The aim of this thesis is to examine, develop, and assess innovative best management practices (BMPs) in stormwater management for pollutant reduction, flood control, and environmental sustainability. Previous research has clearly shown that urban stormwater runoff quickly transports pathogens, metals, sediment, and chemical pollutants to receiving waterbodies, resulting in the degradation of receiving waters and disruption of ecological networks. In response to this growing concern, regulatory agencies, such as the Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP), have set forth regulations aimed at protecting and restoring waterbodies. Currently, many stormwater management systems do not provide sufficient nutrient reduction to meet growing regulations; thus, there is a clear need to develop additional BMPs to enhance nutrient reduction.

Firstly, this thesis provides an overview of BMPs used in urban regions across the globe to create networks of low impact development (LID), with a focus on policy analysis. Chapter 2 examines the regulatory policies in areas of the United States, Europe, Asia, and Australia from a federal, state, to local perspective in order to pinpoint what policies are supporting the shift from gray cities to green cities. Gray cities are cities comprised mainly of impervious surfaces, with little regard to the ecological health and hydrologic characteristics of the area. Green cities utilize LID to mimic pre-development hydrologic and ecological characteristics, resulting in a city that is both environmentally sustainable and offers many ecosystem services. The results of the global policy analysis identified the policies and other factors, such as funding and public involvement, necessary to facilitate the shift from gray cities to green cities and support the widespread implementation of LID.

Secondly, this thesis provides a comparative analysis of three stormwater wet detention ponds, which all contained floating treatment wetlands (FTWs). FTWs are a new BMP, used to enhance nutrient reduction rates in stormwater wet detention ponds. Both episodic (storm event) and routine (non-storm event) sampling campaigns were carried out at the three stormwater wet detention ponds located in Gainesville, Ruskin, and Orlando, Florida. The comparative analysis of the three stormwater wet detention ponds was based on two perspectives. The first analysis, found in Chapter 2, focuses solely on the nutrient reduction potential of FTWs and how the installation of FTWs can be used to improve nutrient reduction rates in stormwater wet detention ponds. The second analysis, found in Chapter 3, focuses on the interaction between nutrients, microcystin, and chlorophyll-a in the stormwater wet detention ponds before and after installation of the FTWs. FTWs were found to have a significant impact on nutrient reduction rates in the three stormwater wet detention ponds, with total nitrogen (TN) reduction rates reaching 33% at the Ruskin pond during storm events and total phosphorus (TP) reduction rates reaching 71% at the Gainesville pond during storm events. Moreover, microcystin concentrations were found to have a negative correlation with nutrient concentrations, specifically total phosphorus, for both storm and non-storm events across all three ponds.
The public is welcome to attend.