Campus Sustainability Week 2011

Ravine Romp and Tour of Storm Water Best Management Practices

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Dr. Peter J. Wampler

Department of Geology

Introduction and Overview

Environmental sustainability and storm water runoff is increasingly becoming a focus at many universities and cities throughout the United. Since construction of Grand Valley State University's (College's) Allendale Campus began in 1960, the infrastructure has steadily increased to accommodate a growing student population. By 2004, this growth had resulted in roughly 170 acres of impermeable surfaces, such as parking lots and walkways (Womble and Wampler, 2006). When precipitation falls onto these impermeable surfaces, runoff is rapid and abundant. Historically much of the runoff has been collected in pipes and directed toward the ravines east of campus. This practice has resulted in severe erosion, water quality degradation, and slope stability problems in the ravines. Initial baseline data has been collected (Snyder et al., 2008; Wampler, 2009).

In order to understand the impacts of urbanization at GVSU it is useful to think in terms of a runoff hydrograph. A hydrograph (graph of water flow or height versus time) for a watershed with little or no urbanization, or few impermeable surfaces, has broad peaks which occur with a significant time lag between the rain event and the peak flow. The time between the precipitation event and the peak flow is referred to as the lag time (Figure 1). Urbanized watersheds, such as those that have been directed toward the ravines, have very short lag times and high peak flows.

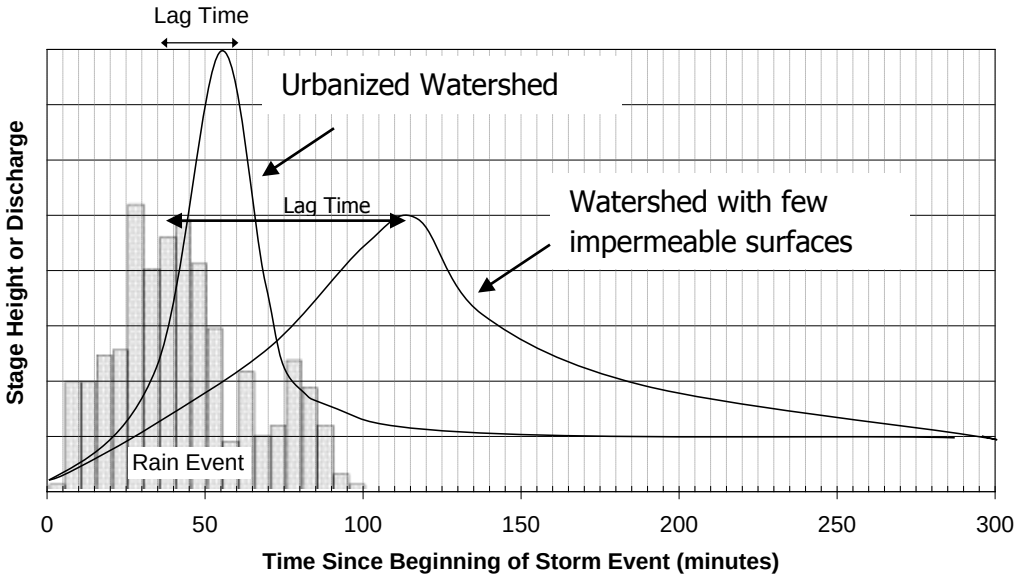

Figure 1. Example hydrograph showing lag time and the affect of urbanization on a typical runoff hydrograph.

Lag times in the ravines near GVSU, into which storm water runoff pipes are directed, range from a few minutes to several 10's of minutes. Lag times for Sand Creek, a non-urbanized stream located northwest of GVSU, typically range from 100's to 1,000's of minutes. An example of the difference in hydrographs can be seen in the response to an intense rainfall (~2.25 inches in about an hour) event that occurred on July 17, 2006 (Figure 2). The lag time for lower Little Mac ravine was approximately 50 minutes, while Sand Creek experienced a lag time between 250 and 1,400 minutes.

