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SciFYI
King County
Department of Natural Resources and Parks
Water and Land Resources Division
A science section digest of current environmental issues in King County
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Water Resource Inventory Area 9 Stormwater Retrofit Project

By Olivia Wright and Jim Simmonds

Stormwater from developed landscapes is one of the biggest threats to water quality and ecological health of the Puget Sound. Forecasted population growth in the region will result in the conversion of additional land for urban use, and the redevelopment of previously developed land for higher density use. The increase of impervious surfaces associated with development alters the natural hydrology, reducing infiltration and creating larger volumes of stormwater runoff that increase the risk of flooding, erode stream banks and channels, damage aquatic habitat, and increase the amount of pollutants entering a stream. Stormwater facilities, such as rain gardens or detention ponds, are implemented to mitigate the impacts by capturing stormwater runoff and providing flow control or water quality benefits through storage and infiltration. In 2010, King County received a grant from the U.S. Environmental Protection Agency to estimate the stormwater facility needs, and associated costs, necessary to rehabilitate stream flows and water quality of existing and future development within the Water Resource Inventory Area (WRIA 9) to pre-development conditions and extrapolate to the Puget Sound drainage basin.

Project Area

The WRIA 9 project area covers 278 square miles of the Green/Duwamish watershed and portions of the Central Puget Sound watershed, excluding areas upstream of the Howard Hanson Dam and the city of Seattle (**Figure 2**). Land uses range from forested, agricultural, and low density residential in the east to moderate/ high density residential and commercial/industrial lands in the west.

Project Approach and Methods

Within the project area, stream flow and water quality parameters were measured, and watershed hydrology and water quality models were developed to estimate cost-effective stormwater facilities required to improve stream flow and water quality of existing and future development in the next 30 years. Additional analyses were made on the impacts of population growth and economic activity on stormwater facility construction, the uncertainty associated with climate change impacts on stormwater facility sizing, and the presence of existing facilities. Stormwater facility cost estimates included capital costs (design, construction and land acquisition), operation and maintenance costs, and inspection and enforcement costs. Results of the WRIA 9 project area were extrapolated to the Puget Sound drainage basin.

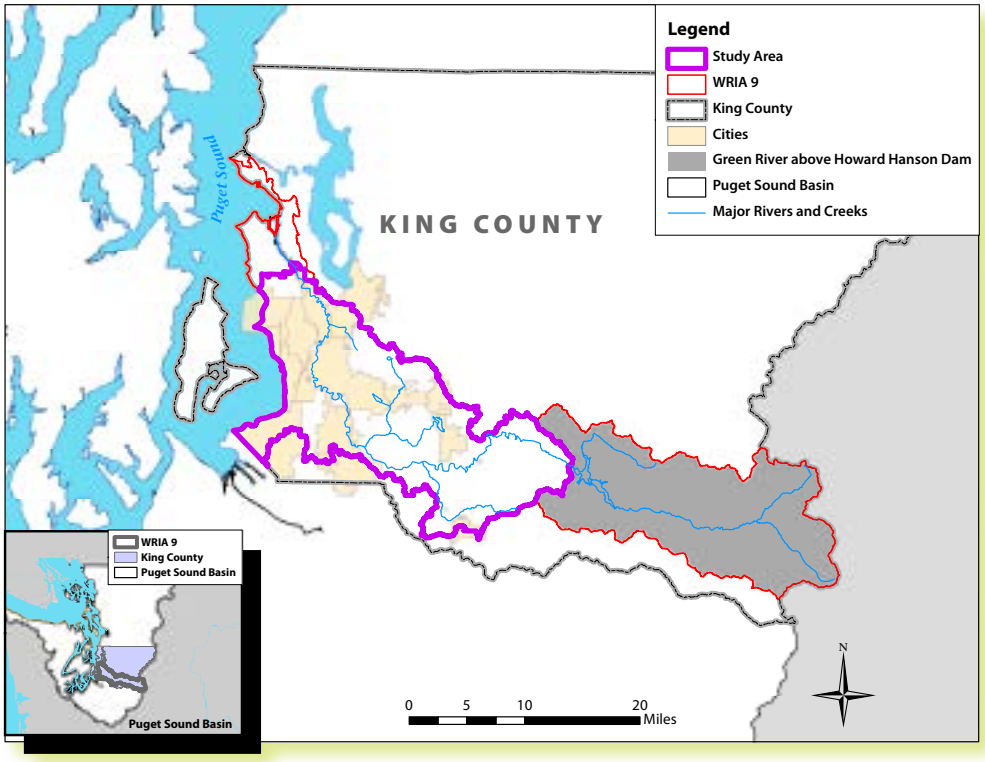

FIGURE 2.
Project area map

Key Findings

The model results show that stream flashiness would be reduced and stream water quality improved to near-predevelopment (e.g., fully-forested) conditions with the implementation of the modeled stormwater facilities. Across the project area, the modeling effort estimated the amount of facility storage, measured in watershed-inches, needed to capture stormwater runoff generated from developed areas. The storage needs ranged from approximately 0.1 watershed-inches in rural areas to as high as 3 watershed-inches in urban areas (**Figure 3**).

The most comprehensive and effective approach for managing stormwater would require implementation of stormwater facilities with new and redevelopment as required by existing stormwater regulations as well as building stormwater facilities for roads, highways and the remaining developed area. To successfully implement all stormwater facilities, a public program would be needed that takes aggressive action to strengthen stormwater requirements during new and redevelopment to lower thresholds requiring stormwater facilities. Additional funding mechanisms for building public facilities would also be necessary to achieve this ambitious goal.

