach is required to achieve on-going participation.
Currently limited to uncontrolled CSO basins (can appear arbitrary); Facility types limited to rain gardens and cisterns
Non-Utility Led/Funded Retrofit Projects
No budget for GSI integration in capital departments can mean GSI integration to address legacy pollution is seen as a taking
Insufficient maintenance budget for street trees
Few external funding sources exist at scale necessary to meet target
GSI tracking systems are not developed or not consistent
Lack of guidance about partnering opportunities for developers who wish to go "beyond Code"
Voluntary bioretention in the right-of-way is technically complex and the complexity can translate into cost barriers for non-experts

Table 10. Summary of Major Opportunities by Project Type

Required by Stormwater Code
Organize the new Stormwater Manual to directly address these challenges; Conduct substantial outreach "early and often" to ease the transition to the new Code
Evaluate how to improve alternative compliance mechanisms, beginning with the highest priority roadway projects; Apply lessons learned to other project types.
Review and revise Land Use Code to integrate low impact development site planning as the "go to" approach. NOTE: Green Factor landscaping standard already weights GSI very strongly;
Conduct an internal review of distribution of GSI facility types/tools used across a current sample of built projects; Address long-term via planned system upgrade process
Utility-Led and Funded Retrofit Projects
Develop new program in creek basins with a focus on partnerships with transportation-related capital programs and community-based planning efforts to deliver additional community benefits as well as cost efficiency. Adaptively manage for these outcomes over time.
Continually seek efficiencies and partnerships; Revisit planned investments in next strategic plan, informed by 2015-2020 outcomes.
Leverage CSO consent decree to incrementally address legacy pollution in creek watersheds (Seattle's most fragile water systems). NOTE: This proposal requires EPA approval.
Develop and conduct on-going, behind-the-scenes work to refine and communicate standard practices and provide needed training; Clarify expectation to evaluate GSI for all large-scale Utility projects during options analysis phase.
Utility-Incentivized Retrofit Projects
Continue engaging community-based organizations as outreach partners and continue leveraging joint-program savings with King County Wastewater Treatment Division; Seek opportunities to characterize the civic value of the community engagement process;
Evaluate expansion to creek basins; Evaluate green roofs and permeable pavement; Evaluate and implement measures to lower barriers to participation, particularly in low-income communities
Non-Utility Led/Funded Retrofit Projects
Include GSI integration budget in Move Seattle and Parks District to support integration with: neighborhood greenways, complete streets, multi-modal corridors, and new park development; Create GSI integration opportunity fund
Include street tree and permeable pavement sidewalk maintenance budget in Move Seattle package
Pursue new WA Dept. of Ecology funding source (up to $5M per jurisdiction, per cycle) for prioritized, integrated capital investments
Apply standard protocols to track GSI implementation in all capital departments and share updates with the public biannually
Develop and disseminate clear guidance about partnering opportunities for both private and public developers; Pilot office hours
Offer direct technical assistance for early project development, starting with retrofits beyond a threshold scale and in high priority areas; Evaluate other opportunities to engage community champions on projects with lower (or no) technical barriers, such as depaving.

Code Implementation Spotlight: Seattle Central Waterfront

The Central Waterfront project will rebuild Alaskan Way and add a regional destination park space along Seattle's western edge. The project includes many sustainability features and innovations designed to enhance public space, save energy, address climate change, prevent air and water pollution, restore habitat, and minimize waste.

GSI implementation for this major capital project is driven by Municipal Stormwater Code requirements and will help prevent polluted runoff from damaging Puget Sound. Currently planned GSI features include roadside bioretention and street trees along Alaskan way as well as a pervious pave cycle track. These integrated design features will intercept, slow, and clean polluted stormwater runoff before it discharges directly to Puget Sound.

Outside of Stormwater Code requirements, the project will also replace nearly three acres of previously impervious surface with landscaped or pervious areas.

Early Progress 2013-2014

Expanded Retrofit Incentives for Private Property

- Increased RainWise-eligible area (40,000 properties are now eligible for rebates) and streamlined City-led and County-led RainWise efforts into one joint-program

Removed Barriers to City & County Capital Projects

- SPU and WTD secured long-term maintenance budget for GSI in the public right-of-way
- SPU and WTD forged agreement to deliver GSI projects under a joint program to achieve consistency across projects and to improve efficiency (share common resources)
- SDOT established common sense approach to yellow and black striped object markers on residential streets
- SPU and WTD developed Siting and Design Manuals for City and County-led capital projects in the public right-of-way. The manuals:
  - articulate the recommended process to assess opportunitie for multiple community benefits and community engagement during the siting/options analysis phase of a project
  - establish field-tested planting palettes and guidance for optimizing tree canopy and stormwater function
  - resolve an array of design-related policy questions

Expanded Community-Driven Approaches

- Participating groups reinvigorated the "Green Infrastructure Partnership" (GrIP) consortium to facilitate networking and support voluntary adoption of GSI
- SPU and WTD improved public outreach processes to better incorporate neighborhood expertise and engage diverse communities
- City of Seattle and WTD held three community listening sessions to inform the development of this *Strategy*

Expanded Community Leadership & Innovation

- SPU developed "Right Place, Right Project" guidance to clarify the process for initiating "beyond Code" retrofit partnerships
- Seattle 2030 District developed a district-wide stormwater management target and calculator tool for project review
- Sustainable Seattle and Stewardship Partners partnered with Highland Park Community Center to implement Seattle's first major "Depave" project (funded by a King County Green Grant)
- Resource Media and Washington Environmental Council launched "Waterspotter" to call attention to stormwater pollution and promote common sense solutions like GSI (See: http://waterspotter.wordpress.com)
- Seattle Parks Foundation facilitated a community open space visioning process with the South Park neighborhood, identifying potential sites for multi-functional GSI investment
- Sustainable Ballard and ECOSS conducted RainWise outreach in eligible neighborhoods in northwest and southwest Seattle

Leveraged Regulatory Obligation

- Seattle pursued an innovative approach to its combined sewer overflow consent decree. If accepted by regulators, the Plan to Protect Seattle's Waterways will allow Seattle to implement high value water quality projects in advance of combined-sewer projects, including roadside GSI investments in Seattle's three major creek watersheds: Thornton, Pipers, and Longfellow.

Removed Barriers to Code-Triggered Projects

- Integrated Low Impact Development (LID) principles and guidance into City of Seattle codes and standards
- Simplified Stormwater Manual for Code-required GSI projects by including all minimum requirements in one consolidated volume and aligning terms and thresholds with WA Department of Ecology's Permit

Integrated GSI into Transportation Infrastructure

- Seattle Public Utilities and Seattle Department of Transportation completed the Delridge Neighborhood Greenway coordinated siting and design process. Construction is slated for 2015.
- Seattle Public Utilities coordinated with Seattle Department of Transportation and Seattle Greenways to site and design roadside GSI in the Ballard neighborhood to align with planned/future Neighborhood Greenways in the area.
- In collaboration with Vulcan, Inc., Seattle Public Utilities built the first phase of the 'Swale on Yale' water quality project on two blocks in the South Lake Union neighborhood.
- King County WTD built roadside GSI in southwest Seattle's Sunrise Heights and Westwood neighborhoods to prevent combined sewer overflows into Puget Sound.

Integrated GSI into Park Operations

- Stewardship Partners, Seattle Parks and Recreation, and a host of additional partners built a retrofitted series of roadside raingardens in Discovery Park as an adaptive management strategy to address flooding.
- Seattle Parks and Recreation applied for Washington Department of Ecology funding to build pilot raingardens and permeable pavement installations at a Parks maintenance facility in a combined sewer overflow area of north Seattle.

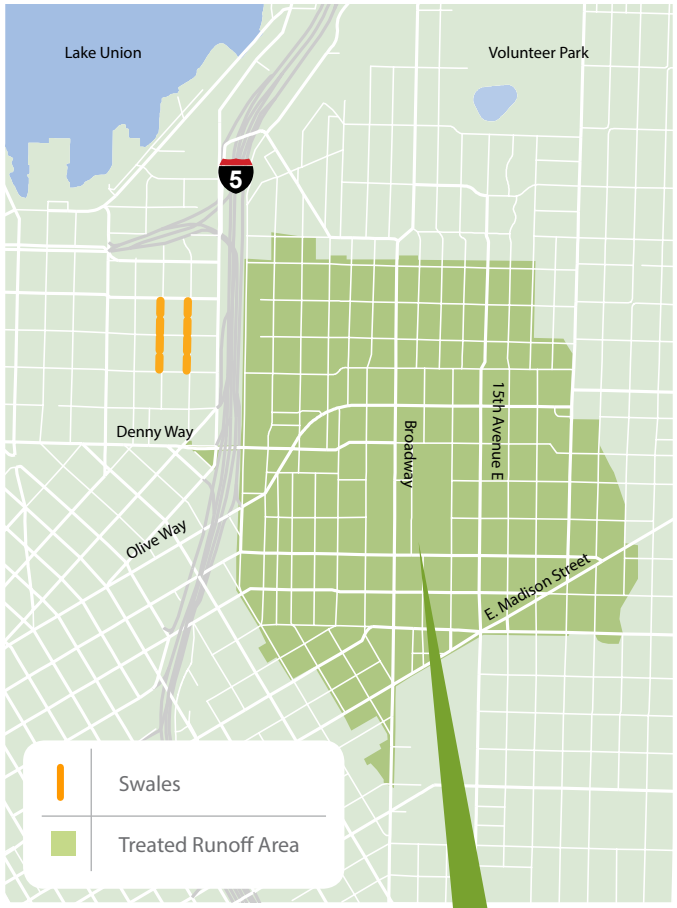


Figure 20. Swale on Yale Project Map

BUDGETED CAPITAL INVESTMENT THROUGH 2020

"Table 11. Current Six-Year Budgeted Totals (2015 - 2020)" summarizes approved City and County capital departments' budgeted investments through 2020 that will result in on-the-ground, additional gallons managed via GSI approaches.

Operations and maintenance figures are included for context. Without appropriate provisions for on-going maintenance, facilities are not built or may lose function over time.

Table 11. Six-Year Budgeted Totals (2015 - 2020)

	Capital Investment	Est. Gallons managed	Operations + Maintenance	NOTES
Seattle Public Utilities				
Right-of-Way Water Quality Projects	**$15M**	**42M**		**Combined sewer overflow projects; Swale on Yale phase II construction**
Right-of-Way Partnering for Creek Protection Projects	**$28M**	**27M-48M**		**Venema Project; Natural Drainage Systems Partnering via the Integrated Plan**
Additional Partnering on Others' Projects (uncontrolled CSO basins)	**$3M**	**6M**		**Funding available to assist others' beyond Code retrofit projects (agencies and community)**
RainWise (voluntary incentives)	**$11.7M**	**26.6M**		**RainWise**
Sub-Total	$57.7M	102M-123M	$5M	
King County Wastewater Treatment Division (WTD)				
Right-of-Way CSO prevention projects	**$92.4M**	**32M-64M**		**Combined sewer overflow projects**
RainWise (voluntary incentives)	**$2.6M**	**5.9M**		**RainWise**
Sub-Total	$95M	38M - 70M	$1.8M	
Seattle Department of Transportation				
Street tree planting	**$.4M**	**<1M**		**Currently funded through 2015**
Sub-Total	$.4M	<1M	**TBD**	
Seattle Parks Department				
Denesmore Pilot Project	**$.2M**	**<1M**		**Funded with Department of Ecology grant**
Sub-Total	$.2M	<1M	TBD	
Seattle Waterfront Office				
Right-of-way bioretention	**.92M**	**3.3M**		**2,800 sq. ft. of bioretention (bottom area)**
Street trees	**$1.26M**	**.3**		**885 new street trees**
Pervious cycle track	**$.2M**	**.6M**		**40,000 sq. ft. of pervious cycle track**
Sub-Total	$2.38M	4.2M	TBD	

Funding Sources

- Funded via drainage rates & fees
- Funded via means other than drainage rates & fees

Project Types

- Required by Stormwater Code
- Utility-led and Funded Retrofit Projects
- Utility-incentivized Retrofit Projects
- Non-Utility Led/Funded Retrofit Projects

Geographic Focus Areas for Seattle Public Utilities (SPU) & King County Wastewater Treatment Division (WTD) Budgeted Investments -- Capital Projects and Incentives

For 2015-2020, SPU-funded capital projects and incentives have been prioritized to address Tier 1 stormwater management challenges as summarized in "Table 12. Tier 1 & 2 Implementation Goals" and "Figure 21. Map of GSI Geographic Focus Areas".

SPU is prioritizing GSI implementation in major creek watersheds, where GSI keeps polluted runoff out of fragile, salmon-bearing creeks, helps protect habitat, improves water quality and improves conveyance. Some projects in these areas will also include improvements such as sidewalks and curb ramps. All GSI projects in the right-of-way also include new and/or protected street trees.

