INDICATOR 3

What is the quality of stormwater entering Casco Bay and its watershed?

CBEP Goal: Minimize the loading of pathogens, toxics, nutrients, and sediments from stormwater and combined sewer overflows to Casco Bay.

Why Is It Important to Monitor Stormwater?

It is sometimes difficult to accept that stormwater runoff could degrade local streams and transport pollutants to Casco Bay. Rainfall has an only partially deserved reputation for purity. Indeed, when rain falls on urban or suburban lands, it can cause water quality problems downstream.

"Stormwater" is a term of art used to refer to surface water and water in drainage systems that flows during and soon after rain events. It washes pollutants from urban and suburban lands, and transports them to streams, lakes, and the Bay.

Automobiles are a significant source of those pollutants, which are often concentrated in runoff from roads and parking lots. Metals are released into the environment as brakes wear out. Oil leaks from engines, transmissions, and hydraulic systems. Exhaust adds a complex mix of pollutants, especially rich in toxic polycyclic aromatic hydrocarbons (PAHs). Newly paved roads are another source of PAHs.

CDOT

Oil entering a storm drain.

Compared with runoff from forests and wetlands, urban stormwater tends to accumulate toxics, nutrients, sediments, and pathogens. Toxic compounds can come from: use of pesticides or lawn chemicals; spills or improper disposal of industrial chemicals; and material washed out of dumpsters, among other sources. Nutrients that can fuel growth of aquatic algae can come from eroding soils, misuse of fertilizer, or failing septic tanks. Bacteria and pathogens stem from failing or poorly maintained private waste treatment systems (*e.g.*, septic tanks, overboard discharges), from combined sewer overflows, and from pet and livestock waste.

Status and Trends

While the presence of a variety of pollutants in stormwater has been well documented in studies nationwide, two recent studies offer data about toxic chemicals in stormwater in the Casco Bay region.

EPA Study

A 2008 US EPA report revealed the prevalence of heavy metals and PAHs in stormwater from 21 sites in Portland and South Portland, which were sampled in 2006.

Metals. Metals of potential concern were observed at all sites. Comparison with federal water quality criteria (US EPA 2009) shows that the concentrations of most metals observed in Portland and South Portland stormwater were generally below federally suggested standards for protecting both drinking water and freshwater ecosystems. Several samples showed concentrations of zinc and copper above state guidelines for protection of aquatic ecosystems. Zinc is widely used as a coating (*e.g.*, "galvanized" fasteners), or for sacrificial anodes to protect steel from corrosion. Copper is used in automotive components, and is released into the urban environment primarily due to wear.

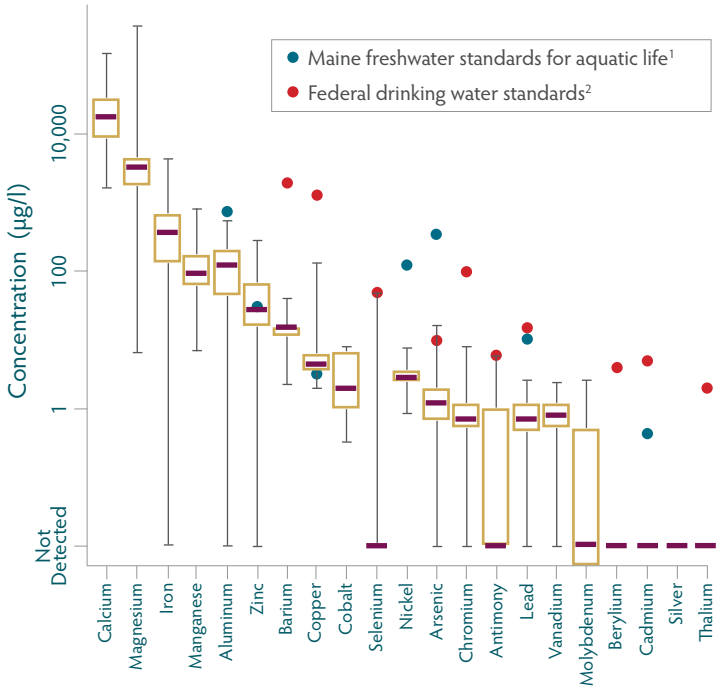
Polycyclic Aromatic Hydrocarbons. PAHs were detected at about one half of all sites tested. A characteristic group of PAHs was often found together, at about a quarter of all sites tested. That consistent PAH "fingerprint" suggests a common source of detectable levels of PAHs, possibly derived from recent paving operations, or application of pavement sealers. No relevant aquatic life criteria for PAHs are available, but when PAHs were present, levels were generally well above drinking water standards.

