Green Infrastructure & Stormwater Management CASE STUDY

Emory University Stormwater Master Plan

Location: Atlanta, GA
Client: Emory University
Design Firm(s): HOK Planning Group, Jordan Jones and Goulding
Landscape architect/Project contact: Teresa Durkin, ASLA
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Project Specifications

Project Description: The Stormwater Master Plan provided Emory University with the environmental planning, engineering and modeling tools needed to support the University's growth needs; simultaneously, it provides solutions to create practical, healthy and functioning campus environments. The process involved the development of advanced, GIS integrated models to analyze the capacity of the University's infrastructure under existing and future development conditions.

Based on this analysis, recommendations were developed to incorporate new low impact development strategies (LIDs) designed to restore natural hydrologic functions to this highly urban campus. The plan also established new policy, design guidelines and an implementation strategy to help the University achieve its environmental goals.

Project Type:
Institutional/education
A retrofit of an existing property

Design features: Bioretention facility, rain garden, bioswale, green roof, cistern, downspout removal, porous pavers, and curb cuts. With future development, collection of roof drainage would be a proactive measure that is especially applicable in light of Georgia's drought conditions and on-going water conservation initiatives. We recommend that Emory set a campus goal of providing at least 75 percent of its irrigation for established landscapes from harvested rainwater. Not only would this achievement reduce costs in the long run, it would also set an excellent example in resource conservation.

This project was designed to meet the following specific requirements or mandates: State statute, county ordinance, local ordinance

Impervious area managed: greater than 5 acres

Amount of existing green space/open space conserved or preserved for managing stormwater on site: greater than 5 acres. Emory University occupies 700 acres of the North Druid Hills neighborhood in the city of Atlanta, Georgia. The current campus is highly developed with many drainage basins exhibiting impervious land cover in excess of 50 percent. Aging campus utilities serve over 100 major buildings with about 7 million gross sq/ft of built space. The current Campus Development Plan will increase the campus facilities more than 50 percent over the next 20 years.

The campus land use is currently 48% impervious. This project protects all land classified as restricted land (26% of campus) such as stream buffers and floodplains, preserved land (22% of campus) such as areas with uniques ecological value, and conserved land (6% of campus) with unique cultural landscape such as the Quadrangle.

The regulatory environment and regulator was supportive of the project.

Did the client request that other factors be considered, such as energy savings, usable green space, or property value enhancements? The primary drivers for this Stormwater Master Plan were regulatory compliance and the University's commitment to environmental stewardship, as evidenced by the emphasis placed on consideration and application of sustainable stormwater management practices and "green" infrastructure.

Cost & Jobs Analysis

Estimated Cost of Stormwater Project: >$5,000,000 (Public funding: Not available)

Related Information: This is a masterplan project, so the cost of the recommended LIDs is for the entire campus to be built over time - both as retrofit projects and as part of new development plans as defined in the 2005 Master Plan Update.

Was a green vs. grey cost analysis performed? No. The plan was intended to provide an integrated strategy to restore and sustain the hydrologic balance of the campus by seeking to:

1. Manage stormwater proactively
2. Focus on subbasin/watershed
3. Improve drainage infrastructure
4. Implement LIDs) for water quality and volume reduction
5. Seek stormwater harvest and reuse opportunities

Cost impact of conserving green/open space to the overall costs of the site design/development project: Emory would realize significant benefits from the implementation of these recommended stormwater management projects. If a majority of the stormwater LIDs were implemented and the high value projects were constructed the result could be a 50 percent reduction in stormwater runoff volume.

The implementation of the recommended LIDs and the conservation and preservation of open space allows the future campus effective impervious percentage to approach the 25 percent impervious threshold that represents degrading urban effects on receiving waters. The benefits of this reduction in stormwater volume include a decrease in pollutant load on the streams, less erosion on the local stream banks, and a reduction in flooding on campus. Additionally, the capital improvement costs and maintenance of the campus drainage system will be reduced due to the lower capacity demand for conveyance and detention.

Cost impact of conserving green/open space for stormwater management over traditional site design/site development approaches (grey infrastructure)? Did not influence costs. A primary goal of these stormwater projects and justification for the additional costs is an improvement in the local environment. To achieve the overall stormwater improvement necessary to maintain the University's high standards of environmental stewardship as well as prudently staying ahead of foreseeable future regulatory requirements required a new approach. The primary function of the stormwater projects recommended is to increase infiltration of precipitation, resulting in a reduction of untreated runoff reaching the receiving streams. The result is an engineered but effective way to restore natural stormwater processes to an urbanized environment.

Stormwater project locations were chosen on the basis of:

- Ease of land use conversion;
- Future construction making a stormwater project cost effective; and
- Where there remained available space to store stormwater drainage for infiltration.

The total projected cost estimate for all LID projects directly related to the 2005 Update is $56.7 million over the next 16 years (2009-2025). The total projected cost of stormwater LIDs projects not tied to a specific development project (including $10.2 million for the eight high value stormwater projects) is $32.9 million. Finally, all of the infrastructure improvement projects (such as detention basun retrofit) are a relatively small fraction of the total projected cost at a total of $540,000. The total projected cost of all recommended stormwater projects is $90.2 million. This would be about 2.25 percent of the projected 2005 Master Plan Update cost of $4 billion over the next 16 years (2025).