Both SPU and King County WTD are also prioritizing GSI implementation in some uncontrolled combined sewer basins. In these areas, GSI helps prevent overflows of sewage and polluted stormwater into Lake Washington, the Ship Canal, Longfellow Creek, and Puget Sound. GSI in these areas also preserves (or improves) local pipe capacity and enhances climate resilience.

Tier 2 stormwater management challenges, as described in "Table 12. Tier 1 & 2 Implementation Goals", may be addressed via grant funding or voluntary retrofit investments by developers or property owners.

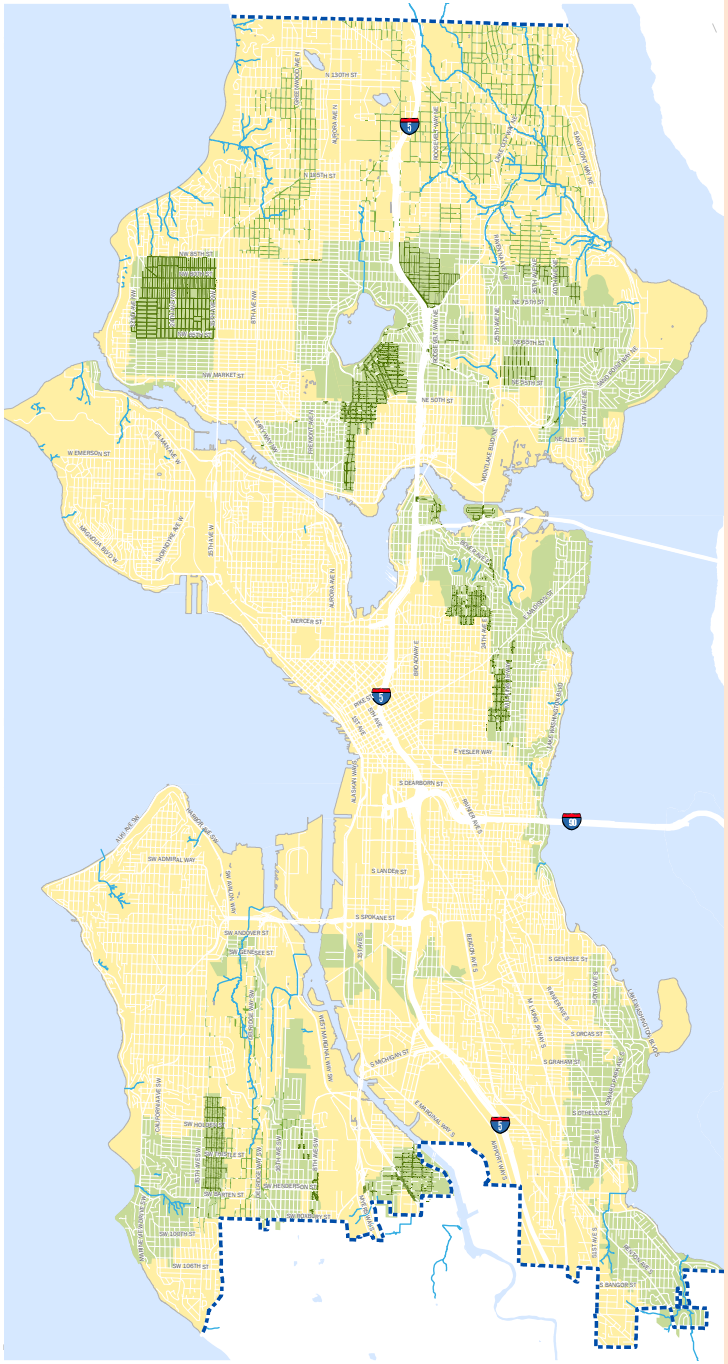


Figure 21. Map of GSI Geographic Focus Areas for Seattle Public Utilities and King County WTD

Table 12. Tier 1 & 2 Implementation Goals

TIER 1 GSI Implementation Goals
A small percentage of potentially feasible streets and parcels is currently budgeted/funded 2015-2020
Decrease flows of polluted runoff into Longfellow, Pipers, and Thornton creeks
Address combined sewer overflows and increase local pipe capacity in uncontrolled combined sewer basins
Address flooding, back-ups and climate resilience in areas with constrained pipe capacity
Streets potentially eligible for creek protection projects
Streets potentially eligible for combined sewer overflow prevention projects
Areas eligible for RainWise rebate program (on parcels) NOTE: These areas are subject to change
TIER 2 GSI Implementation Goals
Not currently budgeted/funded 2015-2020. May be funded via grants or other sources.
Prevent direct discharges of polluted runoff to Lake Washington, Lake Union, and Puget Sound
Preserve pipe capacity throughout system
Restore natural hydrology

Stormwater Code-Triggered Projects

Figure 22. Lake City Court Development Pervious Concrete and Rain Garden
Photo Courtesy of SvR Design

Stormwater Code Purpose

Seattle has had a municpal Stormwater Code in place since 1979. The current Code was adopted in 2009. The purpose of this regulation is to protect life, property, and surface waters from harm caused by storwmater runoff. Seattle must also comply with state and federal law, including the Clean Water Act.

Seattle's current Stormwater Code includes requirements for pollution prevention on existing sites and construction sites. For development or redevelopment of roads, trails and sidewalks, single family residential, and all other parcel-based projects, the current Stormwater Code includes requirements for flow control, water quality treatment, and GSI.

Stormwater Code Revision

Seattle is updating the 2009 Stormwater Code to align its requirements with Washington State Department of Ecology's 2014 Stormwater Manual and 2013-2018 NPDES Permit. The revision process is also an opportunity to simplify and streamline the document and address shortcomings. Table 13 summarizes expected updates that relate to GSI implementation. The new Stormwater Code and related Directors' Rules are scheduled to take effect in January 2016.

Projected Code-Triggered GSI Implementation

The planned updates to Seattle's Stormwater Code are expected to result in approximately a 15% increase in GSI implementation achieved via Stormwater Code, estimated as gallons managed annually by GSI and compared to the 2009 Stormwater Code. The majority of gains will be on single-family residential projects and parcel-based projects. Gallons managed annually via Code-triggered projects in the right-of-way is expected to remain approximately the same.

Table 13. Upcoming GSI-Related Stormwater Code Changes

Upcoming GSI-Related Stormwater Code Changes
"GSI to the Maximum Extent Feasible" requirements in the 2009 Code will be replaced with "on-site stormwater management" requirements, and these will be aligned with and equivalent to those outlined in Washington State Department of Ecology's Manual and Permit. The term "GSI" will not be used.
The threshold for triggering on-site stormwater management for parcel-based projects will be lowered from 2000 to 1,500 square feet of new or replaced impervious surface or 7,000 sq. ft. of land-disturbing activity.
The threshold for single family residential project types will be raised from 0 to 1,500 square feet of new or replaced impervious surface, and the 1,500 square foot credit will no longer apply. This means single family projects with greater than 1,500 square feet of new or replaced impervious surface will have to meet the on-site management requirement for the project's impervious surface.
On-site stormwater management requirements will include amending soils, and evaluating & implementing GSI either by: • Following a pre-defined list of best practices, organized by category or by • Demonstrating compliance with a specified performance standard
A requirement to "protect on-site facilities" will be added to the 'Construction Site Stormwater Pollution Prevention' provisions

Seattle Department of Transportation (SDOT)

SDOT staff and managers have identified several key strategies for integrating GSI into capital transportation projects, including:

- Prioritizing GSI features for traffic calming (retrofits to slow traffic speeds)
- Incorporating GSI into multi-modal corridors, neighborhood greenways, non-arterial paving projects, and sidewalk projects as sensible/feasible
- Removing impervious surface in SDOT capital projects (to maximum extent feasible)
- Implementing GSI integration opportunitie identified via the Complete Streets review process
- Continuing street tree planting investments beyond 2015

Dedicated funding is required to implement these strategies.

Complimentary Strategies

These are approaches that do not deliver additional gallons managed with GSI but that may prevent the loss of stormwater function or the conversion of pervious surface to imprervious surface, including:

- Street tree preservation
  Note: Adequate funding for a regular pruning cycle, necessary for tree health and longevity, is currently lacking.
- Landscaped areas maintenance
  Note: Adequate funding is needed to prevent current (or new) landscaped areas from being removed and paved due to lack of maintenance capacity. Depaving efforts in the right-of-way increase the need for landscaped areas maintenance budget.
- Permeable pavement maintenance
  Note: Sweeping and vactoring maintains performance

Seattle Parks and Recreation (Parks)

Near-term strategies for achieving additional gallons managed by integrating GSI into Seattle Parks, include:

- Retrofitting/converting existing landscaped areas, adjacent to buildings or parking areas, into rain gardens to managed roof runoff or parking lot runoff
- Investing in rainwater capture and reuse systems for irrigation
  Note: This approach also decreases potable water use
- Utilizing GSI retrofits to solve existing drainage issues and/or to improve habitat value or aesthetic value of Park land
- Developing voluntary demonstration projects with interested community partners at Park sites
  Note: RainWise rebates may be used to fund the capital portion of projects in eligible areas. Long-term maintenance budget is still required.
- Decommissioning and removing unnecessary impervious areas in Parks, such as legacy roads and parking areas.
- GSI integration into future park development and land-banked site development beyond what is required by Stormwater Code. This might include, for example, managing adjacent right-of-way runoff on the Park/right-of-way boundary, particularly in creek watersheds.
  Note: Partering funding from SPU may be available in creek watersheds. Partnering funding from SPU or King County WTD may be available in uncontrolled CSO basins.
  See Figure 21 on page 26.

As discussed in the next section, new capital investments require budget allocation for design, construction, long-term maintenance, and operational capacity building.

Community Based Organizations

Community-based organizations such as Stewardship Partners, the Environmental Coalition of South Seattle, Seattle Greenways, Seattle Parks Foundation, Futurewise, and Sustainable Seattle are working throughout Seattle on strategies such as:

- organizing block-level rain garden clusters to facilitate neighbor-to-neighbor learning
- conducting focused outreach within diverse communities to develop project ideas and identify potential funding sources
- identifying high-value opportunities for depaving projects and helping interested residents and groups apply for grant funding
- identifying opportunities to integrate GSI into broader open space planning or urban village planning initiatives

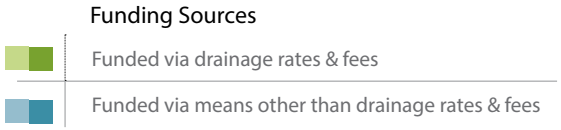
Agency-driven Voluntary Retrofits

No voluntary retrofits planned by regional and state level transportation agencies such as Sound Transit and Washington State Department of Transportation have been identified at this time. However, future light rail development and bridge expansion projects may present opportunities for public-public partnerships or private foundation funding for GSI integration that goes beyond Stormwater Code compliance.

Projected Gallons Managed in 2020

Table 14. Projected Gallons Managed with GSI Anually in 2020 (in millions)

	Gallons Managed 2012 Baseline	Funded initiatives through 2020	Projected Increase by 2020	Projected Total in 2020
Required by Stormwater Code Developer Led & Funded (Public & Private)				
Special Projects, ie: Waterfront	--	bioretention; pervious cycle track; street trees	4.2	4.2
Parcels, ROW, single-family residential, trails and sidewalks	8.7	private development; public projects in the right-of-way, Parks, or building parcels	94.8	103.5
Subtotal	8.7		99	107.7
Utility-Led & Funded Retrofit Projects (in the public right-of-way)				
Seattle Public Utilities	67	right-of-way water quality projects and creek protection projects	75-96	142-163
King County WTD	0	right-of-way projects to prevent combined sewer overflows	32-64	32-64
Subtotal	67		107-160	174-227
Utility-Incentivized Retrofits (on parcels)				
Seattle Public Utilities and King County WTD	2.5	RainWise rebate program; SPU and WTD partnering on others' projects; Green Grants; ReLeaf	33	35.5
Subtotal	2.5		33	35.5
Voluntary Retrofits, Developer Led & Funded (Public & Private)				
Community-Led	10.4	grant-funded; voluntary green roofs and other installations; Depave pilots;	2	12.4
SDOT capital projects & programs beyond Code	1.9	Street tree planting (2015 only); Others TBD, pending transportation levy	1	2.9
Parks operational retrofits and capital projects beyond Code	10	Capacity-building pilot pending funding by WA Department of Ecology; Parks facilities	1	11
Subtotal	22.3		4	26.3
Total	**100.5**		**243-296**	**344-397**



