Environment Education Guide

Protecting Washington's waters from stormwater pollution

Did you know Washington has a stormwater runoff problem?

Stormwater runoff is damaging salmon habitat. It's the Number 1 water pollution problem in the urban areas of our state, and it causes and contributes to flooding.

Chances are pretty good you've seen stormwater runoff. It's the water from rain or snow that runs off yards, roofs and roadways. As gravity pulls it downhill into low spots, ditches and storm drains, the water picks up soil, chemicals and other pollutants and carries them into our lakes, rivers and marine waters.

Our waters and salmon as well as other fish and wildlife species aren't the only things at risk. Stormwater problems also affect the health and safety of people.

As we develop land to accommodate Washington's growing population, our state's stormwater problem grows, too. The good news is we can do something about it—all of us.

In Washington, the state Department of Ecology, the U.S. Environmental Protection Agency and local governments all work together to regulate stormwater.

The key to solving the problem isn't really in the rules and permits. It's in people—how we live on the land and the everyday choices each of us makes.

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Photo: Toni Weyman Droscher

WASHINGTON STATE DEPARTMENT OF ECOLOGY

From rain to runoff — what comes down must go somewhere...

If you want to understand stormwater, watch what happens the next time it rains. Pay attention to how shapes and surfaces determine what happens to the water.

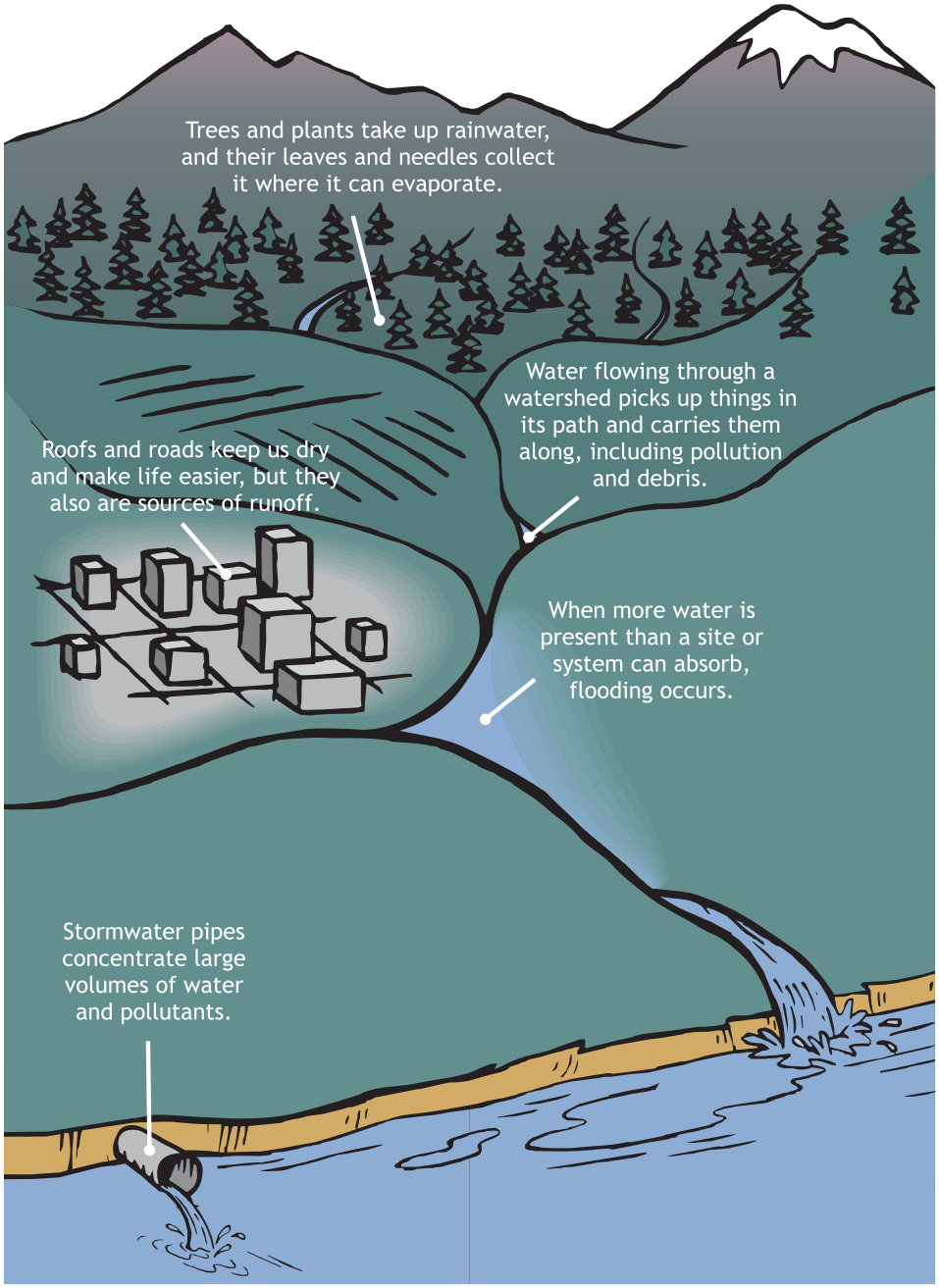
Watch how rainwater flows downhill and collects in low places. See how quickly it starts running down a downspout or into a gutter. Feel how pavement stays hard but soil gets soft. Pay attention to what the water sweeps along in the gutter and where there's an oily sheen on a puddle. Notice what happens to streams and rivers. Notice how runoff seems to be everywhere in the city and is harder to find in the forest.

