Salt in Stormwater Degrades Urban Streams

Ongoing monitoring by the Long Creek Watershed Management District sheds light on how winter salt degrades the health of urban streams, and demonstrates that focused stormwater management can improve urban streams.

Urbanization Diminishes Water Quality of Local Streams

As urbanization increases, surface water quality in local streams typically declines. This "urban stream syndrome" typically results from a complex mix of factors that includes pollutants from the developed landscape, changing stream flow conditions, increased channel erosion, habitat destruction, clearing of riparian vegetation, and increasing water temperature.

The Long Creek Watershed Management District (LCWMD) works to improve water quality in the Long Creek watershed on behalf of 130 participating landowners that each face permit obligations under the Clean Water Act to address stormwater pollution.

A key part of LCWMD's work involves monitoring the conditions in Long Creek. This effort has become one of the most comprehensive urban stream-monitoring programs in the Northeast. Issues observed in Long Creek hold lessons for other urban watersheds in the Casco Bay watershed.

Winter Salt Poses Challenges, but Impacts Vary

Tons of de-icing products ("road salt") of various formulations are applied each winter to roads and parking areas within the Long Creek watershed. Until recently, little was known about the impact these products might be having. Nearly continuous water-quality monitoring in Long Creek has provided insight

into how and when salt washes into the stream, and what impacts it may have on organisms there.

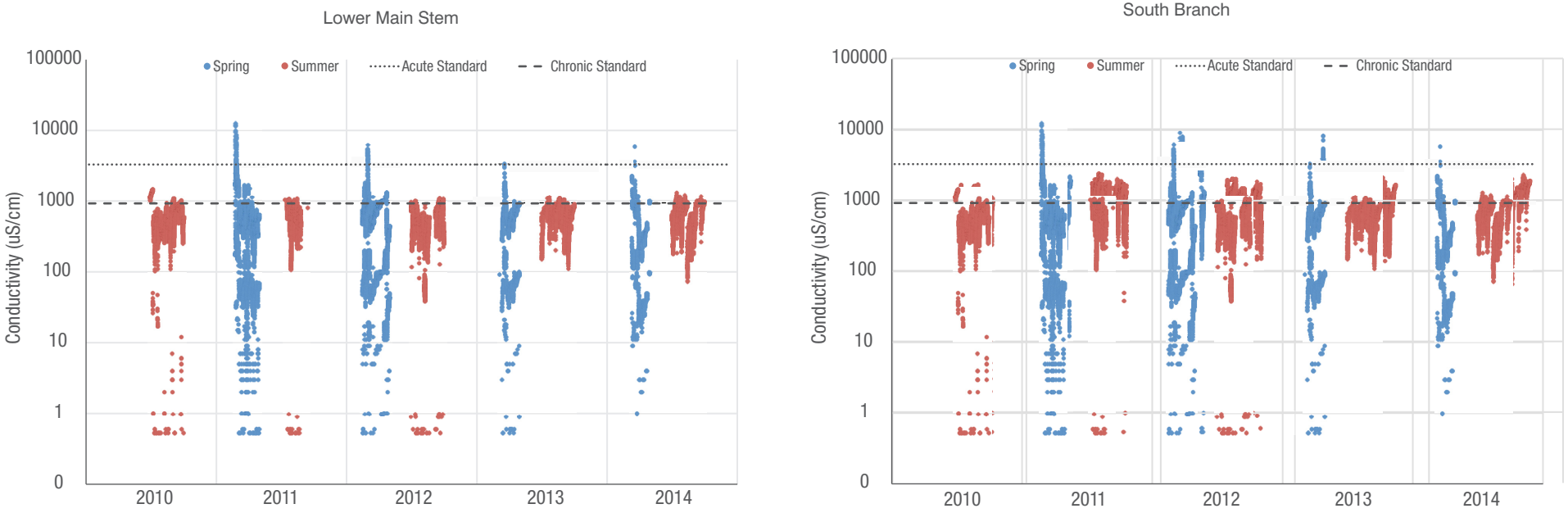
The monitoring station that LCWMD manages on the Creek's lower main stem receives runoff and stream flow from 62 percent of the Long Creek Watershed. Overall, 18.7 percent of the area that drains to this point is impervious, with 4.8 percent in roads and 10.2 percent in parking areas (with the remainder attributable to buildings, pathways, and access areas).

A second monitoring station, only a few hundred yards away, lies on the South Branch of Long Creek. The smaller area draining to that monitoring station, which includes parking lots near the Maine Mall, contains. 54.9 percent impervious cover, of which 8.7 percent is in roads, and 30.5 percent in parking area. Equally important, the area includes some highly permeable, sandy soils that allow stormwater to readily enter the groundwater.

Federal and state water-quality standards restrict the level of chloride in freshwater streams, with standards both for short-term (acute) and long-term (chronic) exposure. Aquatic organisms may succumb to salt concentrations when exposed over a period of days even though they might survive shorter periods of exposure.