PROJECTED GALLONS MANAGED IN 2020

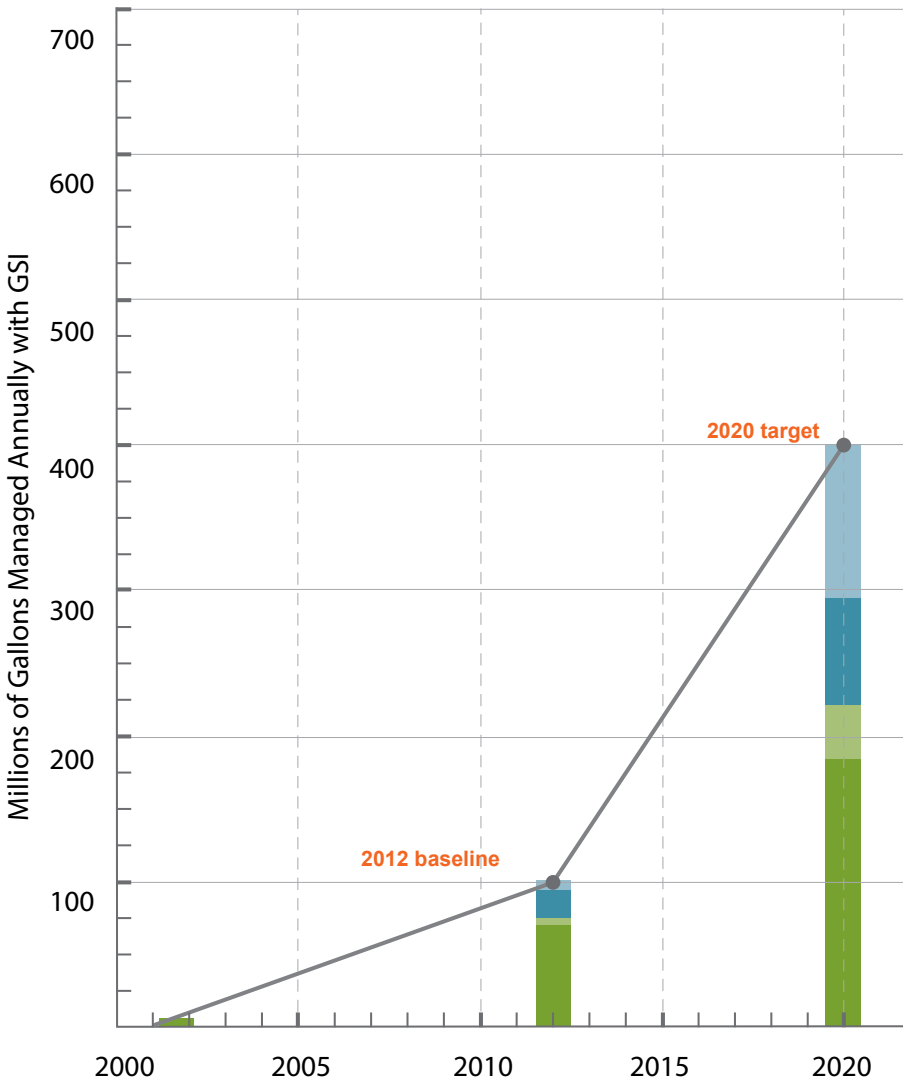


Figure 23. Millions of Gallons Managed Annually with GSI

The strategies outlined in the pages that follow present opportunities to meet the 2020 interim target by accelerating GSI implementation across all sector types, with an emphasis on strategies to increase non-Utility led and funded retrofits.

- Required by Stormwater Code
- Non-Utility Retrofit Projects
- Retrofits Incentivized by Seattle Public Utilities (SPU) or King County Wastewater Treatment Division (WTD)
- Retrofits Led & Funded by SPU or WTD

Civic Center Green Roof

Targeted Distribution of GSI Portfolio in 2020

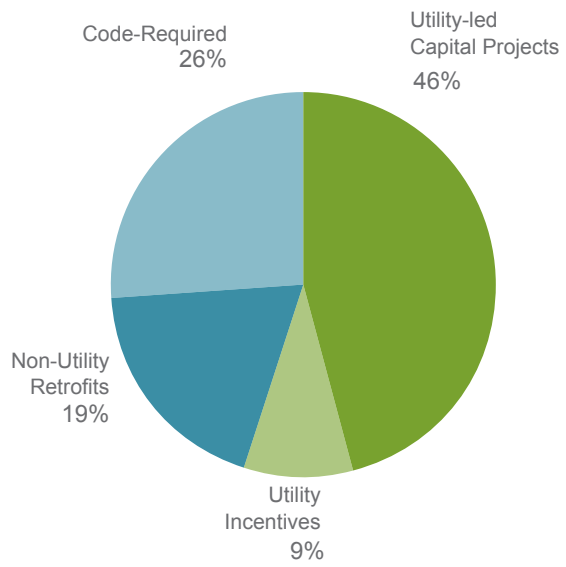
Target Distribution of Seattle's GSI Portfolio in 2020 And The Need to Diversify with a Shared Approach

Given the planned and budgeted investment for GSI implementation over the next six-year cycle (2015-2020), Seattle is on course to make significant progress toward reaching its interim target and the overall 2025 goal by nearly tripling its total GSI portfolio by 2020. Much of this progress will result from gains via Stormwater Code and from SPU and King County WTD work driven by Federal consent decrees. Stormwater Code addresses new development and our drainage and wastewater utilities provide strategic leadership, technical expertise, and critical funding, however Seattle will not meet its implementation goals with these investments alone. Diversifying Seattle's GSI portfolio further by pursuing additional gallons managed via non Utility-funded retrofits and cross-sector partnerships are essential for Seattle to meet its interim 2020 target and will make the longer-term path to the 2025 implementation goal more achievable.

This Strategy, therefore, emphasizes opportunities to get the most from finite Utility investments together with opportunities to incrementally integrate GSI into other capital investments and community-development initiatives -- an approach that delivers multiple community benefits as well as cost efficiency.

"Figure 25. Projected Distribution of Gallons Managed with GSI in 2020" at right reiterates the projected 2020 distribution of Seattle's GSI portfolio, given the 2012 baseline and current capital investment commitments. This projection also assumes developer-funded retrofits required by Stormwater Code progress at a pace that parallels Seattle's overall redevelopment rate.

Figure 24: Targeted Distribution in 2020
TOTAL GALLONS MANAGED: 400M



Sector Goals for Reaching the 2020 Interim Target

This Strategy recommends a diverse approach to reaching the 2020 interim target, emphasizing strategic investment in integrated infrastructure and partnerships to facilitate voluntary, "beyond code" retrofits of existing impervious surface at the point of development, redevelopment, or major renovation/maintenance. These approaches are emphasized because they deliver cost-efficiency and multiple community benefits.

Operating Assumptions

- No new general fund budget in 2015
- No backsliding on 2012 baseline
- SPU cannot increase rates beyond approved 2015-2020 Strategic Business Plan before 2020. Planned GSI capital investments and on-going operations and maintenance funding are included in this baseline budget. New GSI investment could potentially begin in 2021, integrated into next six-year Strategic Business Plan budgeting cycle
- Current City Council-approved SPU investment rate in GSI (in SPU baseline budget) is maintained through 2020 and used to inform investment rate in next six-year cycle
- $/gallon managed range of capital implementation cost: $0.30 - $1.30 (based on project experience to date)

Highpoint Roadside Bioretention, West Seattle

Non-Utility Led and Funded Retrofits

These retrofit projects on private or public land are developed and funded by entities other than Seattle Public Utilities or King County Wastewater Treatment Division, including: foundations, private developers, state or federal grants, and local agency funding via the Municipal or County budget. Examples include Seattle Department of Transportation's Urban Forestry program and Stewardship Partners 12,000 Raingardens campaign. Projects in this sector are not geographically limited to certain basins. Three main approaches for accelerating implementation include:

1. Facilitating City investment in integrated infrastructure
2. Attracting State, Federal, or private investment for integrated infrastructure or expanded community-led programs
3. Removing implementation barriers

Facilitate City Investment in Integrated Infrastructure via Program Budgets or GSI Retrofit Opportunity Fund

Integrating GSI retrofits into non-drainage rate-funded capital infrastructure investments (roads, parks, other City-owned sites, electricity, water, telecommunications, etc.) when cost per gallon managed is projected to be $0.50/gallon or less is an efficient approach to accelerating implmentation. This requires having budget available (either at the program or project level, or in an aggregated "GSI Opportunity Fund") and means expanding project scope(s) to include a GSI retrofit to manage adjacent impervious areas up to the stormwater performance target appropriate for the location (i.e.: retrofit existing impervious area in addition to new and replaced impervious).

Operationalizing a GSI Retrofit Opportunity Fund

Three potential approaches include:

Via a cross-departmental prioritization process, conducted annually by the Integrated Infrastructure team, with recommendations referred to a Joint Executive Team for final decision-making. This approach would require a dedicated manager and an executive sponsor and also requires flexibility on project schedules and evaluation criteria.

Via a community grant process to consider and support proposals from neighborhood-based organizations and sister agencies, within defined minimum eligibility, performance criteria and cost criteria, and service equity goals. Likely community-driven approaches include: district-scale rainwater harvesting and reuse; neighborhood-level Depave efforts; integraion with Neighborhood Greenways, etc. This approach would require staffing resources to develop and administer.

Via direct allocation to City departments, for example: to SDOT for GSI retrofit integration into complete streets, sidewalk projects, neighborhood greenways, non-arterial paving, and/or multi-modal corridor development and to Parks for GSI integration into major renovations, new park development, or conversion of existing conventional landscape features (planting beds) to GSI features, particularly adjacent to park drives and parking areas.

Notes and Risks

$0.50/gallon is the average cost of designing/constructing roadside bioretention as part of an urban right-of-way retrofit when additional infrastructure costs (such as sidewalks, curb ramps, and driveway cuts) are not included in project costs. While bioretention is a cost-effective GSI best practice, it is not practical/feasible in all contexts. Other tools can and should be considered and included. SPU maintains most City-installed GSI in the public right-of-way, with the exception of street trees and permeable sidewalks. Additional ROW projects would require incrementally higher operations budget within SPU, approximately $0.01/gal managed, annually.

Leverage External Funding for Strategic Investment

Develop and regularly update a prioritized list of upcoming capital development projects that present the most promising GSI retrofit opportunities and use this list to leverage available external funding from sources such as WA Department of Ecology, the U.S. EPA, and private foundations.

Remove Implementation Barriers

Continue working systematically to remove implementation barriers related to planning, design, construction, and maintenance of GSI in the right-of-way, on other public land, and on parcels. This includes ensuring sufficient maintenance budget for street trees and permeable pavement sidewalks and disseminating clear guidance about partnering opportunities and dedicated budget available for public-private partnerships.

Notes and Risks

External grant programs at a scale suitable for capital infrastructure investment are not available every year and there may be other pressing stormwater management needs for any given funding source. Required grant timelines may be incompatible with project design, construction and community engagement protocols and best practices.

Dedicated staffing is required for proposal development, project management, and reporting. Local match is typically required for state, federal and foundation grants.

Utility-Led Retrofit Projects

Ballard Roadside Bioretention

These capital improvement projects are developed and funded by local drainage and/or wastewater utilities to proactively address high priority stormwater management challenges, including combined sewer overflows, creek protection, and drainage system capacity issues. These projects most typically retrofit the public right-of-way to manage polluted stormwater runoff from the road system. Projects are designed to improve water quality, prevent sewer overflows or back-ups, and prevent damage to creeks. These projects are also designed for neighborhood co-benefits such as traffic calming, tree canopy recovery, improved streetscape aesthetics, and climate resilience.

There are two main approaches for accelerating implementation for this project type: increased efficiency and increased investment.

Increased Efficiency via Integrated Infrastructure

When feasible for achieving stormwater management goals, prioritizing Utility-led capital GSI investments that can be integrated into concurrent transportation, parks, waterfront, City sites, or privately funded infrastructure investments in the public right-of-way, such that the Utility funds the addition of GSI elements only, reduces the cost per gallon managed and results in more complete overall projects. For this reason, SPU's planned investments in creek watersheds focus on partnerships with other capital programs and community-based planning efforts.

This approach may mean expanding non-stormwater-driven capital project scope(s) to include a GSI retrofit to manage adjacent impervious areas up to the stormwater performance target appropriate for the location, and beyond what is required for Stormwater Code compliance.

Increased Investment

Increased investment for this project type can be considered in the next Strategic Business Plan process for Seattle Public Utilities (2020-2025). The highest priority areas for increased investment are those with constrained pipe capacity and/or creek watersheds where the Natural Drainage System Partnering program is currently planned and is funded to complete only a small percentage of potentially feasible projects.

Notes and Risks

$0.50/gallon is the average cost of designing/constructing roadside bioretention as part of an urban right-of-way retrofit when additional infrastructure benefits (such as sidewalks, curb ramps, driveway cuts, and basic stormwater conveyance) are not included in the GSI retrofit project costs. When these costs (and additional benefits) are included, the cost per gallon/managed is approximately $1.30.

Utility funds must be focused within Tier I GSI priority areas through 2020. (See Figure 22, page 26).

UTILITY INCENTIVES

There are currently three Utility-funded incentives to implement capital GSI retrofits:
1) In high priority areas, RainWise rebates are available to install a raingarden or stormwater cistern to manage runoff from a building roof or from paved walks and driveway on-site. RainWise offers a rebate of $2.35 for every sq. ft. of impervious surface managed.

2) Green Grants of up to $50,000 offered by King County WTD are available to for community-based projects in the Duwamish Watershed and can be used to develop GSI retrofit projects.