In Washington's forests, the needles of evergreen trees hold a lot of rain—as much as 40 percent of a low intensity rainfall.

The landscape connection is the key to stormwater runoff

On undeveloped sites, water from rain or snow follows natural patterns of drainage and circulation. Much of the water seeps down into the soil and into underground water supplies. In forests and grasslands, trees and other plants will take up some of this water. Water will also collect on their leaves and needles and evaporate.

Wetlands absorb and hold runoff. In a natural or near-natural setting, the water that does run off directly into streams or other waters is usually filtered and slowed by the web of plants it runs through, a sort of natural purifying system.



A watershed is all the land that drains to the same body of water. A watershed's natural drainage system includes a network of streams and rivers. In a large watershed, many different sources and land uses can contribute to stormwater runoff.

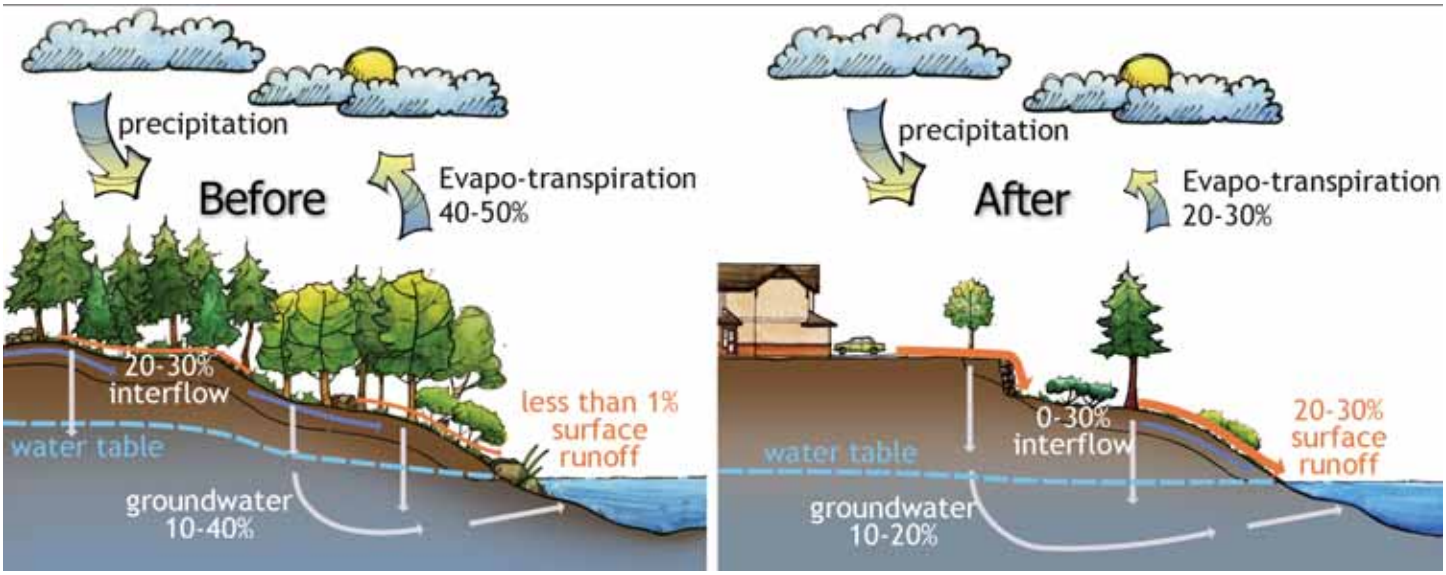


Image courtesy of Puget Sound Partnership

Before *development almost all rainfall is taken up by plants, evaporates or infiltrates through the ground.*
After *conventional development, surface runoff increases significantly while evaporation and infiltration into the ground decrease.*

Developing land typically has meant removing trees or other vegetation, reshaping the land, compacting soil, and creating hard surfaces. These changes alter the natural water patterns, or hydrology, of a site. Much of the water that plants and soil previously would have absorbed now runs off into local waters, either directly or through a system of gutters, ditches, swales, or pipes. These systems collect runoff and concentrate the flow, quickly conveying it into streams or other waters.

Covering as little as 10 percent of a watershed with impervious surfaces can degrade streams, harming salmon, trout and other aquatic life.

The way we use and develop the land changes not only where stormwater goes and how fast it gets there, but also what it meets along the way—parking lots, roads, roofs, farms, ranches, ball fields and more. Whatever stormwater runoff picks up from these places, it carries into Washington's waters.

