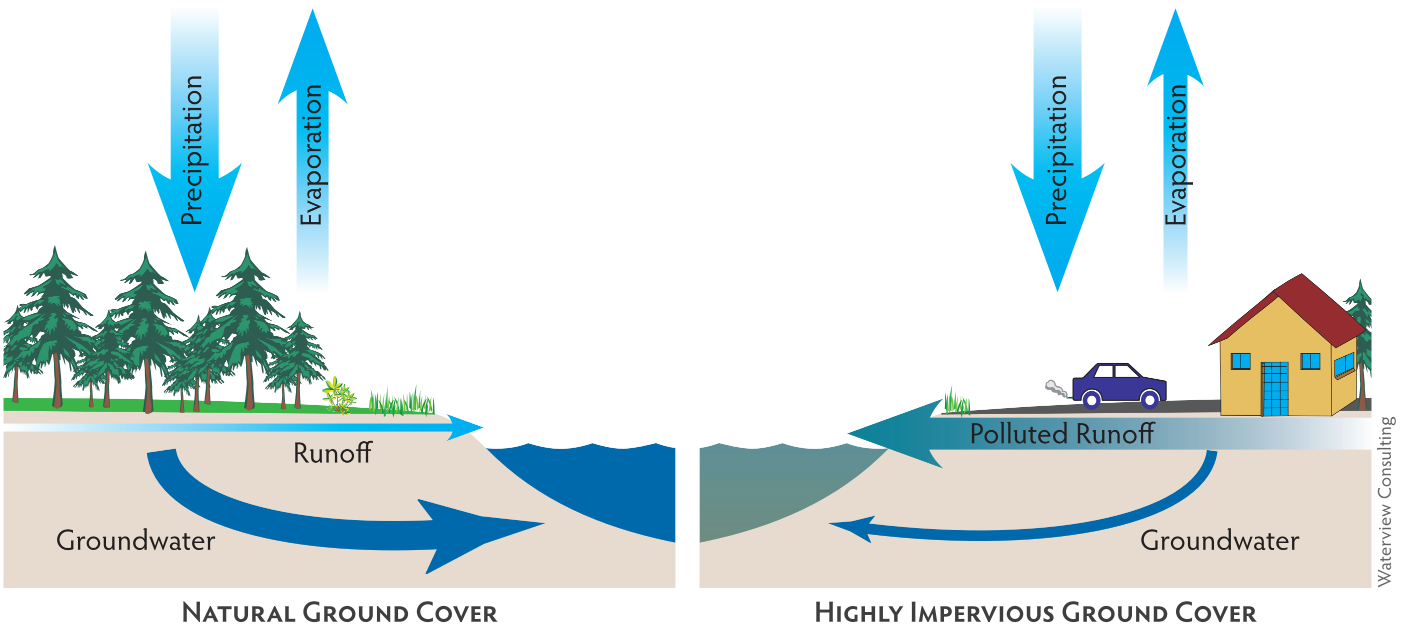
INDICATOR 2

How much of the Casco Bay watershed is covered by impervious surfaces?



The effects of impervious cover on the water cycle include reduced infiltration to groundwater, increased runoff, and less evaporation.

Why Is It Important to Monitor Impervious Cover?