3) Seattle Public Utilities has budgeted $3M over the next six-year budget cycle to develop high-value public-private GSI partnerships in uncontrolled CSO basins. (The NDS Partnering Program will develop partnerships in creek watersheds.) Funds are available to partner on large-scale development projects (public or private) to deliver GSI benefits beyond what is required by Stormwater Code. (See eligible areas in Figure 22, Page 26).

There are three approaches for accelerating implementation in this sector: increased efficiency, increased investment in existing rebates or grants programs, and increased investment in large-scale public/private partnerships.

Increased Investment in RainWise

An increased RainWise investment of $1M per year for five years (at the current cost/gallon of $0.45) would yield an additional 11.36M gallons managed by 2020, assuming full participation.

Increased Investment in Public/Private Partnerships

SPU's current investment in direct funding partnerships is expected to deliver 5.7M gallons managed over the six -year period of 2015-2020. This investment could be expanded beginning in 2021.

Increased Efficiency

The current cost/gallon managed via the RainWise rebate program is approximately $0.45, or 2.3 gallons managed per dollar invested. Options for decreasing the cost per gallon were evaluated. However, this would likely shift costs to the property owner and decrease overall participation rates, particularly among low-income property owners. For this reason, the approach is not recommended.

Notes and Risks

RainWise customer surveys show up-front capital outlay as a barrier to participation in the program, particularly among low-income residents. Without addressing this barrier, increased capital budget may not yield proportional increases in participation. Addressing this barrier is a priority for the program in 2015-16. An Advanced Loan Fund, structured to bridge up-front capital costs until the project is constructed and approved and a rebate can be issued, is one approach for addressing this issue. The Advanced Loan Fund is being piloted in 2015-2016.

RainWise Raingarden Installation

Required by Stormwater Code

Roadside Bioretention near Ravenna Park

These projects are required when public or private land is redeveloped. Project requirements are defined by Municipal Stormwater Code and differ by project type and scale. Projects are developed and funded by the developer, which may be a private entity or a public agency. Roughly 1% of Seattle's land is redeveloped every year, according to Seattle's Department of Planning and Development.

There are three main approaches for accelerating implementation in this sector: 1) Revising Stormwater Code to require GSI on a wider range of development projects 2) Refining alternative compliance mechanisms to ensure GSI implementation when the GSI implementation is infeasible at the precise location of the development project 3) Tracking, assessing, and applying lessons learned from other cities and from other sectors, as applicable.

Refine and Test Voluntary Contribution Mechanisms

Alternative approaches to Stormwater Code compliance are already permitted in Seattle; however, these can be complex and do not necessarily result in additional GSI implementation.

A focused pilot study between Seattle Public Utilities and Seattle Department of Transportation is recommended to test and refine one type of alternative code compliance -- voluntary contribution -- as a GSI acceleration strategy. Results of the pilot can be reassessed in 2018 and 2020 to quantify gallons managed achieved via voluntary contribution and to assess the viability of expanding a refined approach to private sector development projects.

Revise Stormwater Code

Revisions to Stormwater Code are expected to result in approximately a 15% increase in GSI implementation. Table 13 on page 27 summarizes the planned changes that will drive this projected increase.

Apply Lessons Learned from Energy Efficiency Sector

The challenge of accelerating energy efficiency retrofits in aging building stock is similar to the challenge of addressing legacy stormwater pollution resulting from historically unmitigated impervious surface. For this reason, there may be useful lessons learned and potential policy models in the energy efficiency retrofits sector with viable application in the stormwater retrofit sector. Several different energy efficiency upgrade policy tools are being tested in cities across the U.S. (as well as here in Seattle) to spur, and in some cases, require, energy efficiency retrofits. The Office of Sustainability and Environment is researching the relevance and transferability of these models from an energy efficiency context to a stormwater management context.

Tracking Progress

Progress toward the target will be tracked across relevant departments and reported biannually. The first reporting cycle will include three years of data (2013-2015). Subsequent reporting cycles will include two years of data. The first progress report will be published in late spring/early summer, 2016.

Table 15 summarizes the City of Seattle's two-year work plan (2015-2016), a set of next-step actions to advance the directives of the GSI Executive Order and City Council Resolution and make progress toward acheiving the the 2020 interim target.

Table 15. Two-Year City of Seattle Work Plan, 2015-2016

	Directive from Resolution or Executive Order	2015-16 Actions/Tactics *italics = tentative due to lack of funding*	Expected impact on gallons managed	Lead Dept(s).
A	Encourage and facilitate the implementation of GSI on private land, where appropriate. (For implementation related to Code compliance, see Section N below)	Evaluate expansion of the RainWise program to include creek basins and new eligible technologies	Direct;	SPU
		Evaluate and pursue targeted RainWise outreach to large land holders (large roofs) such as schools, churches and mosques	Direct	SPU
		Continue implementation of RainWise in eligible combined sewer basins	Direct	SPU
		Evaluate and remove barriers to RainWise participation and improve access to program by: developing an advance loan fund and continuously improving inclusive outreach approaches	Direct	SPU
		(Re)charter and staff the Green Infrastructure Partnership (GrIP), a voluntary consortium of agencies, non-profit organizations, community-based organizations, and interested residents that promotes and supports voluntary GSI implementation in Seattle	Indirect	SPU (with King County WTD)
B	Encourage leveraging of City GSI dollars with outside funding, when appropriate	Develop outreach materials to assist external project partners and funders assess which project types would be most successful and valuable in which locations ("Right Place, Right Project") and to clarify partnership opportunities	Indirect	SPU (with SDOT & DPD)
		Complete "Voluntary Rain Gardens in the Right-of-Way" client assistance memo	Indirect	SPU & SDOT
		Participate in WA Department of Ecology's Low Impact Development Training (LID)	Indirect	SPU

SPU = Seattle Public Utilities

OSE = Office of Sustainabiltiy and Environment

DPD = Department of Planning and Development

SDOT = Seattle Department of Transportation

Parks = Seattle Department of Parks and Recreation

DON = Department of Neighborhoods

WTD = King County Wastewater Treatment Division

Fire = Seattle Fire Department

Waterfront Office = Seattle Office of the Waterfront

Tactic advances Utility-led projects/programs

Tactic advances non-Utility-led projects/programs

Tactic removes barriers to facilitate either/both

TWO-YEAR CITY OF SEATTLE WORK PLAN

Tactic advances Utility-led projects/programs

Tactic advances non-Utility-led projects/programs

Tactic removes barriers to facilitate either/both

Two-Year City of Seattle Work Plan, 2015-2016 (Continued)

	Directive from Resolution or Executive Order	2015-16 Actions/Tactics *italics = tentative due to lack of funding*	Expected impact on gallons managed	Lead Dept(s).
B	Encourage leveraging of City GSI dollars with outside funding, when appropriate (con.)	Prioritize integrated infrastructure opportunities to implment GSI and use prioritized list to compete for relevant funding	Direct	OSE
C	Explore novel and innovative funding, financing, and partnership opportunities	Evaluate the potential for a refined voluntary contribution program focused on stormwater code compliance on SDOT projects in creek watersheds and/or additional approaches to alternative compliance	Direct	SPU (with SDOT)
D	Provide opportunities for civic engagement on public GSI projects	Continue implementing current informed consent model and process as outlined in GSI Manuals; Continue coordinated community outreach between SPU and SDOT on Neighborhood Greenways in Ballard and Delridge (no new action steps) and low cost sidewalks alignment with NDS Partnering (new)	Indirect	SPU and SDOT
E	Identify economic development and job opportunities created by increased implementation of GSI	Quantify the total scope of SPU-WTD investments for maintenance contracts when next six-year CIP cycle is built-out (Current contract is with Seattle Conservation Corps)	Indirect	SPU (with King County WTD)
		Track small business and WMBE participation in RainWise	Indirect	SPU
F	Integrate GSI into other appropriate infrastructure investments in order to maximize GSI's community benefits	Continue coordination via Integrated Infrastructure Inter-departmental Team	Indirect	DPD
		Evaluate GSI for all large-scale SPU projects	Direct	SPU
		Integrate street tree planting into all right-of-way projects to the maximum extent feasible	Direct	SDOT

Two-Year City of Seattle Work Plan, 2015-2016 (Continued)

	Directive from Resolution or Executive Order	2015-16 Actions/Tactics *italics = tentative due to lack of funding*	Expected impact on gallons managed	Lead Dept(s).
G	Integrate GSI into other appropriate infrastructure investments in order to maximize GSI's community benefits [continued]	*Remove unnecessary impervious surface to the maximum extent feasible in SDOT capital projects that are subject to Complete Streets review (This strategy requires landscape maintenance funding for long term success)*	Direct	SDOT
		Implement GSI integration opportunities identified via the Complete Street review process (This strategy requires design and construction funding)	Direct	SDOT
		Prioritize GSI features when selecting traffic calming treatments in the right-of-way (Features must be larger than 500 sq. ft. in order to be maintained as an asset by SPU)	Direct	SDOT
		Coordinate paving and right-of-way capital program priorities with Natural Drainage System Partnering program on residential streets in creek watersheds	Direct	SPU & SDOT
		Identify opportunities to integrate GSI to the maximum extent feasible into Levy-funded parks and/or park development on land-banked sites	Direct	Parks
		Integrate GSI into Central Waterfront design to the maximum extent feasible, with a focus on treating polluted runoff from the new roadway and achieving cohesive urban design	Direct	Waterfront Office
H	Articulate design guidance for the use of GSI within areas restricted from parking, including near fire hydrants and within 30 feet of stop signs	Completed in 2013. No new action steps.	Indirect	SPU & SDOT

Tactic advances Utility-led projects/programs

Tactic advances non-Utility-led projects/programs

Tactic removes barriers to facilitate either/both

TWO-YEAR CITY OF SEATTLE WORK PLAN

Tactic advances Utility-led projects/programs

Tactic advances non-Utility-led projects/programs

Tactic removes barriers to facilitate either/both

Two-Year City of Seattle Work Plan, 2015-2016 (Continued)

	Directive from Resolution or Executive Order	2015-16 Actions/Tactics *italics = tentative*	Expected impact on gallons managed	Lead Dept(s).
I	Develop package of standard design concepts for GSI installations in the public right-of-way	Develop siting and design guidance for permeable paving in the ROW	Indirect; regulatory requirement	SPU & SDOT
		Continue to develop concept plans and details for GSI best practices in the ROW for highest priority contexts such as curbless neighborhood streets and other new street types defined in the Right-of-Way Improvement Manual update	Indirect	SPU & SDOT
		Develop/disseminate siting and design guidance for optimizing trees and GSI in the public ROW, and integrate into the Right-of-Way Improvement Manual update	Indirect	SPU with SDOT & OSE
		Evaluate need for Parks-specific GSI design standards by reviewing SPU-King County Wastewater Treatment Division Design Manual	Indirect	Parks
J	Collaborate on Neighborhood Greenways development and other integrated streetscape efforts such as Complete Streets	Coordinate NDS Partnering program development with SDOT modal plans (Ped/Bike Master Plan); Neighborhood Greenways: Safe Routes to School; Complete Streets; Multi-Modal corridor development; etc.	Indirect	SDOT & SPU
K	Develop an option for SPU's integrated municipal stormwater and wastewater planning effort ("Integrated Plan") that integrates pedestrian goals and stormwater goals within urban creek watersheds	Completed in 2014. No new action steps. Natural Drainage Systems Partnership Program was developed for the Integrated Plan and later approved for inclusion in Seattle's Plan to Protect Our Waterways	Direct	SPU
L	Develop viable strategies to ensure on-going GSI maintenance	Update Operations and Maintenance Memorandum of Understanding between SPU and SDOT for GSI in the right-of-way	Indirect	SPU & SDOT
		Develop updated maintenance chapter for GSI Manual (for capital improvement projects in the right-of-way)	Indirect	SPU
		As needed, evaluate strategies to improve efficiency while preserving quality for landscape maintenance of GSI assets in the ROW (external guidance materials, new contracting options)	Indirect	SPU

Two-Year City of Seattle Work Plan, 2015-2016 (Continued)

	Directive from Resolution or Executive Order	2015-16 Actions/Tactics *italics = tentative*	Expected impact on gallons managed	Lead Dept(s).
M	Develop viable strategies to ensure on-going GSI maintenance [continued]	Evaluate and scope the potential consolidation of Adopt-a-storm drain, Adopt-a-traffic circle, street tree stewardship program, and Shoreline Street Ends stewardship into one menu-based, voluntary streetscape stewardship program (drawing from Green Seattle Partnership and Portland, Oregon Green Streets Program models).	Indirect	OSE
		Develop internal mechanisms (monitoring and management plans) for defining/including GSI assets in Parks operations and maintenance systems	Indirect	Parks
N	Examine and revise development-related codes, rules and standards to prioritize the use of GSI wherever feasible	Review, revise, and make effective changes to Stormwater Code, Standard Plans and Specifications, Park Design Standards, Right-of-Way Improvement Manual, Land Use Code and other development-related Codes, per the Low Impact Development integration requirement in the City's MS4 Stormwater Permit	Indirect	OSE with SPU, SDOT, DPD, Parks, Fire
		Add clarfying details and design guidance to the Right-of-Way Improvement Manual and Standards Plans and Specifications	Indirect	SPU & SDOT
		Update Client Assistance Memos/TIPS related to on-site stormwater management requirements of 2016 Stormwater Code	Indirect	DPD with SPU
O	Remove administrative/policy barriers to GSI implementation	Develop third-party inspection protocol to help ensure SPU receives quality assets that are installed per plan	Indirect	SPU
P	Study (and report on) the public and private benefits and economic value of built GSI, beyond its water quality benefits	Further refine assessment of climate resilience/ system capacity value of distributed GSI and/ or soil sequestration value of compost use in bioretention and Code-required soil amendment	Indirect	SPU
Q	Demonstrate and assess the feasibility of 'zero stormwater impact' GSI designs in residential, commercial, and right-of-way sites	University of Washington has produced a summary of Bullitt building design (commercial scale); Identify and develop similar case studies for right-of-way and single family residential.	Indirect	OSE