Water flowing through a watershed picks up things in its path and carries them along, including pollution and debris.

How much stormwater do we make?

POTENTIAL RUNOFF	1,200-square ft. roof	1-acre of pavement
1 inch of rain or snow melt	748 gallons	27,150 gallons
Average annual precipitation		
Seattle (37 in./yr)	27,700 gallons	1 million gallons
Spokane (17 in./yr)	12,700 gallons	0.5 million gallons
Olympia (51 in./yr)	38,100 gallons	1.4 million gallons

Roofs, roads and paved parking lots keep us dry and make life easier, but they are also common sources of runoff. Imagine all the roofs and roads in your area and across the state, and imagine how much runoff they generate.

Precipitation data source: NOAA - Average annual precipitation, 1971-2000. Figures have been rounded.

Washington's growing problem with stormwater runoff

Altered flows — too much, too soon and too little, too late

Stormwater often gets to where it's going faster after an area is developed. Runoff quickly flows into streams and other surface waters instead of seeping into the ground to recharge groundwater and slowly feeding those streams year round.

The results include much higher stream flows and flooding when it rains (especially during heavy rains), and much lower stream flows in the dry season. These extreme high and low flows are bad for salmon, trout and other fish as well as people and communities.

The high-energy, faster, heavier flows erode stream channels and scour streambeds, churning up silt and damaging spawning areas. The energy from high flows also flushes away tiny aquatic life that serve as part of trout and salmon's diets and part of a healthy stream.

Extreme low flows are also a problem for fish. Some urban streams that used to run year round sometimes dry up in the summer. Others have too little flow to allow salmon to swim up them to spawn. Hardened surfaces contribute to this problem by interrupting the natural water-absorbing process. Rainfall hits these hard surfaces and escapes directly into rivers rather than soaking into the ground to recharge underground water supplies that feed small streams in the summer months.

Did you know…?