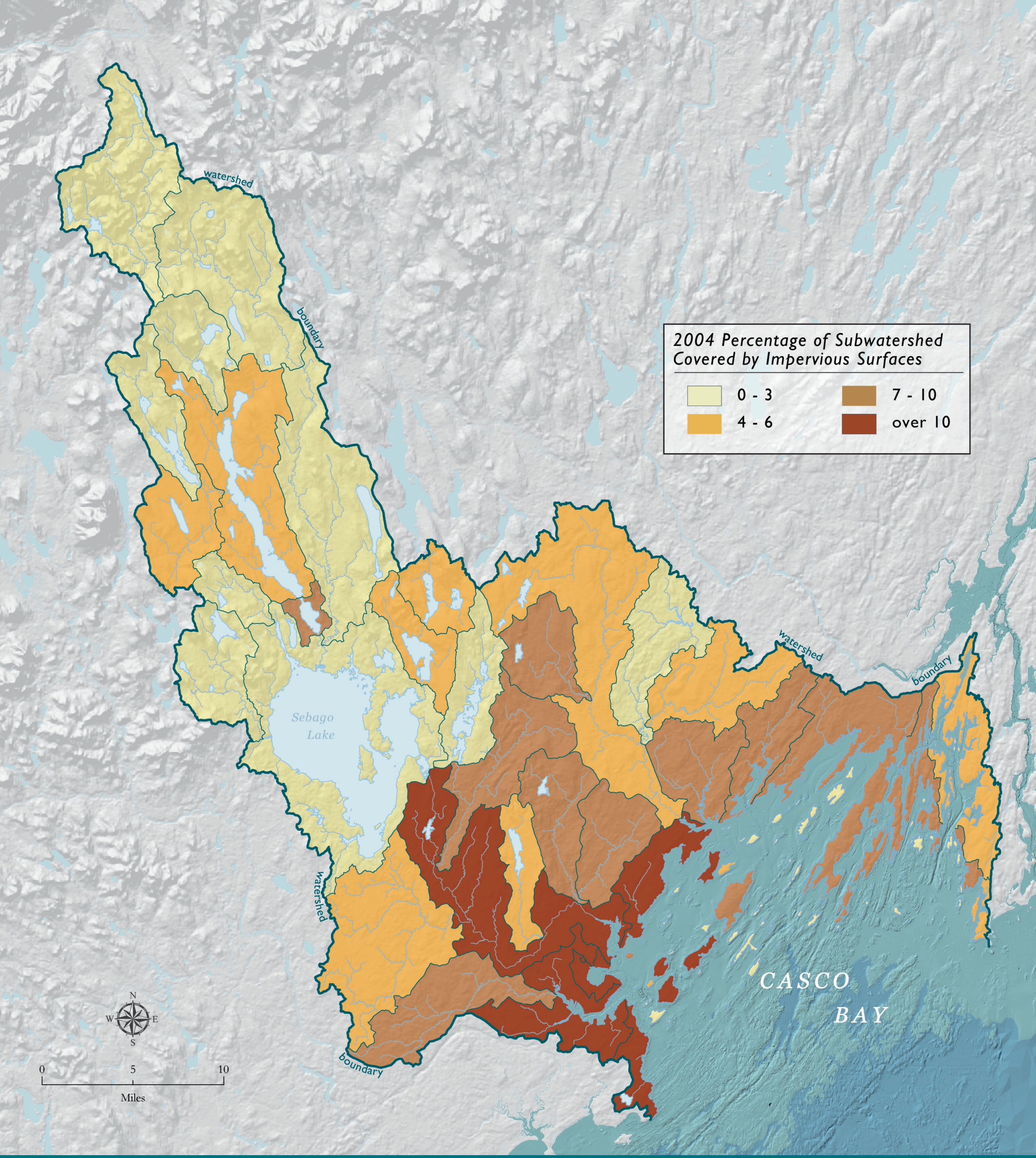
As population densities increase around Casco Bay, formally rural areas become increasingly urbanized, resulting in extensive impervious surface cover. Impervious surfaces - any material or structure on or above the ground that prevents water from infiltrating through the underlying soil – include paved parking lots, sidewalks, roof tops, driveways, patios, and paved, gravel and compacted dirt surfaced roads (Horsley Witten 2007). Rainwater and snow melt that falls onto an impervious surface collects contaminants, sediments, and debris before entering stormwater drainage systems and discharging to downstream waters, including Casco Bay. Impervious surfaces increase pollutant loads, exacerbate erosion and sedimentation, and increase both the volume and the velocity of stormwater runoff into rivers and streams. The *Casco Bay Plan* points to stormwater as being the single greatest contributor of contaminants to Casco Bay.

The Maine Department of Environmental Protection (DEP) has determined, based on research in Maine as well as other parts of the country, that there is a relationship between the percent impervious area of a watershed, and the water quality of the water body to which the watershed drains. Detrimental impacts to stream communities occur where impervious surfaces cover more than about 10 percent of a watershed's area. Therefore, percent impervious cover within a watershed is increasingly used as an indicator of the intensity of development and the degree to which development is impacting water quality.