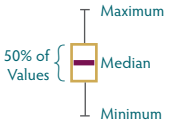
Pesticide Surveys

The Maine Board of Pesticides Control (BPC), working in association with Friends of Casco Bay, has been sampling surface waters in the Portland area since 2001 looking for a variety of pesticide residues. Pesticides have been found in area streams, sometimes at concentrations above federal aquatic life criteria. Detected pesticides include compounds commonly used in lawn care and on golf courses.

Most of the compounds found are not thought to persist for long periods in the environment, so detection probably reflects application somewhere upstream a few days to weeks before sampling. If that is the case, elevated levels may occur sporadically throughout the growing season. It is difficult to know just how frequently streams face elevated levels of pesticides without much more extensive sampling.

Metals in Stormwater in Portland and South Portland





"Box and Whisker Plots" of concentrations of various metals observed in 21 stormwater samples collected in Portland and South Portland during spring of 2006. The vertical axis is a logarithmic scale. Many stormwater samples exceeded aquatic life criteria for zinc, copper, or both. Copper and zinc are commonly found at elevated levels in stormwater nationwide.

Pesticides in Surface Water of Casco Bay

Pesticide	Primary Use	Maximum Concentration Observed (ppb)	Maximum Exceeds Aquatic Life Criteria
Diazinon	Organophosphate insecticide	2.6	✓
2,4-D	Herbicide	36.4	✓
Dicamba	Herbicide	4.1	
MCPP	Herbicide	26.0	✓
MCPA	Herbicide	0.45	
Clopyralid	Herbicide	0.91	
Propiconazole	Fungicide	0.07	
Chlorothalonil	Fungicide	0.22	

Pesticide residues detected in surface water samples from the Casco Bay region 2001-2008 (only highest concentration shown). Pesticide residues have sometimes been found at concentrations of concern. (See also sidebar in Indicator 10.)

[1] Maine's ambient water quality standards from Maine DEP 2005. Some standards depend on water hardness; values were calculated assuming a hardness of 20 mg/l.
[2] Federal drinking water standards from US EPA 2008.

Solution and Actions

The best approach to reducing pollutants in stormwater is to address them at their source by releasing fewer toxic compounds into the environment, or by removing them before they enter the water. Toxic chemicals and other pollutants enter stormwater because they are present in the urban environment as a result of human activity. Use of lawn chemicals, for example, brings with it the potential for those chemicals to find their way into surface waters. Many PAHs find their way into the environment because of a heavy reliance on automobiles for transportation.

Several public education campaigns encourage area businesses and residents to make choices that can reduce releases of pollutants into stormwater. Those include Friends of Casco Bay's Bayscaping program, the Board of Pesticides Control's Yardscaping Partnership and the statewide "Think Blue" media campaign, which has many partners, including CBEP, Maine DEP, and the Cumberland County Soil and Water Conservation District. Think Blue is funded largely by municipalities. Such programs emphasize actions that can be taken by individuals to reduce pollutants in stormwater.

Federal and state permit programs under the Clean Water Act require many industrial enterprises, large municipalities, and a few commercial businesses to take steps to reduce pollution in stormwater. Those include practices such as spill prevention, and response plans for organizations handling toxic materials. Another important strategy is placing sources of pollutants such as dumpsters or automobile maintenance areas out of the weather, or in areas where spills can readily be contained. In some cases, vacuum sweeping of road and parking lot surfaces can remove pollutants before they find their way into streams. Finally, a variety of engineered and structural solutions (discussed in more detail under Indicator 2) can help trap pollutants before they reach the waterways.

References

United States Environmental Protection Agency. 2008. *Wet Weather Water Quality Study, Portland and South Portland, Maine*. Project Report, December 2008. Region I, New England. Office of Environmental Measurement and Evaluation, Ecosystem Assessment Unit.

Maine Department of Environmental Protection. 2005. Chapter 584: Surface Water Quality Criteria for Toxic Pollutants. 06-096 *Code of Maine Rules* Chapter 584. http://www.maine.gov/sos/cec/rules/06/096/096c584.doc

United States Environmental Protection Agency. 2009. *National Recommended Water Quality Criteria*. United States Environmental Protection Agency, Office of Water, Office of Science and Technology. http://www.epa.gov/ost/criteria/wqctable