- *Economic costs related to stormwater in the Puget Sound region are expected to exceed $1 billion over the next decade.**
- *Even the drier east side of the state has to deal with stormwater, especially in urban areas. If laid end-to-end, Spokane's storm sewers would stretch all the way to Seattle and back.*

There are other flow-related impacts, too. Flooding from extreme high flows can damage private property, public roads and utilities. And when stormwater runs off instead of seeping into groundwater, some wells may go dry.

With high amounts of hardened or paved surfaces, urban areas generate more and faster runoff, increasing the risk of flooding.

Stormwater runoff can affect both the quality and quantity of drinking water supplies. Cities and counties require more stormwater protection in areas near public supply wells to protect them from pollution.

** Damages and Costs of Stormwater Runoff in the Puget Sound Region, 2006; Derek B. Booth, Bernadette Visitacion and Anne C. Steinemann*

Polluted waters

Most stormwater runoff carries pollution and more pollution comes from highly urbanized areas. More importantly, most of it is not treated, or "cleaned up" before it enters Washington's waters.

Stormwater runoff is the Number 1 urban water pollution problem in the state.

As runoff flows over roofs, pavement and developed land, it picks up soil particles, oil and grease (mostly from cars and trucks), and many different toxic chemicals, including those from fertilizers, weed-killers, and pesticides. It also picks up bacteria from pet and livestock waste and failing septic systems.

About one-third of the state's waters are too polluted to meet state water quality standards. Frequently, the cause of this pollution is stormwater. This water is not fit for drinking or swimming.

Photo: Jill Williams

Contaminated stormwater runoff can create hazards to human health and affect recreation, tourism, fishing, and businesses.

Beaches have been closed for swimming and shellfish harvesting.

Salmon suffer not only from chemical pollutants, but also from soil washed in from construction sites and other bare ground. Mud can cover spawning areas, suffocating salmon eggs. It also can clog gills, making it harder or impossible for salmon, trout, and other fish to breathe.

Salmon and trout need cool water to survive, but stream temperatures can rise when cool groundwater isn't available to feed a stream year round. Also, stormwater runoff entering a stream is often warmer than the stream itself.

Shared connections

Polluted stormwater runoff is an issue across the state. It's easy to see how it connects to issues about Puget Sound, the Spokane River, the Columbia River, and salmon recovery. Stormwater runoff connects to other issues, too:

- *Many of the same things that pollute runoff and surface waters can also pollute aquifers, which are sources of drinking water.*
- *The danger from landslides and unstable slopes increases in areas with stormwater problems.*
- *As we prepare for climate change, we must consider how changes in rain and snowfall could affect flooding and water supplies.*

The good news is that solutions for stormwater can help us deal with many of these connected issues.

Rethinking stormwater runoff

Dealing with stormwater has traditionally focused on getting it out of the way quickly. In Washington, many communities have rules for managing stormwater as part of regulating development and preventing erosion and flooding.

However, many communities are not as used to dealing with stormwater runoff as a major source of pollution or destroyer of habitat. With increasing stormwater runoff problems and new state and federal requirements, Washington is rethinking how it handles stormwater.

Washington has successfully tackled other pollution problems. By combining regulations with cooperation, creativity and good long-term planning, we can reduce the problems with stormwater runoff.

Our transportation choices are part of the runoff picture. Many pollutants in runoff from roads, driveways and parking lots come from cars and trucks. Some sources are:

- *Antifreeze*
- *Brake fluid*
- *Brake lining*
- *Exhaust particles*
- *Oil*
- *Pavement particles*
- *Tire particles*
- *Transmission fluid*

A new approach — reduce runoff at its source

Stormwater runoff accumulates, and so do the problems it creates as it flows downhill. It makes sense to try to stop the problems before they start or get too big to manage.

Innovative developers, engineers and designers are already looking at ways to reduce runoff at its source and better mimic nature's systems by:

- Retaining more natural vegetative cover.
- Reducing hardened surfaces and soil compaction.
- Keeping more stormwater on site to percolate into the ground.

Better designs for new developments can make a difference for the future, but improvements to existing developments can help deal with today's stormwater problems, too. The Department of Ecology is providing grants to local governments to help fund innovative approaches to preventing stormwater runoff.

