Evaluation of the Quality and Significance of Stormwater Discharge to Sediment Quality in Urban Waterways

Philip Spadaro[1], Luca Sittoni[2], Christopher Moody[3], Katherine Cronin[4], Jason Dittman[5], David Profusek[6], and Samantha Bowerman[7],

[1]Senior Scientist and Managing Director, The Intelligence Group, LLC,
1200 Westlake Avenue North, Suite 809, Seattle, Washington 98109, USA
[2]Researcher, Deltares, Boussinesqweg 1, 2629 HV Delft, Netherlands
[3]Senior Scientist, The Intelligence Group, LLC,
1001 SW 5th Avenue, Suite 1100, Portland, Oregon 97204, USA
[4]Researcher, Deltares, Boussinesqweg 1, 2629 HV Delft, Netherlands
[5]Senior Scientist, The Intelligence Group, LLC,
443 North Franklin Street, Suite 220, Syracuse, New York 13204, USA
[6]Senior Scientist, The Intelligence Group, LLC,
443 North Franklin Street, Suite 220, Syracuse, New York 13204, USA
[7]Project Scientist, The Intelligence Group, LLC,
1200 Westlake Avenue North, Suite 809, Seattle, Washington 98109, USA

Phone: +01-206-390-2842
E-mail: pspadaro@intell-group.com

Introduction: Stormwater from urban areas discharges to waterways around the world through outfalls and direct run-off. The chemistry of these discharges has been much studied yet no clear consensus exists on how to estimate the possible impact on sediment quality. The objective of this work is to identify which chemicals of concern (COCs) are commonly found in urban stormwater and then evaluate the quality and significance of that discharge to the adjacent waterways. Additionally, a methodology for estimation the impact on sediment is presented.

Methods: Stormwater sampling from urban areas in selected North American cities is summarized to characterize the following COCs associated with stormwater: cadmium, chromium, copper, lead, zinc, total polycyclic aromatic hydrocarbons (PAHs) and bis(2)-ethylhexylphthalate (BEHP) (as a representative of phthalates) and polychlorinated biphenyls (PCBs). Several methods to estimate the flux of COCs from stormwater to site sediment are evaluated. An approach is selected that includes calculating the mass of the COCs associated with the runoff and using a series of models to identify the most likely depositional area affected by the outfalls and resultant sediment bed concentrations. The depositional areas for stormwater loadings reaching the river were modeled using a 2D hydrodynamic and sediment transport model. Concentrations of COCs in river sediment that could result from urban stormwater loading are predictively modeled using a 1D mixing model. The modeled sediment concentrations can be compared to existing measurements of sediment quality in the delineated depositional area or used as a screening tool to evaluate compliance with sediment quality goals or the potential for recontamination.

Results/Lesson Learned. The predicted sediment COC concentrations attributed to urban runoff are generally on the low end of the spectrum of threats to sediment quality. However, the particulars of source strength and depositional regime, as well as transport processes post deposition can have a dramatic effect on the ultimate impact on sediment quality. Thus urban stormwater discharges need to be evaluated individually to assess the potential for adverse effects on sediment quality including recontamination of previously remediated areas.