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Stephen H. Jones
University of New Hampshire

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BACTERIAL AND NUTRIENT DYNAMICS IN STORMWATER CONTROL SYSTEMS IN NEW HAMPSHIRE

Principal Investigator: Dr. Stephen H. Jones

Descriptors: Bacteria, nutrients, storm water management, contaminant transport, public health, water quality standards

Problem and Research Objectives:

Runoff from impervious surfaces in urban areas contains significant amounts of hazardous contaminants, including microbial pathogens/indicators, heavy metals, and toxic organic compounds like oils and hydrocarbons. Such contaminants pose threats to humans directly during recreation uses of surface waters and seafood consumption, and aquatic life through chronic and acute exposure to toxic concentrations. Water quality in New Hampshire's coastal areas is negatively affected by stormwater, especially the bacterial contamination that prohibits shellfish harvesting. However, the sources of contaminants are unknown, as are the fate and transport of contaminants to surface waters. Suspected sources are inappropriately cross-connected sanitary sewage lines, leaking lines, and non-human sources of non-enteric pathogens. In many studies, bacterial indicator contamination during dry periods and in runoff where no human sources of contaminants can be identified has been attributed to animal sources. In numerous recent studies in New Hampshire, evidence for animal sources has not been apparent and elevated concentrations of indicator bacteria following storms at some locations appeared to be independent of any identifiable sources. The hypothesis for this study is that low levels of bacteria giving positive indicator tests can multiply in the environment under favorable (warm, moist, plentiful nutrients) conditions in stormwater control systems during dry periods, and give misleading indications of fecal contamination in storm effluent water.

The study sites include two wet ponds and two vegetated swales in coastal New Hampshire that have been the subject of a previous study. Sampling will occur at all four sites around eight storms of >0.5"/24 h during the study period. In addition to storm event sampling, dry weather sampling will be conducted between storms (nine times) to provide base flow information on contaminants and conditions within the study areas. All samples will be analyzed for bacterial indicators used for classifying surface waters in NH (fecal coliforms, Escherichia coli and enterococci). In addition, all samples will be analyzed for dissolved nitrogen (nitrate/nitrite, ammonium, dissolved organic nitrogen), dissolved organic carbon, total phosphorus and suspended solids. At sites with elevated microbial indicator levels, samples collected during at least one event per season will be analyzed for some common bacterial pathogens, including Pseudomonas aeruginosa, Klebsiella sp., Salmonella sp. and Escherichia coli. The most direct benefit of this project will be an increased understanding of the nature of one of the most important existing sources of bacterial contaminants to surface waters. This study will help to determine if permanent stormwater control systems are effective at removing bacteria and nutrients, or are actually sources. The data would also provide information needed for development of new technologies for treating stormwater, if necessary. Even though bacterial contamination results in the closure of shellfish beds and restricts recreational uses of surface waters, the actual public health threat of contamination implied from elevated concentrations of indicator bacteria is unclear. This study will provide results on the presence of bacterial pathogens in addition to indicator bacteria to shed light on the public health question.