Photo: Seattle Public Utilities

Seattle's SEA (Street Edge Alternatives) Streets pilot project reduced the amount of stormwater runoff leaving a street by 98 percent for a small rain event. This successful project has inspired similar projects, and the City expects that future projects will cost less than traditional street improvements.

Permeable pavement like this provides a hard, drivable surface, but it also lets some stormwater soak back into the ground.

Choices for the future

Stormwater pollution often goes hand in hand with growth. Since 1982, Washington's population has grown by two million people, adding the equivalent of 10 new cities the size of Spokane or Tacoma. Millions more people are expected to be added in the next few decades. As the state's population grows, we can choose to limit polluted runoff and the harm it does, or risk losing some of what makes Washington a special place to live.

While new regulations and technologies can help, we can't expect them to completely make up for the impacts of converting forests and grasslands into shopping malls or subdivisions.

Choices we make about how we use the land, including how much development to allow, where it occurs, and how much vegetated land is retained, are crucial for successfully managing stormwater and for keeping Washington's watersheds healthy.

Washington Waters — Ours to Protect

People really can make a difference when it comes to reducing stormwater runoff and the problems and costs that go with it. Because we all contribute to the problem, we all can be a part of the solution. It starts with paying attention to stormwater — at home, at work and in our communities.

We can reduce the amount of runoff.

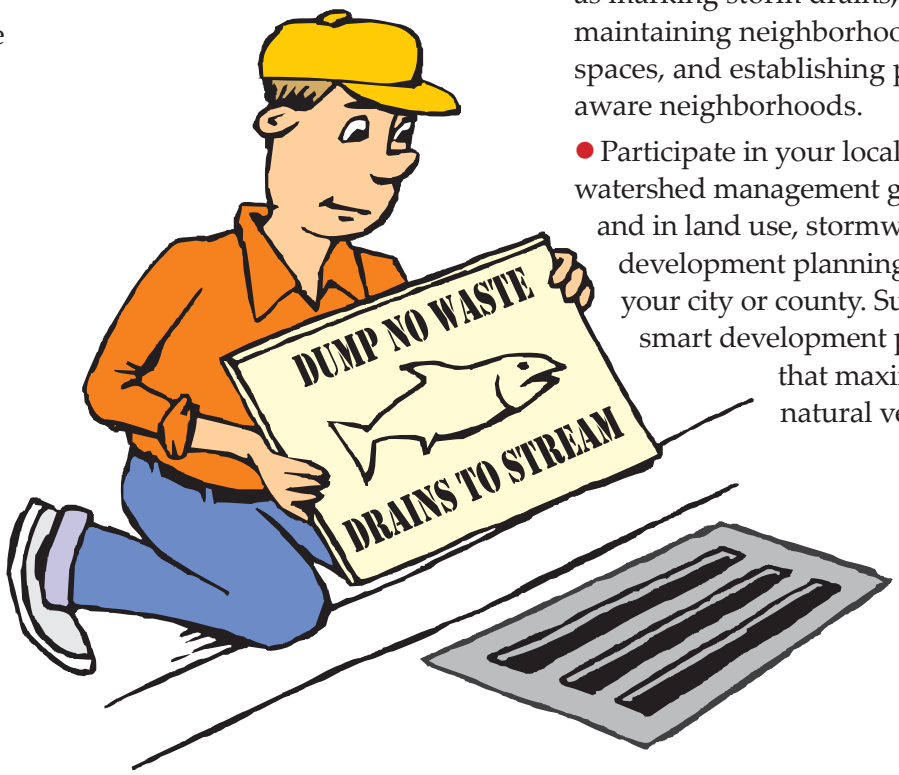
- Reduce the amount of paved or hard surface areas. Consider permeable paving for that new patio or driveway.
- Look for ways to keep runoff out of the stormwater system so it can soak into the ground. Plant rain gardens. Use rain barrels. Wash your car on the lawn or at commercial car wash that recycles water. (This helps prevent runoff pollution, too!)

We can create cleaner runoff.

