Green Streets

LA

The Storm Water Problem

Storm water and urban runoff are the #1 sources of pollution in Southern California

Credit: NRDC

The Storm Water Problem

[redacted] Toxicity was detected in virtually every sample obtained from Ballona Creek and this toxicity was often present even after the sample was diluted 10-fold in the laboratory. The results indicated that even though a large

Storm water and urban runoff are the #1 sources of pollution in Southern California

Pollutants include:

- Cyanide
- Bacterial pathogens
- Copper
- Lead
- Mercury
- PAHs
- Zinc
- Nickel
- Diazinon
- Chlorpyrifos

Credit: NRDC

The Storm Water Problem

Storm water and urban runoff are the #1 sources of pollution in Southern California

The Health Effects of Swimming in Ocean Water Contaminated by Storm Drain Runoff

Robert W. Haile,[1] John S. Witte,[2] Mark Gold,[3] Ron Cressey,[4] Charles McGee,[5]
Robert C. Millikan,[6] Alice Glasser,[7] Nina Harawa,[8] Carolyn E
Janice Harper,[1] John Dermand,[1] James Alamillo,[3] Kevin Bar
and Guang-yu Wang[10]

Waters adjacent to the County of Los Angeles (CA) receive untreated runoff from a series of storm drains year round. Many other coastal areas face a similar situation. To our knowledge, there has not been a large-scale epidemiologic study of persons who swim in marine waters subject to such runoff. We report here results of a cohort study conducted to investigate this issue. Measures of exposure included distance from the storm drain, selected bacterial indicators (total and fecal coliforms, enterococci, and *Escherichia coli*), and a direct measure of enteric viruses. We found higher risks of a broad range of

symptoms, including bo
nal, for subjects swimm
water with high levels o
ratio of total to fecal col
viruses were detected.
associations we observe
imply that there may b
outcomes associated wit
contaminated with unt
1999;10:355–363)

Keywords: environmental epidemiology, gastrointestinal illness, ocean, recreational exp borne illnesses, waterborne pathogens.

Runoff from a system of storm drains enters the Santa Monica Bay adjacent to Los Angeles County (CA). Even in the dry months of summer 10–25 million gallons of runoff (or non-storm water discharge) per day enter the bay from the storm drain system. Storm drain

From [1]University of Southern California, Department of Preventive Medicine, Los Angeles, California; [2]Case Western Reserve University, Department of Epidemiology and Biostatistics, Cleveland, Ohio; [3]Heal the Bay, Santa Monica, California; [4]City of Los Angeles, Department of Public Works, Bureau of Sanitation, Environmental Monitoring Division, Los Angeles, California; [5]County Sanitation Districts of Orange County, California; [6]University of North Carolina, Department of Epidemiology, Chapel Hill, North Carolina; [7]University of California Los Angeles, Department of Prevention & Control, Los Angeles, California; [8]University of California Los Angles, Department of Epidemiology, Los Angeles, California; [9]University of California Los Angeles, Department of Pulmonary and Critical Care Medicine, Los Angeles, California; [10]Santa Monica Bay Restoration Project, Monterey Park, California.

Address reprint requests to: Robert W. Haile, USC/Norris Comprehensive Cancer Center, Department of Preventive Medicine, 1441 Eastlake Avenue, Room 4455, P.O. Box 33800, Los Angeles, CA 90033-0800.

This work was supported by the Santa Monica Bay Restoration Project, City of Los Angeles, California State Water Resources Control Board, Beach Cities Health District, City of Santa Monica, Los Angeles County Department of Public Works, Heal the Bay, Los Angeles Regional Water Quality Control Board, Chevron USA, Las Virgenes Municipal Water District, U. S. Environmental Protection Agency, and Milken Families Foundation.

Submitted March 4, 1998; final version accepted January 22, 1999.

Editors' note: See related editorial on page 351 of this issue.

water is not subject t
rectly into the ocean.
as enterococci, are so
adjacent to storm dra
teric viruses have als
effluents, even when l
tors, including F2 male
Approximately 50–
Monica Bay beaches a
adverse health effects
been raised by nume
reports indicate that sw
ample, due to sewage) i
health outcomes (Pruss
literature). To our kno
been a large epidemiol
marine waters contami
These circumstances
the possible health eff
present here the main r
people that addressed t
of swimming in ocean
runoff.