Rainwater collection has been suggested in many of the high value project scenarios and introduced in the LID Strategies; it could be incorporated as the campus moves forward with

future development. Rainwater collection and reuse has become an especially popular practice as a result of frequent drought conditions. If Emory made it a common practice to collect the relatively clean rainwater from roof drainage, it could reduce campus water consumption considerably. Given the 35 acres of proposed Campus Master Plan roof area and an annual rainfall average of 50 inches, Emory could "recycle" more than 47,000,000 gallons of water annually, which equates to over $180,000 purchased from DeKalb County.

Number of jobs created: Not available

Job hours devoted to project:

Planning and Design: 2,000 hours
Construction: Not available
Annual Maintenance: Not available

Performance Measures

Stormwater reduction performance analysis:

LIDs were identified that would create a 50 percent reduction in stormwater runoff volume campus wide. The future effective imperviousness of the campus would be reduced from its current 48 percent to 30 percent for 85 percent of the storms in an average year. The benefits of this reduction in stormwater volume include a decrease in pollutant load on the streams, less erosion on the local stream banks allowing for restoration projects to be implemented and a reduction in flooding on campus.

Community & economic benefits that have resulted from the project: The 181.77 acres of forested land on the Emory Campus are important because they provide a rare example of natural lands in a sea of urbanization and an opportunity to contribute to the science of restoration ecology. Good stewardship and restoration practices are vital to protect the ecological services and biodiversity of these natural lands. There is a need in the community to do the work of restoration, to learn best management practices, and to teach and inform.

The natural lands of Emory's campus are an ideal setting for these missions. Its problems mirror the ecological stresses of the whole region. Development of a coherent plan for the entire property, restoring ecological integrity, and setting high goals for a deep knowledge base can answer these regional needs.

Equally important, with the increasing pressures on the natural landscape—both global and local— conservation alone cannot preserve and protect the biodiversity of the preserve. The multiple threats of development pressures, stormwater mismanagement, invasive exotic flora, and overabundant and destructive fauna, such as deer, have degraded the natural plant communities and habitats of the site.

Land preservation and ecological restoration must work together along with programs that support a long term commitment to sound land management. A logical next step to managing the high quality conservation lands already assembled is to develop restoration programs and to use them as the basis for future education programs. This goal defines the main audience as restoration students and professionals, as well as paid or volunteer land stewards.

Professors and students alike have already recognized the importance of these lands and have been using the sites as living laboratories. A long term commitment to landscape-scale restoration and applied research in Restoration Ecology are the next steps that must be institutionalized at Emory. The significant ecological diversity found throughout the Lullwater Preserve can provide a wide variety of opportunities for ecological restoration at many different scales. An increasingly sophisticated program to restore every plant community and habitat on the site will allow Emory to be the regional leader in demonstrating not only how to protect our stream corridors and their adjacent areas, but also how to take care of these lands once protected.

Additional Information

Links to images: Images, charts and drawings can be provided upon request by contacting Teresa Durkin, RLA at teresa.durkin@hok.com

Principal Findings

This Stormwater Master Plan yields the following important findings:

1. The Emory Campus lands consist of significant natural resources of high quality forested land and stream habitat; these resources are also important to the health of the overall watersheds. Stormwater runoff is directly impacting the ecological health of these areas – disturbing vegetation, lowering the water table, and causing erosion and sedimentation of the receivingstreams and Candler Lake. Research has shown that an impervious cover of more than 25 percent of a watershed's total area generally results in severe degradation of the downstream receivingwaters (Schueler 1994). The current campus impervious cover is approximately 46 percent.
2. In the next decade, planned development projects will occur mostly in areas that are already developed. The total increase in impervious surface associated with the 2005 Campus Master Plan Update (12.6 acres) represents a two-percent increase over the existing campus imperviouscoverage. Although the 2005 Update does not significantly worsen the Campus stormwater conditions, current conditions are ecologically unsustainable.
3. Conveyance capacity in a significant amount of the campus drainage system exceeds 75 percent of pipe capacity during the standard design storm (25-year, 24-hour), which

indicates a need for additional pipe capacity or a decrease in runoff. Moreover, the current system does not provide sufficient water quality treatment volume for the 1.2-inch rainfall runoff. Finally, the detention capacities for downstream channel bank protection (1-year, 24-hour storm) and for flood protection (25-year, 24-hour peak) are also lacking in most of the sub-basins, which is confirmed by reported flooding events and by the observable campus stream bank erosion.

4. Future new development and redevelopment projects on campus must meet the DeKalb County (GSMM) water quality and quantity design guidelines. Compliance is a challenge because the Campus has little open land available to construct conventional detention facilities. The University must adopt new land use practices and apply LIDs to reduce runoff volume and attenuate peak discharge.
5. If all stormwater LIDs proposed in this Master Plan were implemented, the effective campuswide impervious surface would be decreased from 48 percent to 30 percent in the future campus development scenario. This reduction would reduce runoff volumes and velocities to the receiving streams and improve their overall ecological health. The core campus, consisting of the Peavine Creek subbasins, can realize the most benefit of the effective impervious reduction from implementation of the LIDs. The analysis indicates that effective impervious percentages of many of the primary campus drainage subbasins could be reduced to under the 25 percent impervious benchmark.