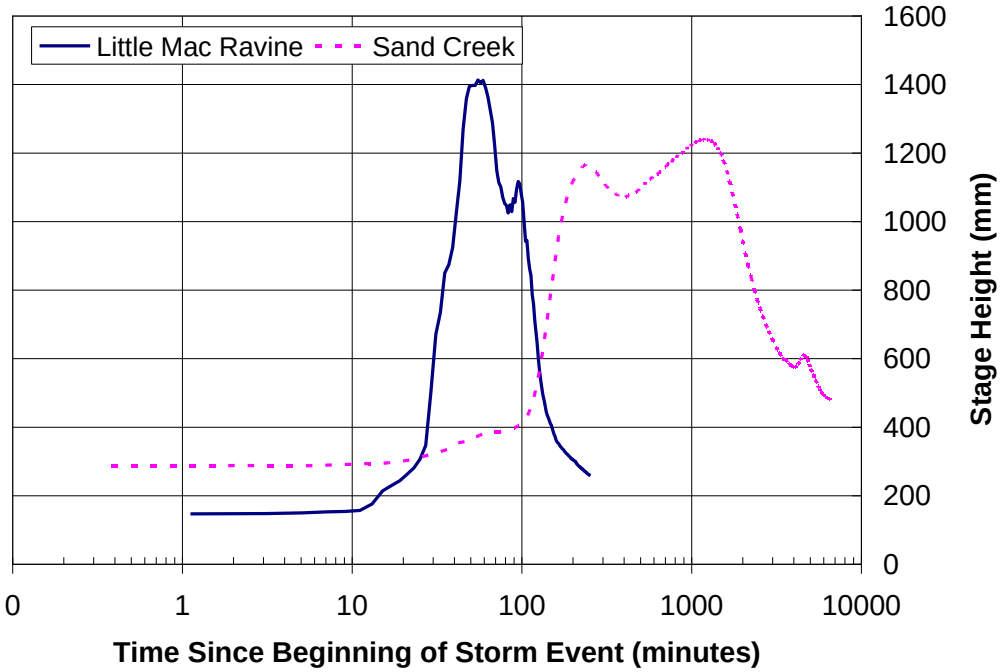

Figure 2. Hydrographs for stream gages located at Sand Creek and Little Mac ravine during a rain event that occurred July 17, 2006.

In order to increase lag times and decrease runoff volumes at GVSU, it is necessary to mimic the non-urbanized conditions of Sand Creek Watershed by increasing opportunities for infiltration and water detention. GVSU Facilities have already made great strides toward this goal by incorporating rain gardens and detention ponds into new construction, which have increased detention, infiltration, and lag times.

The Stormwater Footprint of GVSU

In 2007, GVSU faculty, the ad-hoc Storm Water Advisory Group (SWAG), and Fishbeck, Thompson, Carr, and Huber (FTCH) collaborated to draft a comprehensive storm water management plan for the Allendale Campus (FTCH, 2007). This plan included a robust hydrologic model for predicting runoff from various storm water release locations. Facilities improvements over the last several years have been designed to be "runoff neutral." This means that no additional runoff will be directed to the ravines in the process of new building construction. Several best management practices for storm water management have been employed including a large rain garden near the new turf building on the east side of campus. Through a grant from Facilities, flow data has been collected for this large rain garden (Figure 3). Data collected in 2009 suggest this structure is capable of reducing peak runoff rates by over 600 percent (Figure 4).

Figure 3 - Photo taken August 2009 of the rain garden and monitoring sites located near the Turf Building, GVSU.

Construction of the new library at the Allendale Campus of GVSU, has allowed almost 33 acres of impermeable parking lot, currently being directed to Little Mac Ravine (the ravine below Little Mac Bridge) to be redirected to the west. Water will be redirected to a large constructed wetland complex on Pierce Street. The initial phase of the wetland was completed in 2009 and the final phase was completed in 2011 (Figure 5).