Status and Trends

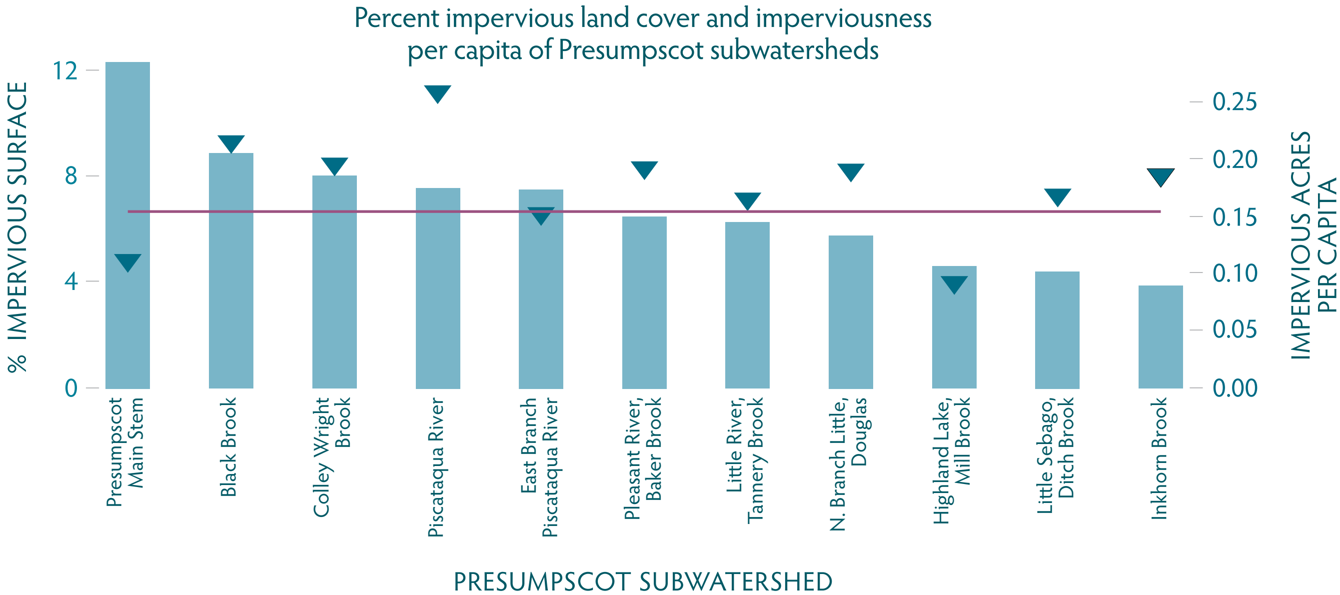
The best and most recent high resolution assessment of impervious surface cover was developed in 2004 by Maine DEP based on five-square-meter resolution SPOT satellite imagery. The dataset was previously used to present impervious surface area in the 2005 *State of the Bay* report. At that time, the impervious surface area of the Casco Bay watershed was calculated to be about six percent, the equivalent of 57.9 square miles.

In 2010, CBEP staff recalculated impervious area to include the Bay's largest islands, and there was no significant change to the overall impervious surface cover. Casco Bay's coastal subwatersheds were broken into separate drainages to reflect the geography of the coastline, so that watersheds of distinct features such as bays were distinguishable. The Back Cove watershed in Portland (52 percent), and the Fore River watershed in Portland and



Impervious Surfaces by Subwatershed

Data: Maine DEP 2004 LandSat imagery.



Bars: Percent impervious cover. Triangles: Impervious acres per capita. Line: Impervious acres per capita for Casco Bay watershed as a whole. Sources: MEGIS; Per capita data are estimates based on analysis of US Census data by R. Mosher.

South Portland (34 percent), contain the highest percent impervious covers of any Casco Bay's HUC 12 subwatersheds. With the exception of the Cousins River and the New Meadows River watersheds, Casco Bay's coastal watersheds, as well as the Stroudwater River watershed, are at or above eight percent impervious surface cover.