- Reduce fertilizers, turf builders and pesticides on your lawn and garden. Use small amounts of slow-release fertilizer and environment-friendly products for problem areas.
- Reduce pollution from roads, driveways and parking lots. Wear and tear on roads, tires and brakes leaves a lot of pollutants behind. Fix vehicle fluid leaks immediately, and consider alternatives to driving solo.
- Reduce bacterial pollution from animal waste. Scoop pet waste and put it in your garbage. Cover and control animal manure on small farms.
- Maintain your septic system. This will keep it from failing and causing pollution.

We can work together.

- Get involved with community stormwater projects such as marking storm drains, maintaining neighborhood green spaces, and establishing pesticide-aware neighborhoods.
- Participate in your local watershed management group and in land use, stormwater and development planning with your city or county. Support smart development practices that maximize the natural vegetation.



For more information

Washington Department of Ecology

Water Quality Program
www.ecy.wa.gov/programs/wq/stormwater/index.html

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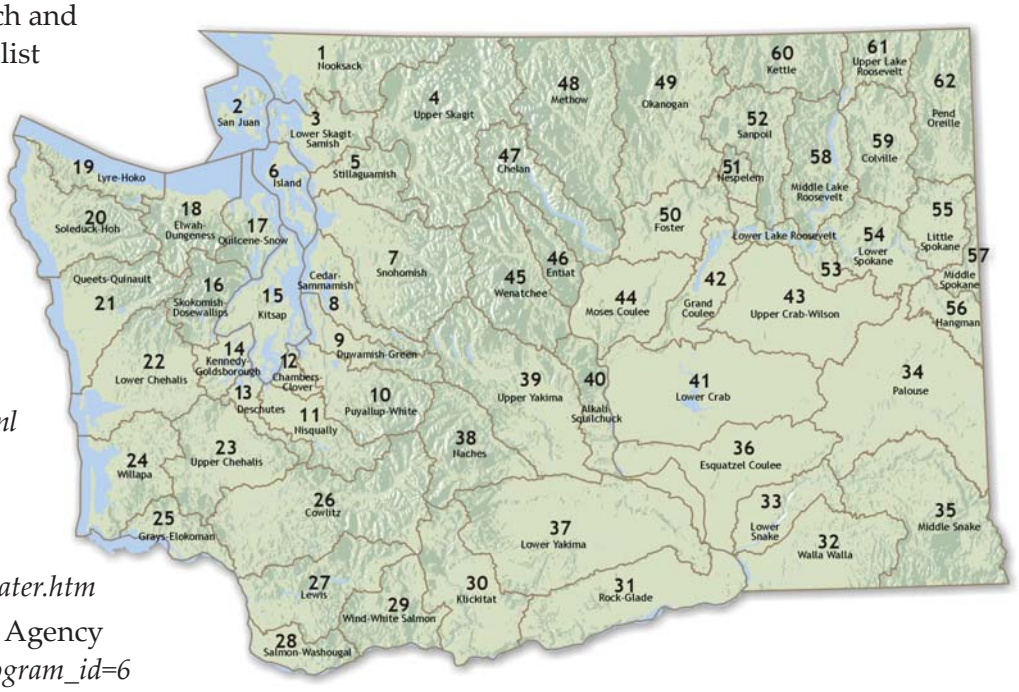
Water Resource Inventory Areas are administrative and planning boundaries for water basins, commonly known as watersheds.



Watershed planning

To find out what watershed you live in and how to get involved:
www.ecy.wa.gov/watershed/index.html

Helpful websites

- Puget Sound Partnership
www.psp.wa.gov/our_work/stormwater.htm
- U.S. Environmental Protection Agency
cfpub1.epa.gov/npdes/home.cfm?program_id=6
- Seattle Public Utilities SEA Streets Project
www.seattle.gov/util/About_SPU/Drainage_&_Sewer_System/Natural_Drainage_Systems/Street_Edge_Alternatives/index.asp

Other resources

- For local information, contact your city or county.
- Search the Internet for more information on stormwater, runoff, rain gardens, low impact development, etc.

To view this publication online, go to: http://www.ecy.wa.gov/biblio/0710058.html

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