Methods

Design and Subjects

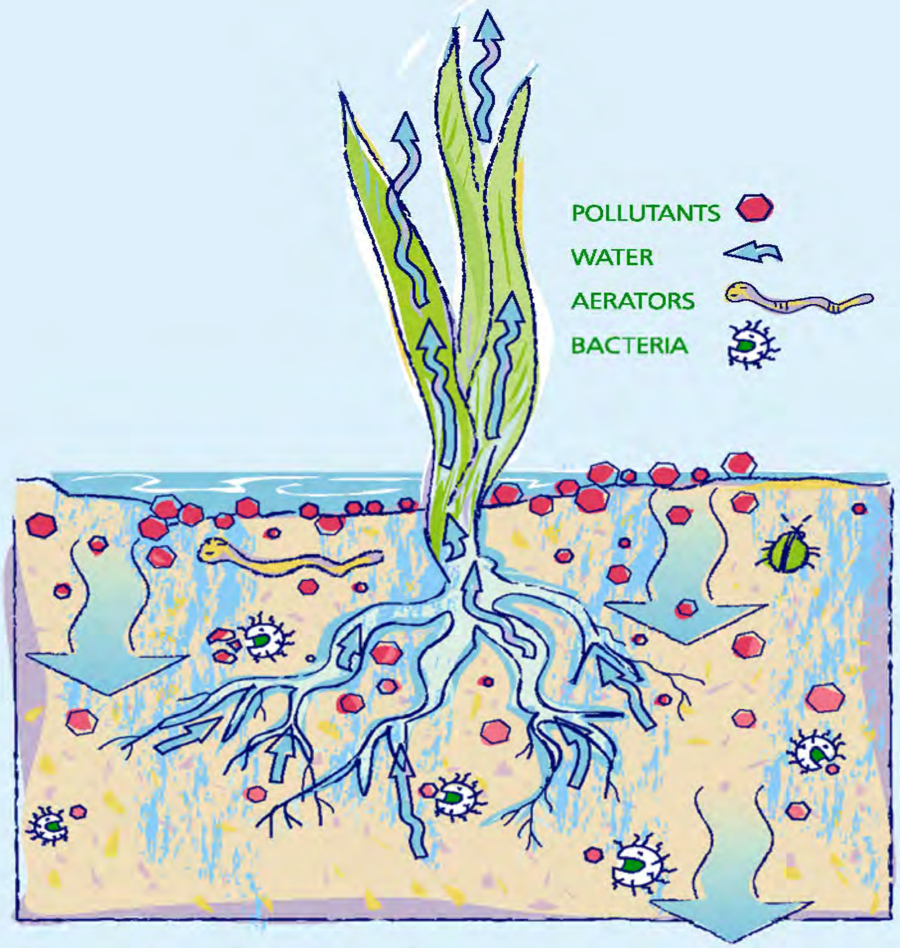
The exposures of interest were distance swimming from storm drains, levels of bacterial indicators (total coli-

Results

Table 1 presents results for each of the adverse health outcomes by distance swimming from the storm drain. Across all distances, risks ranged from about 0.001 (that is, 1 per 1,000) for diarrhea with blood to about 0.1 for runny nose. The risk of numerous outcomes was higher for people who swam at the drain (0 yards away), in comparison with those who swam 1–50, 51–100, or >400 yards from the drain. In particular, we observed increases in risk for fever, chills, ear discharge, coughing with phlegm, HCGI 2, and SRD. In addition, the risks for eye discharge, earache, sore throat, infected cut, and HCGI 1 were also slightly elevated. A handful of outcomes exhibited small increased risks among swimmers at 1–50 yards (skin rash) or at 51–100 yards (cough, cough with phlegm, runny nose, and sore throat). Adjusted estimates of relative risk (RR) comparing swimmers at 0, 1–50, or 51–100 yards from the drain with swimmers at least 400 yards away from the drain showed similar relations as the aforementioned patterns of risks (Table 1). Among the positive associations for swimmers at the drain, RRs ranged in magnitude from about 1.2 (eye discharge, sore throat, HCGI 1) to 2.3 (earache), with varying degrees of precision; most of these RRs ranged from 1.4 to 1.6.

