

Green Stormwater Infrastructure



Background

Definition

Stormwater is rain and snow melt that runs off surfaces such as rooftops, paved streets, highways, parking lots, and compacted landscaping such as lawns. As water runs off these surfaces, it can pick up pollutants such as oil, fertilizers, pesticides, soil, trash, and animal waste. From here, the water might flow directly into a local water body or infiltrate into an aquifer. Or, it may go into a storm drain and continue through storm pipes until it is released untreated into a local waterway or combined with sewage and taken to a wastewater treatment plant. Stormwater is of concern for two main issues: one related to the volume and timing of runoff water (flooding and erosion) and the other related to potential contaminants that the water is carrying (contamination of drinking, recreational, and fish-bearing waters). These problems can occur where there is no stormwater infrastructure, and also where there is conventional stormwater infrastructure such as storm drains. Combined sewer overflows can contribute to water quality problems when wastewater exceeds the capacity of the combined sewer overflow system, usually during storms. When this occurs, untreated wastewater discharges from combined sewer outfalls directly into water bodies, further impairing water quality.

Green stormwater infrastructure (often called low impact development), addresses the problem of runoff by using vegetation and soil to filter and cleanse rainwater where it falls. By weaving natural processes into the built environment, green infrastructure provides not only stormwater management, but also flood mitigation, groundwater recharge, stream and wetland replenishment, air quality management, green spaces, water quality management, and other benefits. There are many types of green stormwater infrastructure, including bioswales, rain gardens, planters, and green roofs. Keeping stormwater out of combined sewer overflow systems by diverting it to green infrastructure can decrease the number of overflow incidents.

Health, equity and sustainability considerations

Effective and ecologically sound stormwater management techniques reduce a community's risk for a number of public health issues, such as drinking water and seafood contamination, unsafe transportation

Stormwater management systems that utilize green infrastructure often result in lower capital costs.

and living conditions, urban heat island effect, and pollution of water bodies used for recreation. Many people in rural and suburban areas use their own private water supplies, typically shallow groundwater wells

that are not covered by the Safe Drinking Water Act and are rarely treated or monitored. These people are particularly at risk when development increases around them (more septic tanks and impervious surfaces), although new development and redevelopment is regulated by local jurisdictions.

Stormwater management can be viewed through an equity lens as part of a larger effort to ensure environmental justice, as vulnerable populations may be exposed to greater environmental risks and should be adequately protected. And while green stormwater infrastructure has clear implications for protecting health, water resources, and habitat, it can also reduce infrastructure costs by preventing erosion and flooding damage to roads and other public infrastructure. Using green stormwater infrastructure can also help beautify a neighborhood, making it more attractive for walking. Mental health, social capital, economic, and [other benefits](#) have also been associated with green infrastructure.

Polluted stormwater often finds ways into the Puget Sound [and detrimentally affects water quality and wildlife](#). The Washington State Department of Ecology and other organizations are actively working to limit the amount of polluted stormwater that enters the Sound.

According to the [Puget Sound Partnership](#), stormwater transports a mixture of pollutants such as petroleum products, heavy metals, animal waste and sediments from construction sites, roads, highways, parking lots, lawns and other developed lands, with the following results:

- Stormwater pollution has harmed virtually all urban creeks, streams and rivers in Washington state.
- Stormwater is the leading contributor to water quality pollution of urban waterways in the state.
- Two species of salmon and bull trout are threatened with extinction under the federal Endangered Species Act. Loss of habitat due to stormwater and development is one of the causes.
- Shellfish harvest at many beaches is restricted or prohibited due to pollution. Stormwater runoff is often one of the causes.
- Stormwater likely contributes to the killing of high percentages of healthy coho salmon in Seattle creeks within hours of the fish entering the creeks, before the fish are able to spawn.
- English sole are more likely to develop cancerous lesions on their livers in more urban areas. Stormwater likely plays a role.

Improving management of stormwater so that water quality, habitat and aquatic resources are protected is one of eight key objectives established in law for the [Puget Sound Partnership's 2020 Action Agenda](#).

Program and Policy Examples

Program examples—How is it used locally?

The following programs and projects have increased sustainable stormwater management through construction of projects and providing education on green stormwater infrastructure.

The city of Puyallup's [Rain Garden Program](#) has educated hundreds of citizens on stormwater pollution prevention and green infrastructure techniques. The program has helped disconnect millions of gallons of stormwater from storm and sewer systems since its start in 2009.

Bainbridge Island's [Winslow Way project](#) helped create a vibrant pedestrian downtown by introducing new green infrastructure systems including rain gardens, stormwater planters, Silva Cells™ and porous pavements.