Tactic advances Utility-led projects/programs

Tactic advances non-Utility-led projects/programs

Tactic removes barriers to facilitate either/both

Two-Year City of Seattle Work Plan

Tactic advances Utility-led projects/programs

Tactic advances non-Utility-led projects/programs

Tactic removes barriers to facilitate either/both

Recommended Two-Year City Work Plan (Continued)

	Directive from Resolution or Executive Order	2015-16 Actions/Tactics *italics = tentative*	Expected impact on gallons managed	Lead Dept(s).
R	Evaluate the efficacy of next-generation best management practices for green stormwater infrastructure that could aid Seattle in reaching the 2025 target	*Conduct an analysis of excess or derelict impervious surface showing potential for a Depave pilot program (public and/or private land) and evaluate cost-benefit of a pilot campaign/program*	Indirect	OSE
S	Identify unique and promising near-term City capital projects that would provide an opportunity for Seattle to demonstrate leadership on GSI above and beyond what is triggered by development projects that are subject to the Stormwater Code	Utilize GSI to extent feasible for water quality treatment to manage polluted runoff from the new Alaskan Way in the Central Waterfront design; Optimize tree canopy recovery and water quality treatment in the right-of-way	Direct	Waterfront Office with SDOT and SPU
T	Estimate how many gallons each department and their six-year capital improvement programs will contribute toward the 2025 target, including associated costs	See Table 11 of this document for 2015-2020 planned investments by City capital departments Report biannually on progress toward the 2025 implementation target. First reporting cycle: 2013-2015 reported in mid- 2016. Two-year cycles thereafter: 2016-17 reported in mid -2018 and so on	Indirect	OSE with SPU, DPD, SDOT, Parks
u	Establish viable structures for on-going tracking and reporting of progress	Require biannual reporting from relevant capital departments (SPU, SDOT, Parks) and from Stormwater Code (DPD) and develop tracking systems to support reporting Develop web-based GIS data systems so that map-based reporting can be shared with the community; Share progress with the public via www.700milliongallons.org website.	Indirect	OSE with SPU, DPD, SDOT, Parks

Toward a Vision for Sustainable Growth

As Seattle grows in population and confronts the uncertainties of climate change, we face new challenges as a community. We are called to grow in a way that maintains affordabilty and quality of life for current residents and future generations. We are called to grow in a way that ensures racial equity and guarantees all people benefit from our shared prosperity. And we are called to grow in a way that helps our city come into balance with the ecological systems that are the bedrock of our health and our identity.

While these challenges place new demands on our basic infrastructure, they also create new opportunities for innovation. Green stormwater infrastructure is one such innovation, delivering multiple layers of value with each investment. It is a critical component of our city's vision of sustainable growth.

A Platform for Partnership

Seattle has a long history of establishing its vision of sustainability and then working collaboratively to achieve that vision. As a community, we are striving to protect and enhance our urban forest, to implement a zero waste strategy, and to achieve climate neutrality by the year 2050. We are also implementing a first-of-its-kind environmental equity assessment and developing ground-breaking policy to advance energy efficiency and housing affordability. As is true with these precedent-setting efforts, we will not achieve our GSI implementation goal solely with the efforts of City government. The target and five-year Strategy are, instead, a platform for partnership and an invitation to collaborate.

Accountability and Adaptive Management

Tracking our progress regularly allows us to adapt our approach and retool our action steps as needed. Biannual progress reporting is included in the City's work plan to ensure we can adaptively manage this work and adjust our approaches as necessary.

A: RESOLUTION 31459 AND GSI EXECUTIVE ORDER

Resolution Number: 31459

A RESOLUTION establishing a City policy that green stormwater infrastructure is a critical aspect of a sustainable drainage system and adopting a 2025 goal for green stormwater infrastructure implementation in Seattle.

Status: Adopted
Date adopted by Full Council: July 22, 2013
Vote: 9-0

Date introduced/referred to committee: June 24, 2013
Committee: Libraries, Utilities, and Center
Sponsor: GODDEN; O'BRIEN
Committee Recommendation: Adopt as Amended
Date of Committee Recommendation: July 16, 2013
Committee Vote: 6 (Godden, O'Brien, Bagshaw, Burgess, Clark, Conlin) - 0

Electronic Copy: PDF scan of Resolution No. 31459

Resolution Text

CITY OF SEATTLE

A RESOLUTION establishing a City policy that green stormwater infrastructure is a critical aspect of a sustainable drainage system and adopting a 2025 goal for green stormwater infrastructure implementation in Seattle.

WHEREAS, for the purposes of this legislation, green stormwater infrastructure (GSI) is synonymous with "natural drainage solutions" and is defined as the set of distributed stormwater best management practices that mimic natural hydrological function by slowing and/or reducing stormwater volume close to where it falls as rain; and

WHEREAS, GSI best management practices include but are not limited to tree planting and preservation, green/vegetated roofs, permeable pavement, stormwater cisterns, rainwater harvesting and reuse, raingardens, and bioretention cells; and

WHEREAS, GSI is a proven approach for achieving water quality, stormwater control, flooding prevention, and creek protection goals; and

WHEREAS, GSI reduces the strain on the City's sewer system and stormwater system and preserves system capacity, which will be important in managing Seattle's growth and the potential precipitation impacts from climate change; and

WHEREAS, the Green Ribbon Commission, charged with developing climate action recommendations for inclusion in

the next version of Seattle's Climate Action Plan, has identified enhancing the resilience of Seattle's drainage system as a critical climate adaptation measure and has recommended (as a quick start action) the adoption of a green stormwater infrastructure policy that affirms GSI as the preferred stormwater management tool and articulates pathways for multi-agency implementation; and

WHEREAS, Seattle's Urban Forest Stewardship Plan highlights the stormwater benefits of urban trees and forested park lands among the many social, ecological and economic benefits of Seattle's urban forest; and

WHEREAS, GSI projects should closely coordinate with urban forest recovery efforts to strategically prioritize and sequence tree planting efforts; and

WHEREAS, the prioritized use of locally generated compost in GSI projects supports the City's solid waste management goals; and

WHEREAS, GSI can provide additional community benefits, such as increased tree canopy, improved pedestrian safety, new small business opportunities, improvement to streetscapes or bikeways that provide appreciable economic and aesthetic value, and climate mitigation and adaptation value; and

WHEREAS, certain GSI practices have been integrated into Seattle's Green Factor landscape standards and GSI is being considered as a potential component of Neighborhood Greenway development and other right-of-way improvement efforts; and

WHEREAS, GSI provides opportunities to leverage public investment and promote public education via collaborative partnerships with the private sector; and

WHEREAS, Seattle has been a national leader in the development and delivery of high-performing GSI projects and programs for more than a decade; and

WHEREAS, the City will be obligated to require and use low impact development best management practices in accordance with its 2013 National Pollutant Discharge Elimination System municipal stormwater permit, and the City's Stormwater Code requires the use of certain GSI practices to the "maximum extent feasible"; and

WHEREAS, green infrastructure is encouraged in the pending Combined Sewer Overflow Consent Decree between the City of Seattle and the U.S. Department of Justice in the form the Seattle City Council authorized by Council Bill 117481 (2012); and

WHEREAS, a community-wide GSI goal and coordinated approach to implementation will help ensure that GSI is implemented to the maximum extent feasible and designed to improve both water quality and community livability; NOW THEREFORE,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF SEATTLE, THE MAYOR CONCURRING, THAT:

Section 1. The City of Seattle recognizes green stormwater infrastructure (GSI) as a critical aspect of a sustainable drainage system and an essential aspect of a livable community and adopts a policy to: a) rely on GSI for stormwater management wherever technically feasible and aligned with urban development priorities; and b) integrate GSI into other appropriate infrastructure investments in order to maximize GSI's community benefits; and c) encourage and facilitate the implementation of GSI on private land, where appropriate; and d) when appropriate, encourage leveraging of City GSI dollars with outside funding; and e) explore novel and innovative funding, financing and partnership opportunities to support GSI implementation efforts; and f) provide opportunities for civic engagement for public GSI projects.

Section 2. The City adopts the following GSI implementation goal: Seattle will strive to manage 700 million gallons of stormwater

A: RESOLUTION 31459 AND GSI EXECUTIVE ORDER

annually with GSI methods by 2025, to be achieved via a combination of publicly and privately owned and maintained facilities.

Section 3. The Office of Sustainability and Environment (OSE) will work under Executive Order 2013-01 to coordinate an interdepartmental effort to develop and deliver a "2025 GSI Implementation Strategy" by June 30, 2014. Seattle Public Utilities (SPU), Seattle Department of Transportation (SDOT), Department of Planning and Development (DPD), Seattle City Light (SCL), and Department of Parks and Recreation (Parks) will collaborate with OSE to develop and implement the strategy. In support of that strategy, OSE will work with affected City departments to:

* Balance the demands of increasing density with community livability, mobility, stormwater management, and other landscape functions in the public right-of-way (ROW) as well as on non-ROW public and private land.

* Identify and pursue leadership opportunities for the citywide integration of GSI and explore strategies to accelerate GSI implementation.

* Identify economic development and job opportunities created by increased implementation of GSI and promote GSI construction methods that meet the policy goals of the City's Sustainable Purchasing Policy.

* Estimate how many gallons each department and their six-year capital improvement programs will contribute toward the goal including associated costs.

Adopted by the City Council the _____ day of _____, 2013, and signed by me in open session in authentication of its adoption this_____ day

of _____, 2013.

_____

President _____of the City Council

THE MAYOR CONCURRING:

_____

Michael McGinn, Mayor

Filed by me this _____ day of _____, 2013.

_____

Monica Martinez Simmons, City Clerk

(Seal)

Pam Emerson OSE Green Stormwater Infrastructure Goal RES July 15, 2013 Version #16

Executive Order

Clerk File Number: 312840

Executive Order No. 2013-01: Citywide Green Stormwater Infrastructure Goal & Implementation Strategy

Status: Filed
Date adopted by Full Council:
Vote:

Date introduced/referred to committee: March 6, 2013
Committee:
Sponsor:
Committee Recommendation:
Date of Committee Recommendation:
Committee Vote:

Electronic Copy: PDF scan of CF 312840
Location Note: Filed in Seattle Municipal Archives Series

Executive Order Text

Executive Order: 2013-01 Citywide Green Stormwater Infrastructure Goal & Implementation Strategy

An Executive Order directing City departments to coordinate to develop an implementation strategy for managing 700 million gallons of stormwater annually with green stormwater infrastructure approaches by 2025.

Green stormwater infrastructure (GSI) as a critical aspect of a sustainable drainage system, because it is a proven water quality and flood prevention strategy and also because it provides additional community benefits and public value, including green space, urban tree canopy recovery, climate change mitigation and adaptation, and increased pedestrian and bicycle safety.

Seattle, more than a decade ago, was the first city in the nation to implement a successful GSI project in the public right-of-way, the SEAStreets project. Since the SEA-Streets, Seattle has continued to innovate and lead the nation in the development and delivery of highperforming GSI projects and programs including: the Broadview and Pinehurst Green Grids, the Highpoint redevelopment effort, the Rainwise Program, Swale on Yale, and Seattle Green Factor.

While Seattle has made excellent progress over the last decade with GSI, there is currently no citywide GSI goal or implementation strategy. Both will be required to take the City's efforts to the next level, and to help Seattle continue to lead and innovate in the rapidly evolving field of urban green infrastructure

A: Resolution 31459 and GSI Executive Order

Therefore, I am issuing this executive order to establish a citywide GSI goal of 700 million gallons of stormwater managed annually with GSI by 2025, and to direct the Office of Sustainability and Environment (OSE) to lead a process with City departments to develop a GSI Implementation Plan by June 30, 2014 that outlines a coordinated approach for achieving the GSI goal.

As part of the process to develop the GSI Implementation Plan, I also direct the following:

1) Seattle Public Utilities (SPU), Seattle Department of Transportation (SDOT), and Department of Planning Development (DPD) to collaborate with OSE to establish a coordinated approach for the integration of GSI in the public right-of-way, including:

* Collaborating on Neighborhood Greenways definition, siting criteria, design standards and coordinating on other integrated streetscape efforts such as Complete Streets and Green Streets designation.