Credit: NRDC

Soil
Vegetation
Water



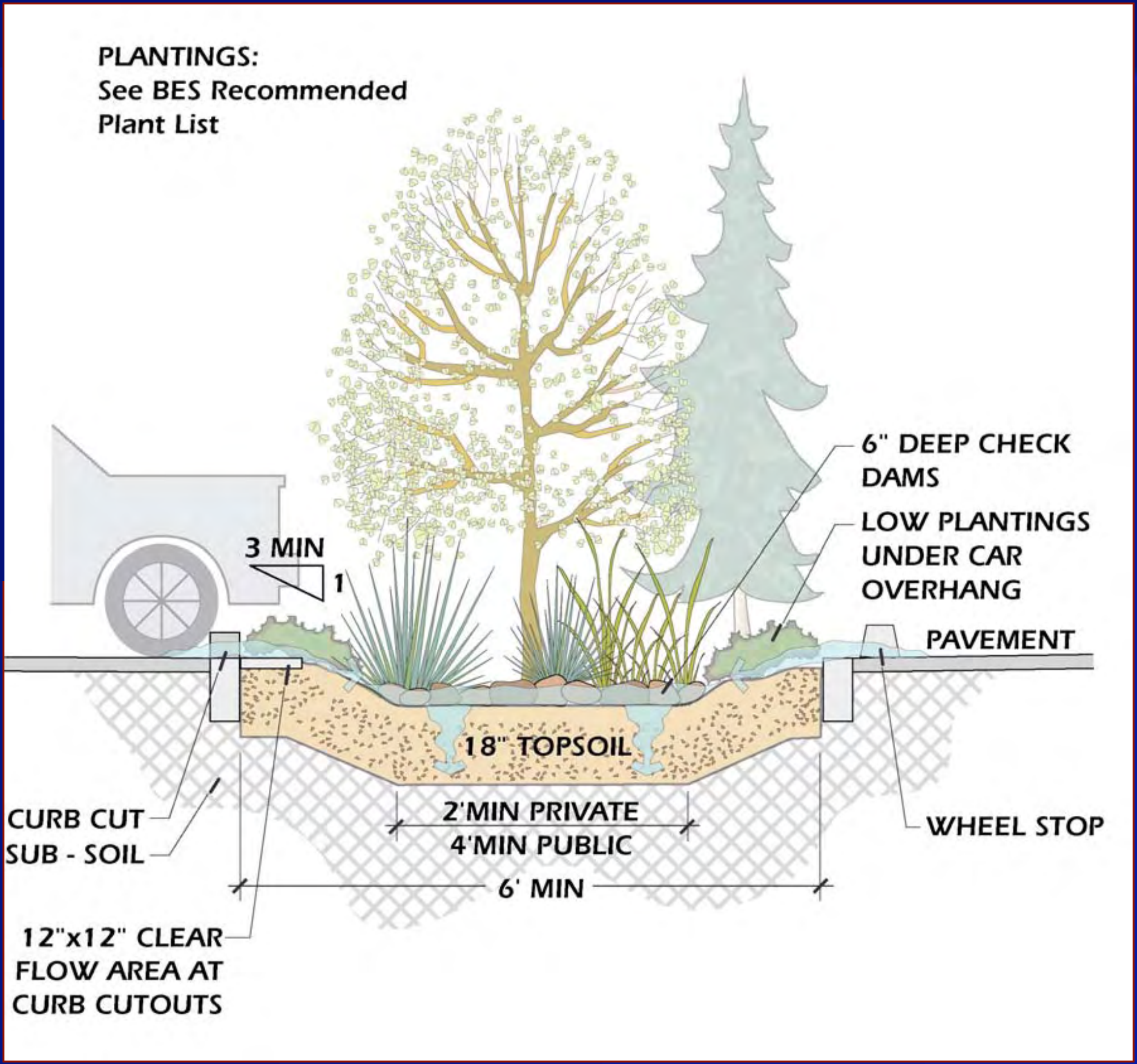
How Swales Work

- ***Adsorption:*** Pollutants in water attach to the surface of soil particles, where roots and bacteria can use them or where they are retained.
- ***Storage:*** Roots, insects, and worms increase the space between soil particles making more room for stormwater runoff storage.
- ***Plant Uptake:*** Water, nitrogen, phosphorus, and trace elements are used for plant functions.

