Green Infrastructure Conceptual Plan For Catchment 3 at the Atlanta University Center

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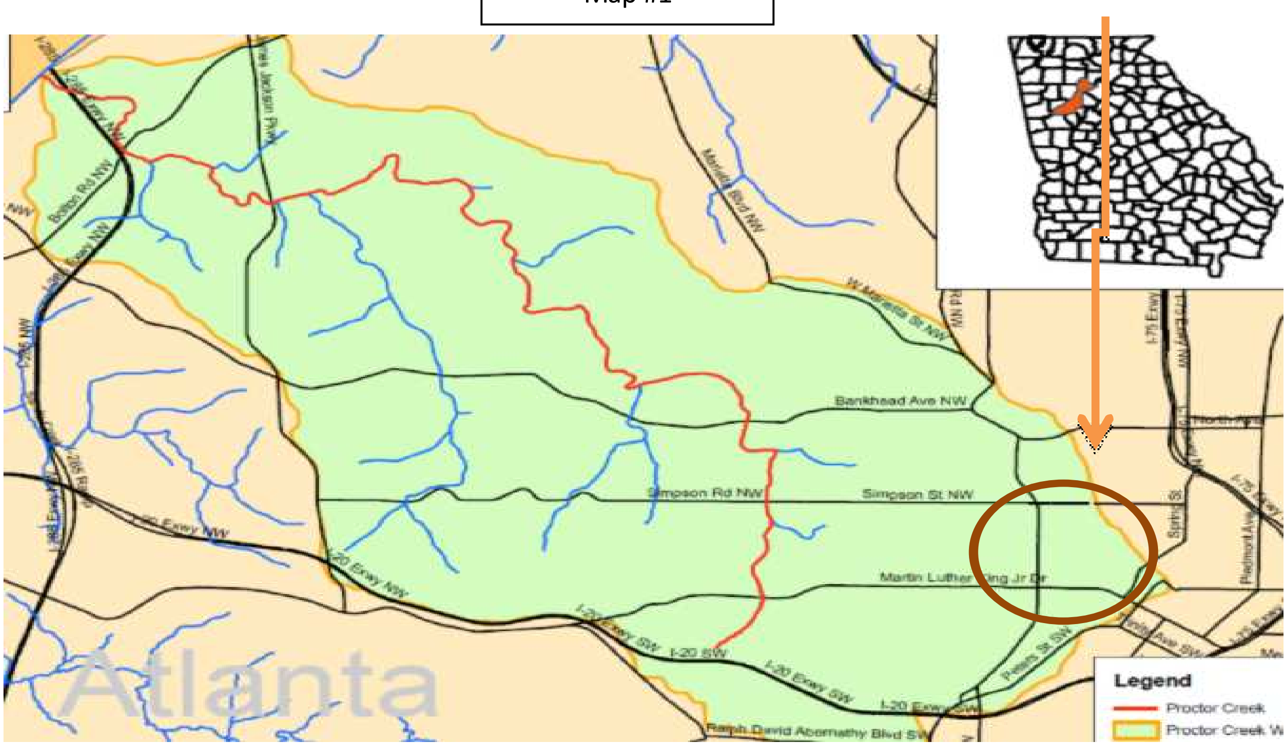
Introduction

This report focuses on Catchment 3 on the eastern side of Subwatershed A which is dominated by the Atlanta University Center campuses (Map #1). The area is a highly irregularly shaped polygon (Map #2). Our goal was to capture 7.7 million gallons during the 100-year rain event. Two-thirds of the area is outside of the boundaries of the Atlanta University Center, but the stormwater run-off from the 68.7 acre total area does flow on to the AUC campuses and feints downstream, toward the lower elevation communities of Vine City, English Avenue, and Washington Park. The boundaries are Northside Drive, Atlanta Student Movement Street (formerly known as Fair Street), Larkin Street, and Walker Street areas. From the 68.7 acre study area, our analysis excluded 14.6 acres, the majority from Cleopas R. Johnson Park on Northside

Drive.