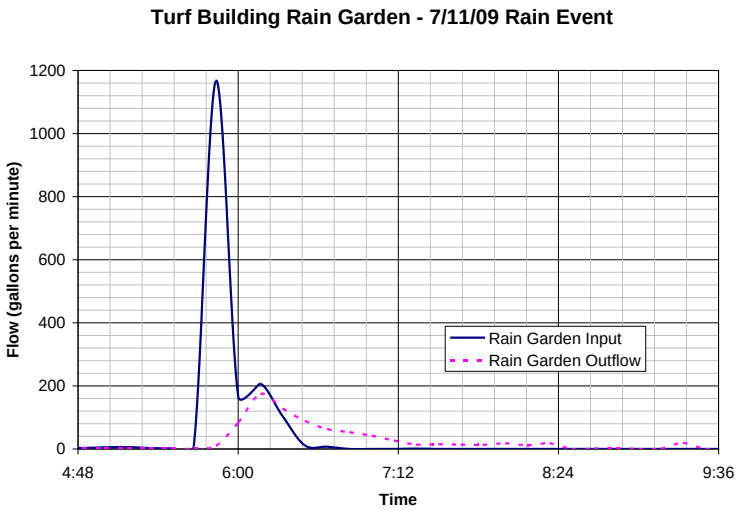

Figure 4 - Example of reduction flow as a result of the installation a large rain garden near the Turf Building, GVSU.