* Articulating design standards for the use of GSI within areas restricted from parking, including near fire hydrants and within 30 feet of stop signs.

* Developing a package of standard designs for GSI installations in the public right-of-way that addresses a range of neighborhood streetscape aesthetics, object markers and other signage requirements, design options for narrow rights-of-way, safety, maintenance, tree canopy recovery goals, and regulatory requirements.

* Engaging residents in making right-of-way prioritization decisions in light of broad community goals for creating livable, walkable, green neighborhoods.

* Developing viable strategies for long-term publicprivate partnerships to ensure on-going GSI maintenance, particularly for voluntary projects (non code-triggered, non-Capital Improvement Project)

* Developing an option for SPU's integrated municipal stormwater and wastewater planning effort ("Integrated Plan") that integrates pedestrian goals and stormwater goals within urban creek watersheds.

2) Seattle Public Utilities (SPU), Seattle Department of Transportation (SDOT), Department of Planning and Development (DPD), Department of Parks and Recreation (Parks), Seattle City Light (SCL), and Department of Finance and Administrative Services (FAS) to collaborate with OSE to develop a coordinated approach for integration of GSI citywide, including:

* Examining and revising their development-related codes, rules and standards to prioritize the use of GSI where technically feasible and aligned with urban development priorities and to remove barriers that may exist.

* Demonstrating continued City leadership by ensuring capital projects implement GSI to the maximum extent that is technically feasible and aligned with development priorities

* Conducting an economic valuation study of Seattle's built green stormwater infrastructure that considers public and private benefits beyond water quality benefits.

3) OSE to work with appropriate City departments to investigate on-going GSI leadership opportunities, including:

* Identifying and promoting living-wage job opportunities created by increased implementation of GSI.

* Demonstrating the feasibility of 'zero stormwater impact' GSI designs in residential, commercial, and right-of-way settings.

* Evaluating the efficacy of next-generation best management practices for green stormwater infrastructure that would aid Seattle in reaching the 2025 target.

* Identifying unique and promising near-term City capital projects that would provide an opportunity for Seattle to demonstrate leadership on GSI above and beyond what is triggered by development projects that are subject to the Stormwater Code.

4) Department Directors named in this Order to assign staff to participate in the coordinated development of the GSI Implementation Plan and to participate in executive-level, interdepartmental decision-making on GSI strategies and implementation, including:

* Identifying best management practices for the planning, siting, design, construction, maintenance, and tracking of green stormwater infrastructure facilities.

* Resolving administrative and code-related barriers to green stormwater infrastructure implementation.

* Advancing GSI implementation through updates to development-related codes, rules, and standards.

Dated this _____ day of March,2013.

_____

Michael McGinn

Mayor, City of Seattle

B: GALLONS MANAGED CALCULATIONS

Notes

(1) SPU installed facilities are assumed to be typical NDS systems designed to infiltrate 95% runoff. The sizing factor used is 4.6% based on the majority of City retrofit project conditions with design infiltration rates between 0.5 and 0.9in/hr., and ponding depths between 9 and 12 inches.

For facilities installed by private entities or other agencies, the data based provide by the City already included impervious area managed for all installations except those in the right-of-way. For right-of-way installations, a sizing factor of 9.3% is used because the projects were predominantly bioretention cells with two inches of ponding and 0.25inch/hr. infiltration rates, designed to infiltrate 91% runoff.

(2) Average of flow control credits for low slope and high slope installations.

(3) This assumes 150% run-on to the facility (i.e., run-on area is 1 and ½ times the facility area)

(4) Source: 2008, Herrera. "The Effects of Trees on Stormwater Runoff". Assumed half canopy within 10 feet of impervious and half greater than 10 feet from ground level impervious. These credits are more generous than those adopted in the City of Seattle Stormwater Manual.

(5) 2012, She. Memorandum "Seattle Green Roof Modeling Results for Emergency Operation Center and Fire Station 10". Based on the volume delayed for larger storms in Table 2B.

(6) Assuming average contributing roof size of 1,200 square feet and 25% reuse of stored volume.

(7) Assuming average contributing roof size of 1,200 square feet, one cistern, and a bioretention cell with six-inch ponding and 0.25in/hr. native soil infiltration rate. Sizing is based on temporary storage in the cistern, which is then metered into the rain garden; use of the cistern for delaying stormwater peaks allows a smaller rain garden footprint than a system without a cistern. For this table, the focus is the volume infiltrated; the calculation is representative of the total volume infiltrated by the cistern/rain garden combination.

Table 16. BMPs Managing Runoff through Volume Reduction

GSI Technology/ BMP	Flow management approach	Impervious area managed (SF)	Average annual runoff volume managed (CF)
Bioretention, infiltrating. Facilities installed by SPU (1)	Removed by infiltrating into native soils	BMP bottom area ÷ 4.6%	Impervious area managed x 2.1 x 95%
Bioretention, infiltrating. Facilities installed by others (1)	Removed by infiltrating into native soils	BMP bottom area ÷ 9.3%	Impervious area managed x 2.1 x 91%
Permeable paving surface (2)	Removed by infiltrating into native soils	BMP area x 1	Impervious area managed x 2.1 x ((100% + 55%)/2)
Permeable pavement facility	Removed by infiltrating into native soils	BMP area x 2.5 (3)	Impervious area managed x 2.1 x 91%
Trees, deciduous, newly planted or retained (4)	Removed by evaporation, evapotranspiration or infiltrating into native soils	Canopy area x 11%	Impervious area managed x 2.1
Trees, evergreen, newly planted or retained (4)	Removed by evaporation or infiltrating into native soils	Canopy area x 22.5%	Impervious area managed x 2.1
Rain water harvesting	Reused	Facility not pre-sized	Project specific, refer to project data
Biofiltration swale without underdrain	Credit for portion removed by infiltrating into native soils	Facility not pre-sized	Impervious area managed x 2.1 x 10%
Green roofs (5)	Evapotranspiration component	Green roof area x 1	Impervious area managed x 2.1 x 29%
Cisterns (6)	Reuse component	Cistern area ÷ 4.8%	Impervious area managed x 2.1 x 25%
Cistern to rain garden (7)	Removed by infiltrating into native soils	Cistern area ÷ 2.8%	Impervious area managed x 2.1 x 95%
Removing impervious surface			Impervious area removed x 2.1 x 91%

Table 17. BMPs Managing Runoff without Volume Reduction

GSI Technology/ BMP	Flow management approach	Impervious area managed (SF)	Average annual runoff volume managed (CF)
Bioretention with underdrain, non-CSO basin (8)	Water quality treatment	BMP bottom area ÷ 2.6%	Impervious area managed x 2.1 x 91%
Bioretention with underdrain, CSO basin (8)	Slowed through engineered soil media	BMP bottom area ÷ 2.6%	Impervious area managed x 2.1 x 46%
Bioretention with detention (9)	Slowed through temporary detaining within 'live storage' portion of ponding area	BMP bottom area ÷ 3.8%	Impervious area managed x 2.1 x 98%
Green roofs	Slowed through engineered soil media	Green roof area x 1	Impervious area managed x 2.1 x 55%
Cisterns on single family properties	Reused	Cistern area ÷ 4.8%	Impervious area managed x 2.1x 95%
Biofiltration swale with underdrain (10)	Credit for portion slowed through engineered soil media and credit for slowing of flow through plants	Swale bottom area ÷ 0.5%	Impervious area managed x 2.1 x 19% + 8% x AAV flowing through biofiltration

Notes

(8) Facilities assumed to have six-inch ponding depth (note High Point is predominantly bioretention with underdrain, non-CSO basin).

(9) This value is in addition to volume managed calculation in Table 1B. Sizing is per bioretention cell with detention to achieve City of Seattle peak flow control standard. Per COS stormwater manual, the facility footprint needed to achieve the target is = [[0.0382 x A] +199 assuming ponding depth = 12", infiltration rate 0.25"/hr). Calculation further simplified for simplicity; this simplification undervalues BMP and should be refined for future efforts.

(10) Biofiltration sizing factor of 0.5% is size estimated to conform to Department of Ecology criteria for biofiltration (per communication with Jason Sharpley – SPU based on modification of Swale on Yale project calculations). Flow treated through soil and drained through underdrains or infiltration into native soil is therefore estimated to be equal to the proportional sizing factor relative to an equivalent bioretention facility, i.e. 0.5%/2.6% = 19%. Modeling of the reduction in flow rate from biofiltration system with mannings n of 0.3 is approximately 8%.

History of City-led GSI Implementation

Seattle has been a pioneer in the use of green stormwater infrastructure to manage runoff from impervious surfaces for over a decade. A brief summary of Seattle's work to date follows.

Seattle Public Utilities

Seattle Public Utilities (SPU) is Seattle's water, sewer, drainage and waste utility. SPU builds, maintains and operates a complex drainage, sewer, and stormwater system comprised primarily of conventional or "gray" stormwater infrastructure like underground drainage pipelines (477 miles), storm drains (36,500) and combined sewer lines (968 miles). SPU also manages approximately 3.7 linear miles of green stormwater infrastructure systems, or natural drainage systems, within the public right-of-way. Taken together, this critical gray and green infrastructure helps prevent flooding and property damage, protects public health, and prevents pollution in our creeks, lakes, rivers, bays, and in Puget Sound.

The now well-known Street Edge Alternative (SEA Street) project was the first public right-of-way retrofit project of its kind in the U.S. when it was constructed in 2001. Since then, SPU has continued to innovate by developing a broader set of approaches to manage stormwater runoff from the public right-of-way using GSI (see "Figure 29. SPU Program History, 2000-2012") and demonstrating their effectiveness at the neighborhood scale. Utility-led capital improvement projects have focused on protecting and improving Seattle's creek systems, improving water quality in Lake Union, and preventing combined sewer overflows (CSOs) into our creeks, lakes, and Puget Sound. In 2009, Seattle updated its Stormwater Code to require GSI be used to the maximum extent feasible and in 2010, SPU also initiated the RainWise program, which provides a rebate to private property owners in high priority areas who install eligible GSI best practices on site, to manage roof runoff or runoff from impervious walkways, driveways, and patios. There have been over 350 voluntary RainWise installations since 2010.

Figure 25. SPU Program History, 2000-2012

1 *2000 // SEA Streets*
This "Street Edge Alternatives" project collected stormwater from across 2.3 acres and showed a 99 percent reduction in runoff volume. SEA Streets became an international model for natural drainage projects and was Seattle's first GSI project implemented in the public right-of-way.

2 *2003 // Carkeek Cascade*
The Cascade collects runoff from across 28 acres and has reduced runoff volume by up to 74 percent. Post-construction monitoring showed that levels of water pollutants like lead, copper, and zinc were reduced by up to 90 percent.

3 *2004 // Neighborhood Green Grids*
The Broadview and Pinehurst Green Grids demonstrated how GSI could be applied at a large scale across a neighborhood. The Pinehurst Green Grid has reduced annual runoff by 82 percent and manages 9.7 million gallons of stormwater from across 49 acres.

4 *2005-2009 // Highpoint*
Seattle built neighborhood-scale GSI into the 129-acre Highpoint Housing Redevelopment Project by partnering with SHA and the WA Department of Ecology. To achieve comparable stormwater benefit with a traditional piped street drainage system would have required a detention pond with five times the volume.

5 *2010 // RainWise*
Seattle introduced the RainWise incentive program to provide rebates to eligible property owner who cosntruct a rain garden or install a stormwater cistern on their property. Collectively, RainWise raingardens collect more than 1M gallons of stormwater annually. The program has also leveraged an 18 percent cost share.

6 *2011 // Ballard CSO Pilot*
Seattle completed its first roadside GSI project designed to reduce combined sewer overflows in 2011. Information gathered through this pilot is informing every aspect of future roadside GSI work for sewer overflow reduction.

C: GSI Implementation in Seattle 2001-2012

Seattle Department of Transportation (SDOT)

Seattle Department of Transportation (SDOT) manages approximately 13,300 acres of public right-of-way within the city of Seattle. The public right-of-way comprises roughly 25% of Seattle's total land, and much of its pollution-generating impervious surface. Providing for the mobility of people and goods is the primary use of the public right-of-way as defined by Title 15 of the Seattle Municipal Code. This includes all modes of travel (pedestrian, bicycle, bus, other forms of transit, private passenger vehicle) as well as the movement of freight around and through the city. Promoting environmental stewardship and providing accessible, high quality public spaces are SDOT core principles supported by the use of GSI in the public right-of-way.

Since 2007, Seattle Department of Transportation (SDOT) has implemented and managed an ambitious street tree planting program, and as of 2012, manages approximately 40,000 street trees. Street trees provide many social and ecological benefits, including modest per-tree stormwater management benefit and therefore represent an important tool in the GSI toolbox. Street trees manage stormwater primarily by intercepting rainwater before it ever hits the ground, and allowing it to evaporate back into the air. Evergreen trees are roughly twice as effective as deciduous trees at managing stormwater runoff though are not often used as street trees in dense urban settings.