Map #1



This narrates an overall objective of developing a conceptual plan to capture 22.4 million gallons of stormwater from Atlanta University Center campuses including Spelman College, Clark Atlanta University, Morris Brown College, and the Interdenominational Theological Center and the Atlanta Housing Authority as well as the higher elevation areas that drain runoff downhill to the AUC campuses.

Although our initial goal was to capture 7.7 million gallons of runoff, our study area was extended to include major public/private land holdings east of Northside Drive.
We were able to capture 9.2 million gallons of runoff from Catchment 3 after the group's data analysis.

Background

The team was a part of a collaborative effort to develop conceptual plans to mitigate stormwater management problems in Subwatershed A of the Proctor Creek/North Avenue Watershed (PNA). This 199 acre Subwatershed, dominated by Atlanta University Center and surrounding public and private properties, was divided into nine Catchment areas. Students studied each catchment area and recommended green infrastructure with which to retain and detain stormwater. The study areas include four at Clark Atlanta University, one at Interdenominational Theological Center, two at Morris Brown College, one at Spelman College and one at the Atlanta Housing Authority.

We are one of nine student/faculty/staff groups working with business, government, and non-government agencies to alleviate flooding issues. Students prepared Conceptual Plans that rely on green infrastructure practices appropriate to each Catchment. Green Infrastructure is a cost-effective, resilient approach to manage storm water impacts that provides benefits to the community.

The focus of the Catchment 3 project includes Larkin Street, Walker Street, Bailey Street, Northside Drive, Trenholm Drive, and Atlanta Student Movement Boulevard, formerly named Fair Street. They are located at both high and low elevations in the study Catchment which drops from 1,084 ft. at the eastern edge to 1,024 ft. at the western edge.

Over time it has become evident that during heavy rainfall, massive flooding occurs as the rain drains through a combined sewer system into downstream lower elevation areas such as Larkin Street, across from the Artists Square Complex. Public health problems related to flooding are greatly magnified when rains from all of Subwatershed A converge into a combined sewer system, and rush into downstream residential neighborhoods in the watershed at elevations lower than 865 ft., some 219 ft. lower than parts of Catchment 3. The stormwater carries pollutants and trash with it that eventually litters the downstream communities such as Vine City and English Avenue. Furthermore, the combined sewer system is overpowered by the rain which causes sewage backups in many of the lower elevation residential areas in West Atlanta.

The beneficence and urgency of this project is the health of the citizens in the City of Atlanta. Sewage overflow exerts adverse physical, chemical, and biological effects on the receiving area resulting in health problems and environmental degradation, as well as aesthetic, cosmetic, and structural damages. These impacts can be both acute and cumulative. Such impacts are dependent on the characteristics of the discharge and it's receiving environments. According to one Atlanta Department of Watershed Commissioner: "In a dense, urban landscape that is undergoing continuous impervious development, less and less stormwater is absorbed and filtered by natural surfaces which can cause an increased amount of pollutants to enter our rivers, creeks and streams."

A variety of health problems are associated with backed up sewer systems. Potential human exposure to the pollutants found in sewer overflows, called sanitary sewer overflows (SSOs) in combined sewer areas, can occur through several pathways. According to EPA, the most common pathways include direct contact with waters receiving combined sewer overflows (CSOs) or SSO discharges, drinking water contaminated by sewer discharges, and consuming or handling contaminated fish or shellfish. However, humans are also at risk of direct exposure to sewer overflows, including sewer backups into residential buildings, city streets, and sidewalks.

Literature Review and Field Work

The group collected a series of maps of the study area that depicted roads, buildings and landscapes, elevations, and combined sewer lines in the initial field work stages. Throughout the plan development process, we conducted several field trip walk-throughs to determine the lay of the land.

