



Compounding Effects of Salinity and Compaction on Hydraulic Properties of Roadside Stormwater Control Measures

Lucy Archibald¹, Ganesh Khatei¹, Josh Caplan², Scott Van Pelt³, Paolo D'Odorico⁴, and Sujith Ravi¹

¹Department of Earth and Environmental Science, Temple University, Philadelphia, United States of America

²Department of Architecture and Environmental Design, Temple University, Ambler, United States of America

³United States Department of Agriculture, USDA-ARS, Big Spring, United States of America

⁴Department of Environmental Science and Policy, University of California, Berkeley, United States of America

Stormwater control measures (SCMs) such as retention basins, bioswales, and bioinfiltration systems are used to reduce peak flows and remove pollutants from stormwater in temperate urban landscapes. However, the application of de-icing salts to roadways can substantially increase the salinity of stormwater basin media (i.e., engineered soil), likely impacting the physical properties of these soils. Further, SCM soils can become moderately compacted, potentially altering the extent and effects of salinization on soil physical properties. Although many studies have documented the high salinity of roadside soils in winter, the effects of salinity on soil hydraulic properties is not well understood, especially in the context of urban stormwater basins. Here, we compared the water retention properties (spanning pressure potentials of -10 to -1,000,000 hPa) of salinity-affected stormwater media (1-100 dS m⁻¹, using Na⁺ and Mg²⁺ salts) that was either uncompacted or compacted. The effects of salinity on both matric and osmotic potential included shifts in the plant-available range with the magnitude depending on a combination of salt type and concentration. We attribute these changes to salinity inducing shifts in both surface tension and pore size distributions. Further, compaction increased the severity of salinization under low salinity conditions but not high. Climate change may increase the number and intensity of snow events in many temperate urban regions, which may increase salt loads to stormwater control measures, exacerbating the aforementioned effects.