Casco Bay's major freshwater watersheds remain slightly less impervious than coastal areas. The Royal River watershed, and those of its tributaries, remains below eight percent. However, the watershed for the main stem of the Presumpscot River exceeds 12 percent, and the Presumpscot's tributaries are close behind, with both Black Brook and Wright Brook watersheds at more than eight percent. A comparison of impervious surface area per capita with impervious surface area within the Presumpscot subwatersheds shows that the two are distinct measurements. Along the main stem of the Presumpscot River, where population density is greater than in surrounding rural areas, and impervious surface coverage is highest (in part due to the presence of Westbrook along the main stem), the estimated effective impervious surface per capita is actually lower (.11 impervious acres per person) than that of Inkhorn Brook's subwatershed (.18 impervious acres per person), despite the fact that impervious surfaces cover only 3.9 percent of the land area there. For sake of comparison, estimated impervious surface cover per capita for the entire Casco Bay watershed is .154 acres per person. Although that analysis of impervious surface per capita is based on population estimates only, the results provide insight into how land consumption patterns differ across the landscape, and can be traced to the types of development (*e.g.*, residential, commercial, industrial).

Solution and Actions

Maine NEMO

Maine NEMO (Nonpoint Education for Municipal Officials) works closely with municipal planning boards and other groups to provide information about the impacts of development and land use change on water quality. NEMO also provides tools for local officials to protect water by addressing stormwater pollution through planning, site design, and treatment strategies. (For information about NEMO presentations, see www.mainenemo.org.)

Interlocal Stormwater Working Group

As part of national and state mandated stormwater permitting requirements, the Interlocal Stormwater Working Group (ISWG), comprising14 municipalities within Cumberland County and the Casco Bay watershed, is working collaboratively to address stormwater pollution. Six programmatic areas are addressed: public education and outreach on stormwater impacts; public participation; illicit discharge detection and elimination; runoff from construction sites; post-construction management; and pollution prevention/good housekeeping. (Additional information about ISWG is available online at www.cumberlandswcd.org/stormwater.)

Low Impact Development

Low Impact Development (LID) approaches to managing stormwater are increasingly being recommended by state and federal agencies for use in new developments. The goal of LID is to reduce the volume of stormwater runoff from a developed site in a way that mimics the way water flowed through the site before it was developed. LID techniques can take the shape of best management practices (*e.g.*, shared driveways to minimize impervious surfaces) or physical structures that are designed to maintain pre-development hydrology, primarily by directing stormwater back into the ground through infiltration. Examples of physical LID design elements include rain gardens, pervious pavement, green roofs, rain barrels, tree box filters, and gravel wetlands. By approximating the "natural" hydrology of a site, LID helps to reduce the impacts that stormwater has on receiving water bodies, both in terms of water quality (reducing pollution), and water quantity (flooding).

Tree box filters. In certain soil and site conditions, tree box filters, which direct stormwater runoff from impervious surfaces for uptake by trees or shrubs, can be useful as aesthetically pleasing tools to infiltrate, treat, and take up stormwater runoff. With partial funding provided by CBEP, the Town of Brunswick installed tree box filters to help absorb and filter stormwater runoff at curb cuts along Maine Street.

Following a heavy downpour, stormwater runs off conventional pavement (at right), while the porous pavement sidewalk (at left) has no standing water.

Green roof at the East End School in Portland.

Green Roofs. Demonstration sites for green roof technology have been constructed in several places around Casco Bay, although information about their performance and maintenance needs is limited. A small green roof was installed on top of the University of Southern Maine's new LEED – Gold certified Wishcamper Center. In addition to its aesthetic benefits, the Wishcamper green roof drains water into a cistern that provides water for toilets throughout the facility. A similar modular green roof was built on Portland's East End School.

Subsurface Gravel Wetland. The University of New Hampshire Stormwater Center tests new and existing stormwater mitigation structures and practices, including several LID approaches, and studies their effectiveness at mitigating stormwater runoff. The center has provided information about the performance and maintenance of different structures year round, with particularly valuable insights about cold climate performance. One of the LID structures evaluated at UNH, subsurface gravel wetlands, was found to be particularly effective at removing pollutants and reducing peak flows (quantity) of stormwater following rain or snow melt. A combination of crushed rock, wetland soils, piping, and vegetation, subsurface gravel wetlands, and other bioretention systems, are recommended in the Maine Coastal Program's LID Guidance Manual for Maine Communities. (Additional information about the UNH Stormwater Center can be found at www.unh.edu/erg/cstev.)

Porous pavement. Porous pavement is a LID design that mimics the performance of standard asphalt for transportation purposes, while infiltrating stormwater runoff to protect water quality. Porous pavement applications are in place in several locations around Casco Bay, including Maine Mall Road in South Portland, at the Wishcamper Center, and at the Freeport Community Center.

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