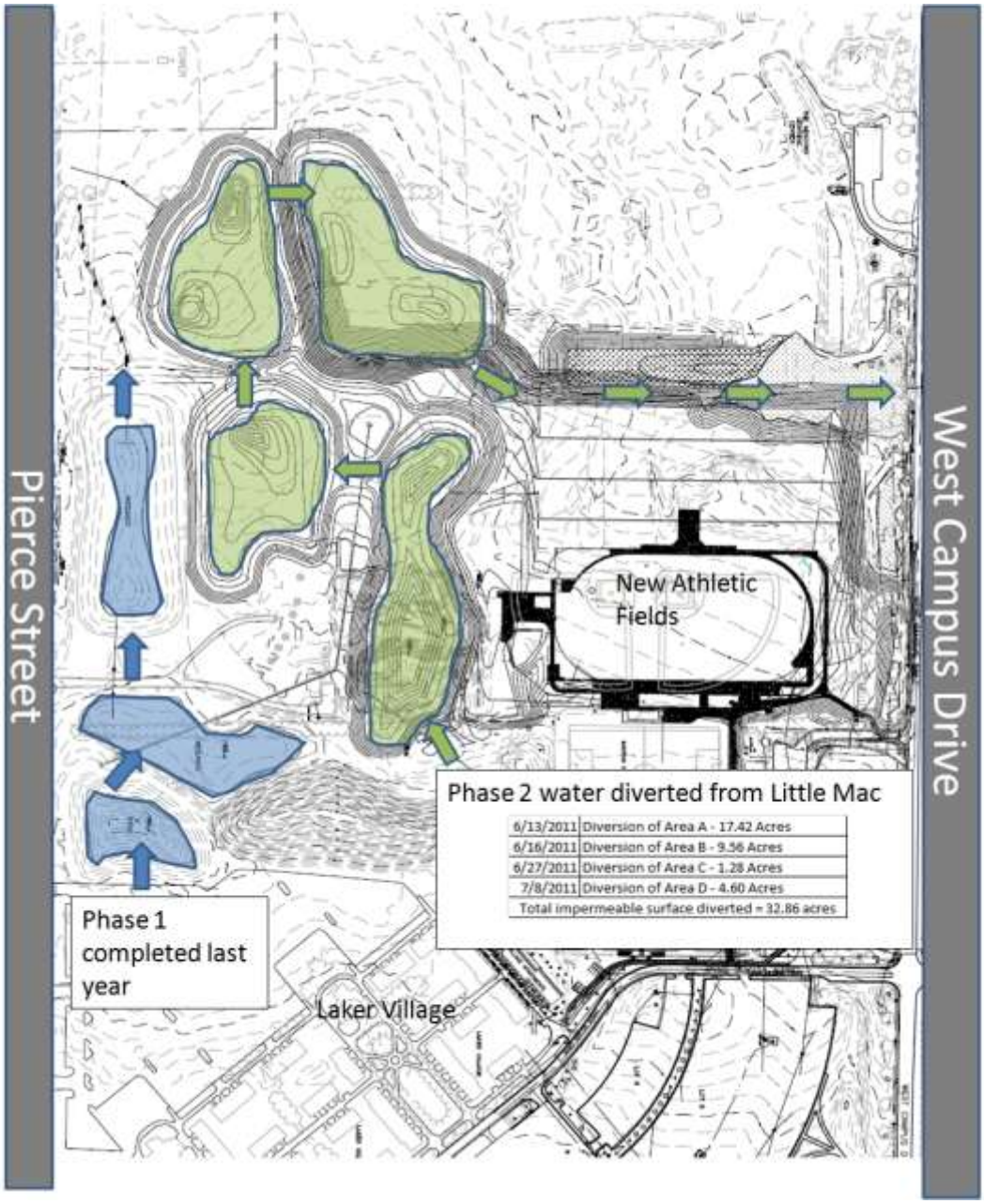

Figure 5 - Pierce Street Wetland Complex.

We will be discussing the runoff issues at GVSU in Kirkoff, then take a walking tour to observe some of these Best Management Practices in person. Below is a map the BMP's we will visit (Figure 6).

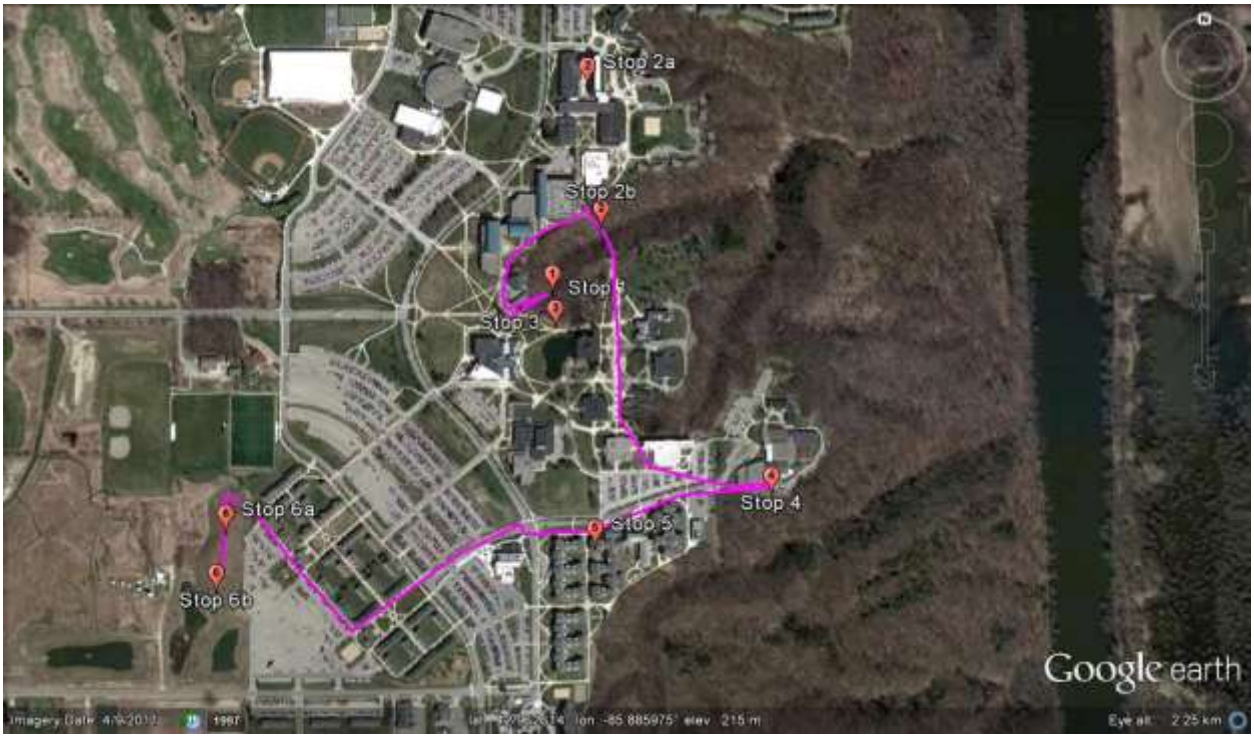

Figure 6. GVSU Sustainability tour stops.