The city of Seattle and Seattle Housing Authority's [High Point redevelopment](#) features the largest natural drainage project that the city has undertaken, and is the first time that a natural drainage strategy of this scale has been used in such a high density urban setting.

Development regulations and model ordinances

The city of Seattle's stormwater regulations work to protect people, property, and the environment from damage caused by stormwater runoff. They also satisfy the city's obligation to comply with its Municipal Stormwater Discharge National Pollutant Discharge Elimination System (NPDES) Permit, issued by the Washington State Department of Ecology (Seattle Municipal Code 22.800-22.808). There are [green stormwater management requirements](#) for new construction and significant remodels and additions.

Decision-making applications

In addition to providing multiple benefits, green stormwater infrastructure can be less expensive than conventional stormwater infrastructure for cities and developers.

Project prioritization for [Transportation 2040](#) included additional points for projects which enhanced water quality by improving hydrological functions and/or reducing stormwater runoff.

Performance evaluation/success stories

The city of Puyallup's [Rain Garden Program](#) has installed over 62 rain gardens since its start in 2009. The program offers a cost-share opportunity to residents to encourage the installation of green stormwater infrastructure at residential properties in the city of Puyallup, supporting water quality improvements. Approved participants pay for labor and equipment fees to install a rain garden or permeable pavement on their property, and the city pays for material costs and disposal fees. For approved rain barrel installations, participants can receive up to a \$75 reimbursement, not to exceed purchase price of the rain barrel. Funding for this program comes from Department of Ecology [grants](#) as well as donations from local businesses and individuals.

Implementation

Developing policy language

The Puget Sound Partnership's [Integrating Low Impact Development into Local Codes: A Guidebook for Local Governments](#) lists the following steps to help local governments ensure that local codes encourage the use of low impact development.

1. Assemble the Project Team
2. Understand General Topics to Address
3. Review Existing Codes and Standards
4. Amend Existing Codes and Develop New Codes
5. Public Review and Adoption Process
6. Ensure Successful Implementation

Opportunities for funding

There are several grant opportunities at the state and federal level. The various programs vary in mission and scope, so it is important to apply for grants that best align with your proposed project. The Washington State Department of Ecology offers [Water Quality Financial Assistance](#), and the U.S. Environmental

Protection Agency offers [Environmental Education Grants](#). City-run programs, such as the Puyallup's Rain Garden Program, have been successful securing in-kind donations and/or reduced prices, including supplies and installation labor, from local businesses.

Considerations for local implementation

Urban areas that collect stormwater runoff in municipal separate storm sewers and discharge it to surface waters are required to have a [permit](#) under the federal Clean Water Act. These permits, administered by the Washington State Department of Ecology, now require that low impact development techniques be included in stormwater management strategies. Incentives to encourage the use of low impact development are included in the Stormwater Management Manual for Western Washington. The Washington State Department of Ecology offers [grants](#) for projects to improve water quality and quantity in watersheds through retrofitting areas with green stormwater infrastructure.

In some compact urban places such as regional growth centers, alternatives to site-by-site stormwater management may be appropriate. A program called [Building Cities in the Rain](#) is providing information on this issue. This approach is supported by regulations under the federal stormwater permit program that offer a structure for considering the [water quality benefits associated with smart growth](#) techniques. The central Puget Sound region's growth management strategy is well aligned with this stormwater best management practice.

The King County [Surface Water Management](#) programs address impacts from stormwater runoff such as flooding, erosion, pollution, habitat degradation, and low stream flows. To pay for these services, a fee is assessed on property owners in unincorporated King County. Charging adequate surface water management fees are needed to allow jurisdictions to effectively manage stormwater and incentivize the construction and use of green stormwater infrastructure.

Challenges to implementation

Green stormwater infrastructure is a fairly new strategy to manage stormwater. Some stormwater professionals, regulators, and planners are still learning how to incorporate low impact development and green stormwater infrastructure into their stormwater management plans. Ecology offers [training](#) on low impact development topics.

Resources

The Puget Sound Partnership's [Stormwater & Low Impact Development Resource Page](#) (2014)

Tacoma-Pierce County Health Department's Healthy Community Planning Toolbox—Policy Intervention Tool: [Natural Environment](#) (2013)

The U.S. Environmental Protection Agency's [Green Infrastructure Resource Page](#) (2014)

The University of Washington's [Green Cities: Good Health Program](#) (2013)

The Washington State Department of Ecology's [Low Impact Development Resource Page](#) (2013)

The Washington State Department of Commerce's [Building Cities in the Rain Program](#) (2014)

The Natural Resources Defense Council's [Rooftops to Rivers Program](#) (2014)