SDOT has also installed roadside green stormwater infrastructure to manage polluted runoff from transportation-related public right-of-way projects that have triggered the 2009 Stormwater Code. The Code applies to both public and private development projects that have new or replaced impervious surfaces that trigger thresholds.

A required review of GSI opportunities is integrated into the planning phase of many SDOT projects via the "Complete Streets" checklist process. The Complete Streets approach to capital transportation improvements was codified via Ordinance 122386 in 2007. The Linden Ave. North project, completed in April 2014, is an example of a complete streets project that improved bicycle and pedestrian safety and mobility on Linden Ave. N. and also integrated bioretention swales to manage stormwater runoff from impervious portions of the right-of-way.

SDOT also manages a distributed network of landscaped areas, or "landscape complexes," in the public right-of-way as well as a system of shoreline street ends. Both of these uses of the right-of-way improve access, safety, and overall experience of the public realm, and most often also include pervious landscaped features like planting beds that bring aesthetic value and minimize unnecessary impervious surface. While these areas are not considered GSI, were they not maintained with landscaped beds they could be converted into paved surfaces that would increase stormwater runoff. Maintaining these assets properly helps avoid backsliding on the overall intent of the 2025 GSI implementation target. This necessity is similar to the imperative of stewarding Seattle's forested parklands, discussed in Section 1.3.c.

Seattle Parks and Recreation Department

Seattle Department of Parks and Recreation (Parks) manages a 6,200 acre park system, roughly 11% of the land in Seattle. Approximately 2,500 acres of this system are held as forested open space. The preservation and enhancement of these forested areas is complimentary to the goals of this Strategy because healthy forested areas manage rainwater in a way that approaches pre-development hydrological patterns, with only a small percentage of rainfall turning into surface flow, or stormwater runoff. This ecological service depends upon a vital forest ecosystem and is jeopardized by invasive species such as English ivy, English holly and Himalayan blackberry.

The City of Seattle, together with allied partners, has developed the Urban Forest Stewardship Plan (UFSP) to guide the protection, enhancement, and expansion of Seattle's urban forest. Formally adopted by Seattle City Council in 2013, the UFSP specifies canopy recovery targets by land use type and details key action steps for achieving these targets by the year 2030. The Green Seattle Partnership focuses specifically on leveraging funding and volunteer resources to improve the health, longevity, and vitality of Seattle's forested open space by removing invasive species and restoring native understory and riparian areas.

Seattle Parks and Recreation manages stormwater runoff from new or replaced impervious surfaces (like community center roofs, paved or compacted roads and trails, tennis courts, and parking areas) by following the municipal Stormwater Code, and has also invested in voluntary GSI retrofits to use natural systems to manage runoff while taking advantage of GSI's other benefits.

Other City Facilities

In 2011, Seattle passed the Sustainable Buildings and Sites Policy via Resolution 31326 that sets specific sustainability and green building goals for City-owned properties (buildings and sites). New City buildings are also subject to Stormwater Code and Seattle Green Factor. These policies help ensure new development and substantial renovation projects led by City departments are leading by example.

Table 18. GSI Installations at City of Seattle Sites

City Building	Green Roof	Rainwater Harvesting + Reuse	Rain Garden
Fire Station 6	X	X	
Fire Station 9		X	
Fire Station 10		X	
City Hall	X	X	
City Justice Center	X		
Zoomasium (Woodland Park Zoo)	X		
Rainier Beach Community Center		X	X
Ballard Library	X		
Seattle Center (north lawn)			X
Seattle Center 5th Ave. Garage	X		

History of Community-Led Implementation

Rain garden clusters and Depaving

Non-profit organizations like Stewardship Partners (12,000 Rain Gardens campaign), Sustainable Seattle, and Sustainable Ballard have been working with interested residents and place-based groups to raise awareness of stormwater pollution and help install small-scale GSI projects since 2010. Stewardship Partners has pioneered the Rain Garden Clusters approach (neighbors helping neighbors install voluntary rain gardens on their property within a small geographic area) and has also partnered with Sustainable Seattle and King County to pursue depaving opportunities in the South Park neighborhood. Mission-driven private consulting firms, such as Urban Systems Design, are also engaged in assisting community-based organizations or groups of interested residents apply for funding to design and install roadside GSI, like the community driven project on S. Orcas St. in the Georgetown neighborhood.

Private green roofs

A 2010 study conducted by the University of Washington's Green Futures Lab tallied and characterized a total of 90 green roofs voluntarily constructed in Seattle, managing runoff from approximately 42.2 acres of impervious roof area. Because there is currently no formalized mechanism for tracking voluntary green roof installations in Seattle, this represents best available data.

Table 19. 2013-2014 Progress on Policy Directive 1

Encourage and facilitate the implementation of GSI on private land, where appropriate

SPU	OSE	DPD
The RainWise rebate program (delivered in collaboration with King County Wastewater Treatment Division in CSO basins across Seattle) facilitated the installation of approximately 135 rain gardens and stormwater cisterns on private property in 2013.	OSE and SPU collaborated with the Seattle 2030 District to guide the development of a new stormwater metric for the District. Seattle 2030 District hired their own consultant to produce a calculator tool for their members.	DPD began development on including an on-site stormwater management element in its prerequisites for expedited Green Permitting and for a potential Downtown FAR bonus program.

Table 20. 2013-2014 Progress on Policy Directive 2

Integrate GSI into other infrastructure investments to maximize community benefit

SPU + SDOT
SPU and SDOT collaborated on the joint development of the Highland Park/Delridge Neighborhood Greenway. The agencies conducted a joint community engagement process to gain input residents' desired Greenway route and desired locations and conceptual design for natural drainage systems along the route. The natural drainage systems are being designed to enhance the goals of the Greenway and to fit with the character and streetscape priorities of the neighborhood. In Ballard, siting for natural drainage systems was conducted to coincide with potential future Neighborhood Greenway routes, based on best-available information provided by SDOT and the Ballard Neighborhood Greenways community group.

Table 21. 2013-2014 Progress on Policy Directive 3

Leverage City GSI Budget with Outside Funding, when appropriate

SPU
SPU completed phase I construction for the Capital Hill Water Quality Project (also known as Swale on Yale). The project received a $1 million stormwater grant from the Washington State Department of Ecology's Stormwater Retrofit and LID Competitive Grant Program in 2011 and a $1.8 million loan from the Washington State Water Pollution Control Revolving Fund Loan Program. SPU is also actively partnering with Vulcan, Inc. to leverage technical and professional services and an additional $1.2 million to help cover design and construction costs for the project. SPU has also negotiated a multi-year, cost-sharing agreement with King County Wastewater Treatment Division to develop joint (program level) modeling, analysis, design, construction and monitoring standards/guidance for GSI built within Seattle rights-of-way and to develop and deliver a joint RainWise incentive program.

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Table 22. 2013-2014 Progress on Policy Directive 4

Provide Meaningful Opportunities for Civic Engagement on Public GSI Projects

SPU	SPU + SDOT
As part of the options analysis phase for a roadside GSI project in Ballard, engagement opportunities included: • A survey sent to all residents in the neigh-borhood to collect local knowledge about known drainage issues and gauge community understanding and acceptance of natural drainage systems/roadside GSI • Two open houses held to keep the community engaged in the process to select project blocks • A door-to-door community liaison reaching out to neighbors to gather input and feedback • A "Walk and Talk" event held to gather residents' input on proposed locations and early design concepts. SPU also formalized program-level community engagement protocols for capital projects in the public right-of-way in the "Options Analysis" and "Design" volumes of the draft GSI Manual	In the Delridge/Highland Park neighborhood of SW Seattle, SPU and SDOT collaborated on a public outreach effort to gain input on a co-located Neighborhood Greenway and natural drainage system project: • Multi-lingual "project ambassadors" reached out to neighbors door-to-door to explain the project and answer initial questions • A survey, additional door-to-door outreach and an open house were used to gather residents' input on project location/siting. A "Walk & Talk" event and additional open house were held to solicit input on proposed sites and early design concepts.

Table 23. 2013-2014 Progress on Policy Directive 5

Characterize Economic Impact Created By Increased GSI Implementation

SPU
RainWise program data from 2012 was analyzed to assess the direct economic impact of this rebate program as characterized by contractor training, contractor work completed labor spending, materials spending, and direct employment/job creation. Of the $0.8 million dollars spent in 2012, nearly 60% was spent on program participant labor (design and construction) distributed across 24 Seattle and King County-based firms. An additional 34% was spent on local materials purchases, and the remainder on program overhead. The vast majority of firms working within the program (87%) have six or fewer employees. Expenditures helped support approximately six direct jobs. These figures do not include secondary impacts associated with supplier expenditures and the circulation of personal income through the economy. SPU is not currently collecting data on how property owners are maintaining RainWise installations. It is assumed that the majority of program participants maintain their own installations, but this has not been verified. On-going operations and maintenance contracts for City-maintained GSI in the public right-of-way is another important component of GSI's potential economic impact. All drainage infrastructure incurs operations and maintenance costs, and these costs can be expressed in terms of jobs or other measures of economic activity. Component expenditures for operations and maintenance of drainage infrastructure include labor and materials in varying proportions, depending on the infrastructure type. The majority of maintenance expenditures associated with GSI are labor-oriented, whereas the majority of expenditures for some comparable conventional approaches, such as storm filters, are media/product- oriented (filters must be replaced on a regular schedule to maintain function). This difference is worth noting qualitatively and may warrant further analysis to determine its full economic impact. GSI maintenance tasks mimic general landscape maintenance tasks and can be readily learned on the job, without an advanced degree. There are low to no barriers to entry, and opportunities for advancement typically follow an entrepreneurial path. Seattle currently contracts with Seattle Conservation Corps to maintain GSI in the public right-of-way. The economic efficacy of this approach will be further analyzed and may be adjusted in 2015. In 2013, Seattle Public Utilities also commissioned a case study analyzing the economic impacts associated with capital expenditures for a GSI project in the public right-of-way, normalized against expenditures for a comparable conventional drainage infrastructure project in the public right-of-way. This analysis showed no appreciable difference in economic impact between the two approaches, with the magnitude of design, construction, and materials expenditures being directly proportional to economic output (cost of labor and materials) and overhead costs being comparable. The case study did not, however, assess differences in the "localness" of capital expenditures (design, construction, materials). To the extent that there is a substantial difference in the proportion of local firms, contractors, and suppliers used on GSI installations, the secondary economic impacts referenced above (sometimes referred to as the local "multiplier effect") would differ.

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Table 24. 2013-2014 Progress on Policy Directive 6

Develop package of standard design concepts for GSI in the right-of-way

SPU + SDOT + DPD + OSE + King County WTD
Seattle Public Utilities led the development of a multi-volume GSI Manual in 2013, working in close collaboration with King County WTD, SDOT, and DPD. The Design volume includes a set of standard block-scale design concepts and details intended to help standardize agency-led GSI right-of-way installations on single family residential streets and minor arterials in Seattle. Components of these layout and detail concepts are also currently being vetted for inclusion in SDOT's Right-of-Way Improvement Manual update. In addition, the Design volume includes guidance for the use of GSI within areas already restricted for parking (within 30' of stop signs and near fire hydrants), offers standardized plant lists and pre-vetted street tree lists appropriate for GSI projects in the right-of-way, and offers clear project-level protocols for optimizing street tree retention and planting within GSI project areas. The "Options Analysis" volume articulates strategies to ensure opportunities for multiple community benefits are considered in early project scoping for GSI installations in the right-of-way. These include consulting the Bike Master Plan, Pedestrian Master Plan, Safe Routes to School, existing neighborhood plans and open space plans, as well as considering key community destinations and/or special land uses, such as parks, schools, community centers, p-patches, churches, etc. The Options Analysis volume also provides outlines requirements for robust community engagement during early project scoping.

Table 25. 2013-2014 Progress on Policy Directive 7

Collaborate on Neighborhood Greenways and Other Integrated Streetscape Efforts Such as Complete Streets

SPU + SDOT	SDOT
SPU and SDOT conducted a joint community engagement process in 2013 to inform siting and concept development for the Delridge Neighborhood Greenway and roadside natural drainage systems project. The goals of the project are to provide a safe and inviting place for people of ages and abilities to walk and bike and to improve water quality in Longfellow Creek. In the Ballard neighborhood, project siting for natural drainage project that will help prevent sewage overflows into Salmon Bay considered proposed/future Neighborhood Greenway routes outlined in the Bike Master Plan and identified by the community to inform early project scoping.	The Complete Streets Ordinance is focused on ensuring Seattle streets are safe and appealing for all users and modes of travel. The Complete Streets checklist is frequently updated and in 2013 was updated to include these GSI-related questions/references: • Does the project fall under the 2009 Stormwater Code? If "no", explain why not. If "yes", describe any GSI elements or techniques included in this project • Describe any GSI recommendations NOT included in this project and reason for deferral • Is there opportunity to remove impervious surface as part of this project? • Are there opportunities to add tree canopy coverage and/or better protect the health of existing trees with this project? Describe any recommendations included in this project. • Describe any recommendations NOT included in this project and reason for deferral • What increase in precipitation, temperature and sea level rise has your project anticipated?