With stronger redevelopment requirements, facilities needed to mitigate stormwater runoff from nearly half of the landscape would be projected to be constructed as part of new and redevelopment over the next 30 years. A 30-year public stormwater program could be responsible for building regional facilities as well as the remaining facilities for roads, highways and all other non-forested lands not redeveloped within the next 30 years. If longer time horizons for completion are targeted, a larger percentage of the stormwater facilities will be built with new and redevelopment, reaching nearly 100 percent of the landscape within about 100 years. A 100-year public stormwater program would be responsible for building regional facilities and road and highway facilities over the next 100 years. The annual capital costs associated with a 30-year and 100-yr public stormwater program for the WRIA

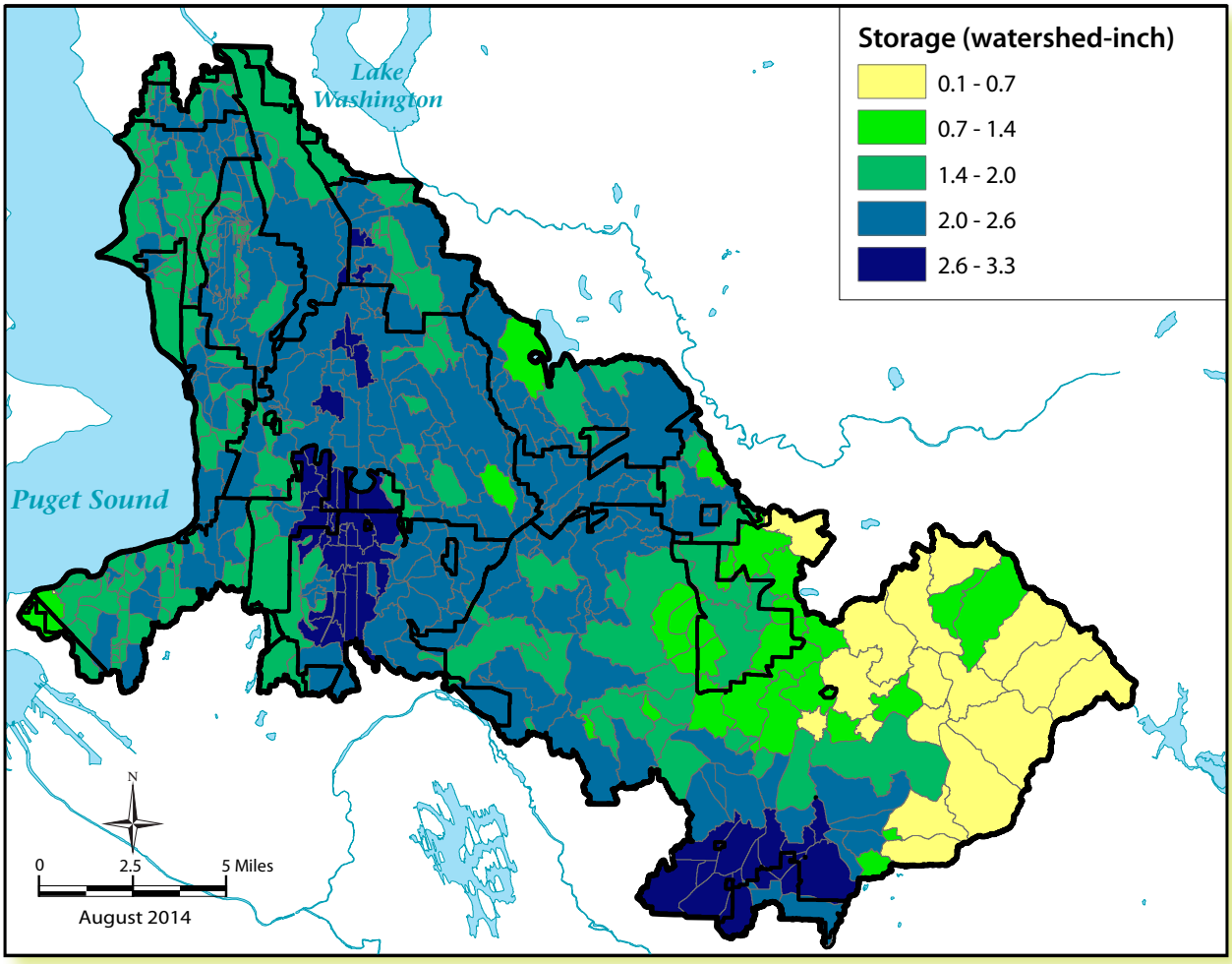

FIGURE 3.
Watershed-inches of stormwater storage needed by 2040 to improve stream health.

9 project area and the Puget Sound basin are presented in **Table 2**. Public operating costs would increase annually as more facilities are built.

For project reports, go to www.kingcounty.gov/environment/watersheds/green-river/stormwater-retrofit-project/documents.aspx.

	Annual Public Stormwater Program Capital Costs	
	30-yr Program	**100-yr Program**
WRIA 9 Project Area	$210M each year	$46M each year
Puget Sound Basin	$4.3B each year	$650M each year

TABLE 2.
Annual 30-year and 100-year Public Stormwater Program Capital Costs for the WRIA 9 project area and the Puget Sound basin.

Contributors to King County's Sci FYI

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