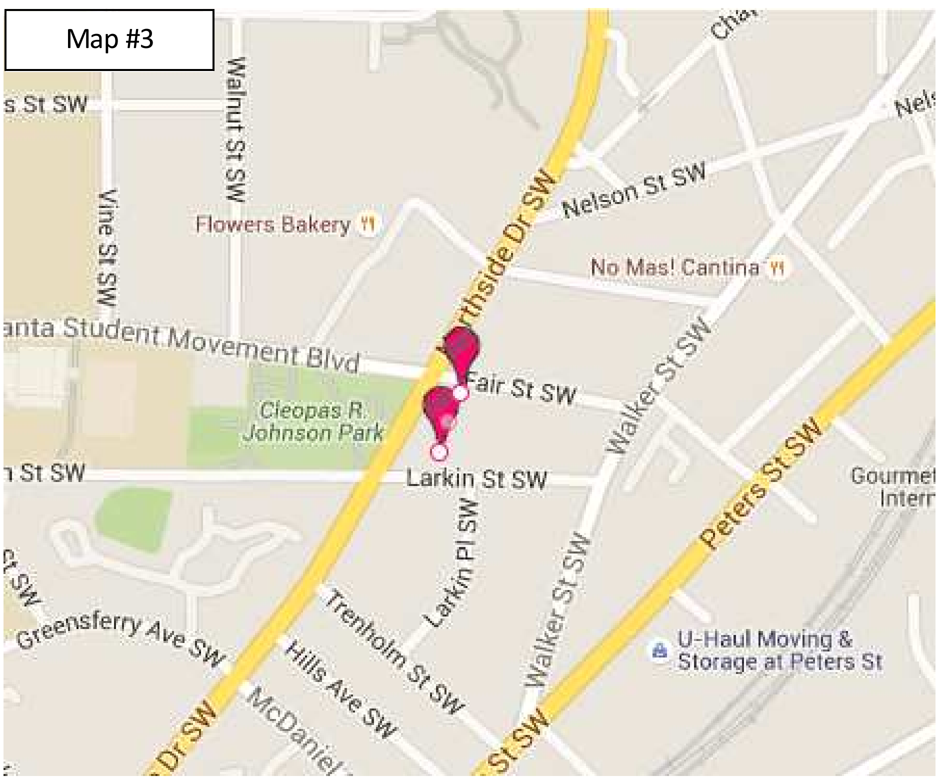
The team met every Thursday and Saturday to discuss ideas for cisterns and other more nature like green infrastructure (GI) options and to determine future prospects for water collection. After acquiring this data and entering it to Excel we conducted additional field work walk-throughs of the entire catchment area to refine and modify our recommendations for possible locations for retention cisterns, detention vaults, floodplains and other green infrastructure. During our walk-throughs of the Catchment 3 we used our elevation maps to separate the study area into zones; we took photographs and made written notes on areas where appropriate green infrastructure can be constructed.

Image #1

The group calculated the square footage of impervious surfaces including current buildings and prospective or "ghost" buildings that are likely to be built, in order to determine retention and detention requirements. We used these calculations in combination with rain event data to determine the average amount of water in gallons that can be harvested in a 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year rain events. To direct these floodwaters out of existing combined sewer system we chose to use retention cisterns, detention vaults, ephemeral streams and reclaimed floodplains, that will do double duty as play spaces. In addition to our field observations, we used the various maps, elevation levels, and the sewer line information as a guide to assist us in deciding the specific locations to place cisterns and other green infrastructure.