Table 26. 2013-2014 Progress on Policy Directive 8

Develop an Option for SPU's "Integrated Plan" that Integrates Pedestrian Goals with Stormwater Management Goals in Seattle's Creek Watersheds

SPU
SPU's GSI Program completed the development of this option for inclusion in the Plan to Protect Seattle's Waterways (described in Section 2.3) in 2013. The proposed program would engage community-based organizations and interested residents in Seattle's three major creek watersheds in a multi-year effort to identify and prioritize high-value natural drainage system projects to improve overall drainage level of service, improve creek water quality, and improve the overall safety, function and appeal of the public right-of-way for all users. Program development is slated for 2014 and program launch, for 2015. This major partnering opportunity is discussed further in Section 7.3.

Table 27. 2013-2014 Progress on Policy Directive 9

Develop Viable Strategies to Ensure On-going GSI Maintenance

SPU	SDOT	Parks
In the public right-of-way, SPU implements predominantly bioretention projects. SPU planners and operations staff articulated per unit maintenance costs needed to ensure continued stormwater function for City-maintained GSI in the public right-of-way and budgeted accordingly for these facilities through 2020. Annual increases proportional to projected increases in implementation were included. Voluntary RainWise installations on private property are maintained by property owners.	SDOT installs and manages two primary types of GSI requiring appropriate maintenance to maintain stormwater function and social function: street trees and permeable pavement sidewalks. SDOT estimated the increase in maintenance budget required to maintain street trees for overall tree health and longevity.	Parks conducted a basic inventory of its GSI assets and established an internal mechanism for tracking these assets in the context of overall operations and for ensuring the proper transfer of new assets to operations managers when new projects are built.

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Table 28. 2013-2014 Progress on Policy Directive 10

Examine and Revise Development-Related Code, Rules and Standards

SPU + SDOT + DPD + OSE + DON + Parks + Fire
This directive was integrated into the Low Impact Development (LID) Code Integration requirement under Seattle's Municipal Stormwater Permit. Per the requirement, inter-departmental work began in the summer of 2013 to integrate LID development principles into major Codes, rules and standards such as Land Use Code, Right-of-Way Improvement Manual, Fire Code, Stormwater Code, Parks Design Standards, and City Standard Plans. Specifically, the intent of the review and revision process is to make LID the default approach to site planning and land development by: 1) minimizing impervious surface 2) minimizing stormwater runoff 3) preserving native vegetation The revision process will be complete by June 30, 2015 and a report summarizing all changes made will be prepared by SPU in the fall of 2015.

Table 29. 2013-2014 Progress on Policy Directive 1 1

Collaborate on Neighborhood Greenways and Other Integrated Streetscape Efforts Such as Complete Streets

SPU + SDOT	SDOT
SPU and SDOT conducted a joint community engagement process in 2013 to inform siting and concept development for the Delridge Neighborhood Greenway and roadside natural drainage systems project. The goals of the project are to provide a safe and inviting place for people of ages and abilities to walk and bike and to improve water quality in Longfellow Creek. In the Ballard neighborhood, project siting for natural drainage project that will help prevent sewage overflows into Salmon Bay considered proposed/ future Neighborhood Greenway routes outlined in the Bike Master Plan and identified by the community to inform early project scoping.	The Complete Streets Ordinance is focused on ensuring Seattle streets are safe and appealing for all users and modes of travel. The Complete Streets checklist is frequently updated and in 2013 was updated to include these GSI-related questions/references: • Does the project fall under the 2009 Stormwater Code? If "no", explain why not. If "yes", describe any GSI elements or techniques included in this project • Describe any GSI recommendations NOT included in this project and reason for deferral • Is there opportunity to remove impervious surface as part of this project? • Are there opportunities to add tree canopy coverage and/ or better protect the health of existing trees with this project? Describe any recommendations included in this project. • Describe any recommendations NOT included in this project and reason for deferral • What increase in precipitation, temperature and sea level rise has your project anticipated?

Table 30. 2013-2014 Progress on Policy Directive 12
Remove Administrative Policy Barriers to GSI Implementation

SPU	SPU + SDOT
SPU solicited input from frequent Stormwater Manual users (designers/ developers) via an online survey and a face-to-face workshop to improve the usability of the Manual and remove administrative barriers to GSI implementation. Proposed changes included in the current revised draft of the Manual include: consolidating and summarizing all GSI-related requirements together on one section; providing a clear framework for documenting code compliance; and updating GSI plant lists to reflect current best practices.	SDOT and SPU collaborated on the development of a Client Assistance Memo (CAM) – also known as a "TIPS" document – describing the steps required to implement a voluntary rain garden in the public right-of-way.

Table 31. 2013-2014 Progress on Policy Directive 13
Study the Benefits and Economic Value of GSI, Beyond Water Quality Benefits

SPU
An initial study was conducted and showed that although air quality and climate change-related benefits linked to avoided pumping and treatment of runoff in combined sewer areas are the benefit categories most easily quantified, these are not representative of the full breadth of ecological and neighborhood co-benefits. Additional research is needed to define viable methods for assessing the value of benefits such as improved access to greenery and natural systems in daily life, improved safety and experience of the right-of-way for all uses, especially pedestrians, and improved terrestrial and downstream aquatic habitat (see additional discussion in Section 2.5).

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Table 32. 2013-2014 Progress on Policy Directive 14
Demonstrate/Assess the Feasibility of 'Zero Stormwater Impact' Designs

OSE
OSE worked with the University of Washington (UW) to develop a case study describing the stormwater management design approach for the Bullitt Center, the first commercial-scale Living Building Challenge building in Seattle. The Living Building Challenge includes a performance metric/ requirement that projects manage their own stormwater runoff onsite. The UW Case Study summarizes the Bullitt Center design, and highlights the connection between onsite stormwater management and water conservation via rainwater harvesting and reuse at the building site scale.

Table 34. 2013-2014 Progress on Policy Directive 15
Evaluate the Efficacy of Next-Generation Best Practices

N/A
No early actions addressed this directive

Table 33. 2013-2014 Progress on Policy Directive 16
Identify Unique and Promising Near Term Capital Projects and Leadership Opportunities

DPD + SPU + SDOT + SCL	Waterfront Office + SDOT + SPU	SPU
DPD coordinates the Integrated Infrastructure inter-departmental team whose purpose is to identify opportunities for synergy, cost-savings, and/or collaboration on major infrastructure investments planned by the Utilities and SDOT. Via this forum, SPU and OSE learned of SDOT's multi-modal corridor planning effort. SDOT is now planning to integrate GSI into the study/ design phase of this work.	Interdepartmental design team is working to integrate GSI in the Central Waterfront design. Primary elements include bioretention to improve water quality of road runoff and street tree canopy.	SPU has identified roadside GSI for creek protection as a proposed near term capital investment under its Integrated Plan.

Street Trees

One Time Capital Costs

Unit (per tree) cost to plant one street tree under Bridging the Gap program = $942/tree
(this includes three years of pruning, staking and watering – tree establishment)

1,060 street trees planted by one crew (5% evergreen, 95% deciduous): 357,985 gallons managed
1,060 trees x $942/tree = $998,500

$998,500/ 357,985 gallons managed = **$2.78/gallon managed**
for capital costs and establishment

On-going Operations and Maintenance Costs

Estimated costs to maintain street trees per year for tree health and longevity, after first three years of tree establishment (establishment costs reflected in capital costs, above):

Per tree average annual pruning/maintenance cost: $255.00*
$255 x 1060 trees = $270, 300
$270, 300/357,985 = **$.76/gallon managed**
for ongoing maintenance and operations

Full maintenance cost calculations would also include first year fixed operations costs associated with tools and fleet purchase ($700,000) amortized over the tenure of the crew's work. This cost has not been included in the above calculations.

*This per tree estimate is based on best-available data from 2012-2015 street tree operations and may be over-reported because the data set could not be normalized across all tree types and sizes.

Bioretention

One Time Capital Costs

The cost per gallon managed for roadside bioretention projects varies according to variables such as the extent of roadway improvements included, the extent of additional stormwater system function (conveyance) required, the performance target for the project and the total area draining to the facility, whether only the immediate block or additional nearby blocks. For these reasons, it is best expressed as a range.

Low End of Range: Highpoint Redevelopment **$0.16/gallon**

- Project bioretention cells manage only the water from the immediately adjacent block
- GSI project cost is the incremental cost between the development incorporating right-of-way bioretention systems to manage stormwater beyond code requirements and the development without those improvements. The cost does not include curbs or conveyance infrastructure, roadway grading, ADA compliance such as curb ramps, utility relocations, or driveway repaving/reconstruction.

High End of Range: Creek Basin Projects **$1.27/gallon**

- Sited in an area of the city with no formal stormwater conveyance system (a third of Seattle is in this category) and therefore includes infrastructure development needed to bring the level of drainage service up to standard, such as the addition of conveyance culverts at driveway crossings, additional drainage structures and piped connections.
- Typically includes roadway regrading and partial rebuilding.
- Typically includes sidewalk construction (in areas lacking sidewalks) and ADA compliance, such as curb ramps up to/down from new sidewalks.
- Cost estimate is for project cells that manage runoff only from the immediately adjacent block.

Projects that manage runoff from more than one block on a single project block are more efficient by a $/gallons managed measure. They are also typically wider, deeper and more consistently wet during the rainy season.

Ongoing Operations and Maintenance Costs

Normalized to dollars per gallon managed, the cost range for bioretention operations and maintenance is **$0.009-$0.012 per gallon managed** annually.

Expressed as a cost per area maintained, the costs break down is: $2.21/sq. ft. for the landscaped top area during establishment (first three years) and $1.69/sq. ft. thereafter. The cost per area maintained for hardscape/drainage structures is $0.31/sq. ft.

Staff and Manager Interviews

Opportunity	Potential Action
Establish a capital budget source and mechanism to facilitate interdepartmental partnerships, particularly for integrated infrastructure (leveraging) opportunities that deliver multiple benefits	Pilot test joint set-aside "partnership fund" at Director level, with contributions from SPU, SDOT, and Parks. Develop staff and/or community recommendations that feed up to Executive decision-making body
Ensure dedicated and sufficient maintenance budgets for GSI in ROW, including for street trees + landscape complexes	Fully fund SDOT Urban Forestry's maintenance budget; Fully fund SPU's GSI Program maintenance budget
Develop mechanisms to aggregate/focus investments in areas yielding highest value combination of stormwater value + community benefits	Further development alternative compliance mechanisms
Foster voluntary stewardship of GSI in the public realm in administratively feasible way, and not as substitute for public investment in operations and maintenance	Combine existing "Adopt-a-_____" programs into cohesive right-of-way voluntary stewardship program
Designate sufficient budget for GSI integration into capital projects in the ROW – particularly when opportunities are identified via the Complete Streets checklist or for Code compliance	Dedicated budget for GSI (and all Stormwater Code compliance) on SDOT capital projects; SDOT-specific funding source for GSI opportunities identified via the Complete Streets review process
Use drainage-rate funding (SPU funding) primarily for drainage and water quality-related project components (such as building bioretention facilities) and use SDOT funding for related general ROW improvements (such as sidewalks, curb ramps, etc.)	Where GSI roadside natural drainage systems program is slated to expand in creek watersheds (SPU), develop in coordination with non-arterial paving and/or pervious sidewalk programs in SDOT.
Identify GSI applications appropriate for Park settings, particularly settings where ROW runoff could be managed on Park/ROW edge without jeopardizing Parks' primary recreational mission.	Develop GSI Program within Seattle Parks Department including Parks-specific design guidance and operations and maintenance guidance; Identify "win-win" pilot projects to test guidance, educate designers and grounds crews, and solicit public input and support.

Community Listening Sessions

Opportunity	Potential Action
Capitalize on community-building potential of GSI to attract project partners and participants	Engage community-based organizations in development of GSI programs and projects and/or provide support (funding, technical assistance) for community-driven projects
Capitalize on brand value and "bragging rights" associated with innovative, sustainability-oriented projects in the private development arena	Develop mechanisms to acknowledge and recognize/publicize designers' and developers' innovative work; i.e.: web-based mapping tool describing built projects; annual award
Align City departments responsible for reviewing and permitting GSI projects around goal of successful implementation	Develop strategies for streamlining permitting process and removing administrative barriers to implementation
Develop mechanism for City to provide early consideration of a project and/or input during the "idea phase" – whether driven by a developer or a community-based organization	Make existing geotechnical information and siting guidance more accessible to the public; Designate staff office hours for this purpose.
Make GSI projects more visible to maximize public education potential of built projects	Engage designers on innovative approaches to iconic project sites like the Central Waterfront and Pike Place Market
Engage residents and business in the stewardship of built GSI, as a way of contributing to community-wide goals to protect and restore Puget Sound	Develop an organizing and support structure to catalyze long-term stewardship of GSI projects in the public realm

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