At both monitoring stations, the highest salt concentrations are observed during snow melt in the winter and spring. Levels then often exceed acute toxicity levels for freshwater organisms (although many aquatic insects are still dormant then, which may reduce the impact of short-lived spikes in salt).

De-icer residues appear to have different effects at the two stations despite their proximity. On the Lower Main Stem, conductivity levels that exceed chronic exposure limits are rare and short-lived. Levels that exceeded chronic exposure limits at least once occurred on 16 percent of summer days from 2010 through



Spring (February-April) and summer (July-September) conductivity measurements from continuous monitoring. Conductivity is an indirect measure of salinity and chloride concentration.

2013, but lasted all day for only 5.6 percent of days. At the South Branch station, high conductivity days are the rule, with elevated levels seen on 81 percent of summer days. High levels last all day 56 percent of days.

Elevated levels in the South Branch are caused in part by the high proportion of parking and road areas upstream, but local soils may exacerbate problems. The area contains lenses of sandy soils interbedded with less permeable silt and clay layers. The sandy soils allow snow melt to enter the groundwater while the silt and clay layers slow the water's travel. As a result, relatively salty water may take months to reach the stream.

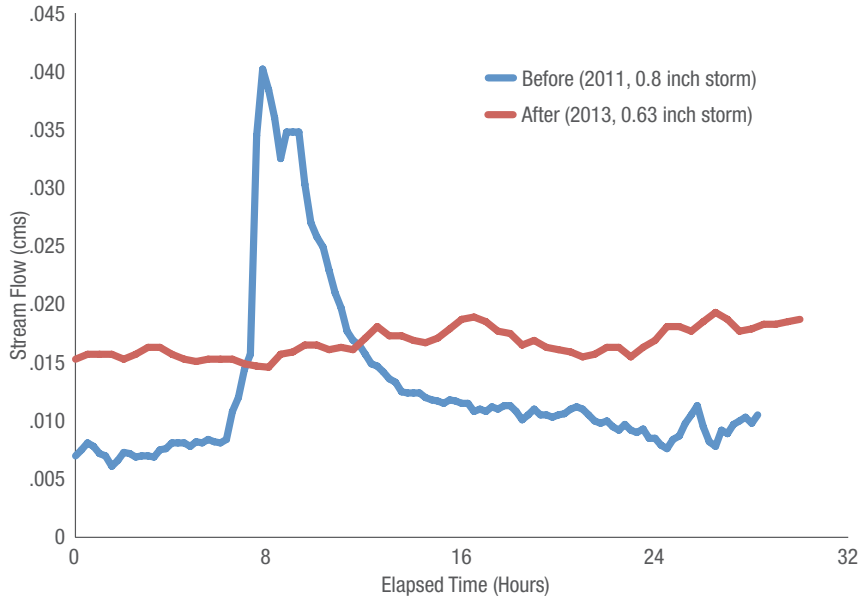
Freshwater organisms living in the South Branch are thus exposed to high levels of salt for long periods of time, exacerbating potential toxic effects. Such high salt levels alone could prevent recovery of stream health.

Effort to Address Stormwater Provides Benefits

Blanchette Brook, a headwater stream of Long Creek, has become a focus of restoration efforts. The area draining to its monitoring station (just above where the Brook meets Long Creek) totals 431 acres, 17.7 percent classified as impervious. Despite a moderate level of imperviousness (compared to the rest of Long Creek), the brook had serious water-quality problems in 2010. Water temperatures were high, dissolved oxygen levels were low, the stream was often choked with algae, and the aquatic insect community was degraded.

In 2011 and 2012, LCWMD installed stormwater control facilities—creating a "gravel wetland", planting riparian vegetation, and completing a stream restoration project that addressed habitat deficiencies in the stream. The stream responded well to these cumulative measures.

In 2010, before the restoration began, minimum dissolved oxygen levels recorded from April through September fell below 5 mg/l (the state "Class C" standard) on 33 percent of days. The comparable figure for 2013 was just 5.7 percent. In 2010, the average daily dissolved oxygen level over the six-month period was only 5.5 mg/l; by 2013, that level climbed to 6.7 mg/l, well above levels of concern for most aquatic organisms.



Flow Data, North Branch of Blanchette Brook

The Blanchette Brook restoration was also highly successful in slowing stream flows following precipitation while increasing flow at other times. Comparison of flows following a storm in 2011 and 2013 showed a clear change in how the stream responds to storms. In 2011, stream flow spiked within a few hours of a storm's beginning. No similar increase was evident in a similar storm two years later.

These physical and chemical changes have benefited the organisms living in Blanchette Brook. Maine DEP uses data on the composition of stream invertebrates (primarily insects) to evaluate stream health (see the Inland Water Quality Indicator). In both the 1999 and 2010 storms, the invertebrate community at a site on Blanchette Brook was so poor that the stream was judged to be in "Non-Attainment" of water-quality standards. By 2013, following the restoration effort, the invertebrate community had recovered to the point that it met "Class C" criteria, a significant improvement.

For additional references and information, please view the Bibliography of the full *State of the Bay 2015* report at www.cascobayestuary.org/state-of-the-bay-2015.