Credit: **Tom Liptan, Bureau of Environmental Services, Portland, Oregon**

Landscape Approaches, infiltration gardens, planters, rain-gardens, etc.

This is the basic approach
that can be adapted
to almost any site.



Credit: Tom Liptan, Bureau of Environmental Services, Portland, Oregon

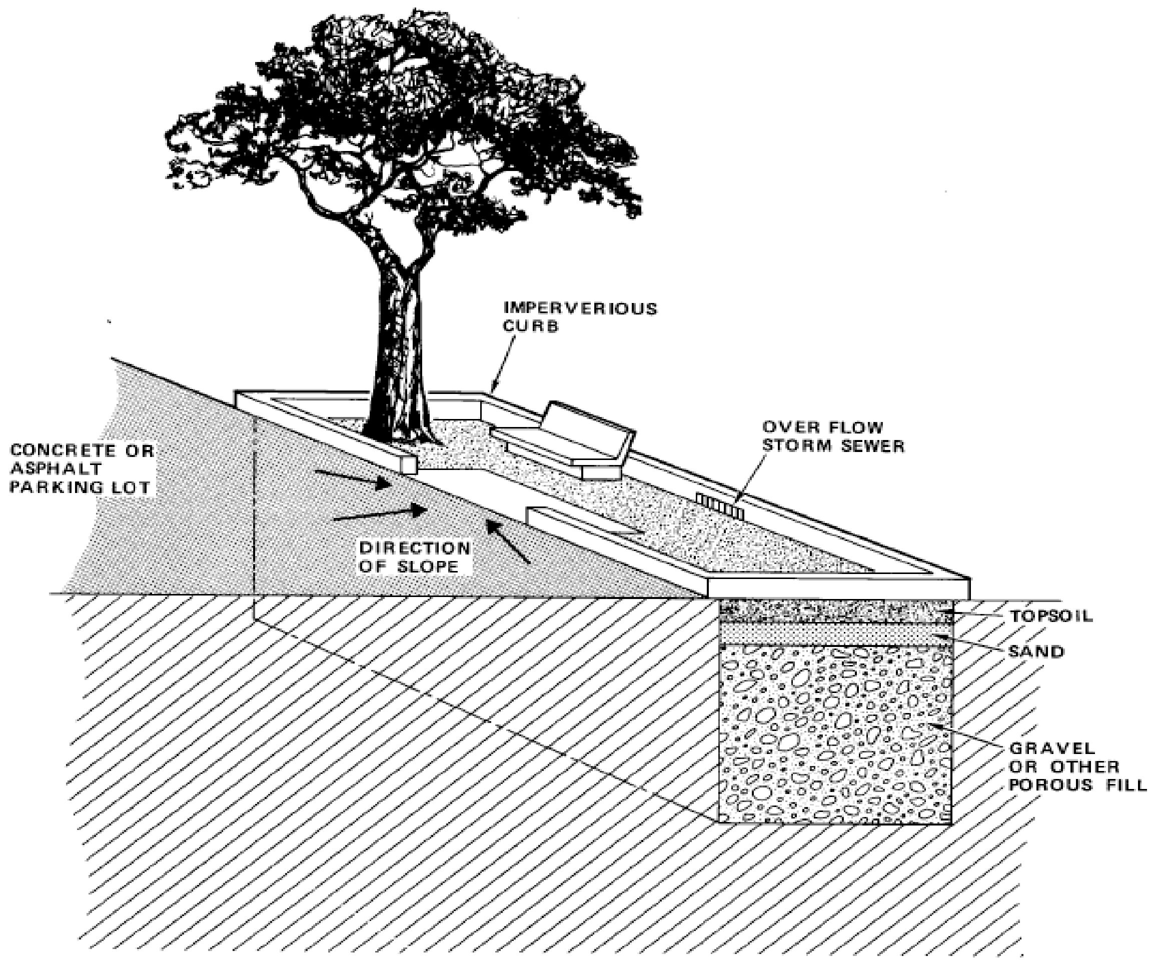


Figure 2. Hypothetical Application of a Greenbelt in a Parking Area.

Seattle SEA Streets program

Vegetated strips, no curbs =

- 11% reduction in impermeable surface
- 90+% runoff reduction
- 25% cost savings compared to conventional design

Green Streets:
Portland, Oregon

Credit: **Tom Liptan, Bureau of Environmental Services, Portland, Oregon**

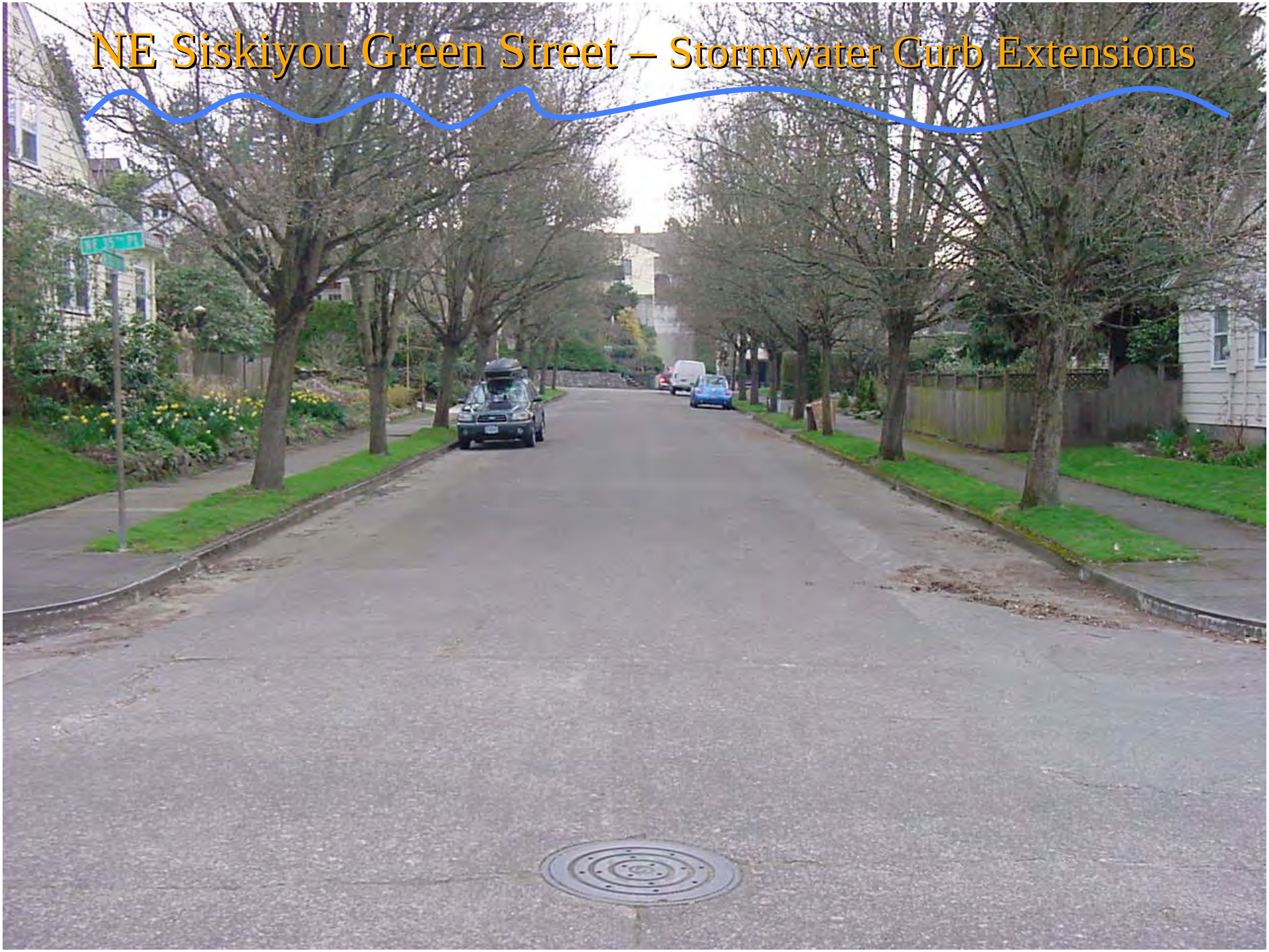
Citywide priority – included in all development, redevelopment

• 40% cost savings compared to conventional design

• 80-85% CSO peak flow Reduction

• Establishes 1% fee on street construction projects to establish Green Streets fund

NE Siskiyou Green Street – Stormwater Curb Extensions




NE Siskiyou Green Street – Stormwater Curb Extensions