Methodology

The methodology for this project was directed at capturing stormwater runoff. To determine the amount of stormwater we wanted to capture, we calculated the surface area of each building and some select ground spaces. Using DaftLogic,com, we were able to pull up the area of Catchment #3 on Google Maps and place "pins" to find the lengths and widths of the space of each space (Map #3). Following, we created a table of each space, noting the dimensions, calculating the surface areas, and figuring the storage for each 5-, 25- and 100-year rain event. To illustrate, DaftLogic.com was used to find the dimensions of each building and greenspace in the study area. The following image displays how Daft Logic can be used:



Once we had made surface area calculations and reviewed topography, campus restraints, historical land use, and aesthetics, we were able to identify the type of green infrastructure we wanted to recommend for specific locations relative to the amount of water that needed to be captured. We tabulated the dimensions and area of each building along with the dimensions of some parking lots, tennis courts, and green spaces

Calculations

The following calculations were used to find the surface areas of each space: (length x width) = area in square feet. To calculate the gallons for each area, we converted the area of square feet to acres to use the following equation:

$$\frac{calculated\ sq\ ft}{43{,}560\frac{sq\ ft}{acre}} = acres$$

$$\left(\frac{acres\ x\ rain\ water\ event(inches)}{12\frac{inches}{ft}}\right) = acre\ feet\ (1\ foot\ deep\ with\ stormwater\ runoff)$$

$$acre\ feet\ x\ 325{,}000\frac{gals}{acre\ x\ ft} = gallons$$

Green Infrastructure Conceptual Plan

The Green Infrastructure Conceptual Plan for Catchment 3 includes four cistern sites, one recreation/floodplain greenway, two stormwater detention vaults, as well as connecting ephemeral streams. See Map #4.

Summary of Results

Green Infrastructure Parts	Acres	Storage Capacity
Cistern # 1 – Walker Street	3.15	482,000 gallons
Cisterns # 2 – H.J. Russell Corp.	15.21	2,634,000 gallons
Cistern # 3 – Artists Square	7.58	1,160,000 gallons
Total Retention		**4,276,000 gallons**
Castleberry Stormwater Management Greenway		1,781,000 gallons
Bread Factory Detention Vault		1,734,000 gallons
Flipper Detention Vault		1,412,000 gallons
Total Detention		**4,927,000 gallons**
Total Retention and Detention		**9,203,000 gallons**

Walker Street Cistern #1 is located at the highest elevation of Catchment 3 at the western edge of Walker Street at its lowest elevation. It will collect runoff from buildings on both sides of Walker Street and from Walker Street itself. This cistern is expected to collect 482,000 gallons of rainwater from a 25-year rain event. During larger rain events this cistern will drop its excess floodwaters into the Castleberry Stormwater Management Greenway which is located adjacent to this cistern as described on page 13 and Map #8.

Map #5

H.J. Russell Corporation Cistern # 2 is actually two large cisterns which should be located below the parking lot shown in Image #2, the property of H.J Russell on the north side of

Image #2

Larkin Street (Map # 6). It will capture runoff from Paschal's property and the Castleberry Hotel as well as the H. J. Russell Property. These cisterns are expected to detain 2,634,000 gallons of rainwater from a 25-year rain event. Total runoff from both pervious and impervious surfaces in this area during larger rain events including the 100-year rain event, which exceeds cistern capacity will cross under Larkin Street in a culvert and then via ephemeral stream (possibly over the property owned by Carl M. Williams Funeral Home) and flow into the Castleberry Storm Water Management Greenway, page 13.

Map #6

Artists Square Cistern # 3 will capture storm water runoff from impervious surfaces at Artists Square. It would also capture runoff from across Larkin Street running down from Walnut Street next to Trenholm Street. See image #3. It could be located under the existing parking lot, or on the east side of Larkin Place as shown on the image below. We calculated the runoff from the existing buildings and parking lots at existing Artists Square, as well as buildings and parking lots that we assume will be built in the future on what is now greenspace. We propose that this cistern will collect 1,160,000 gallons of water from a 25-year rain event.


Image #3

Map #7

Castleberry Storm Water Management Greenway should be constructed in the center of the block surrounded by Walker Street, Trenholm Street, Larkin Place, and Larkin Street. It is shown as a green floodplain on Map #8.

Map #8

This low lying area is already flood prone. Only occasionally, during major rain events in excess of the 25-year rain event, this greenway will flood with excess flows from Cisterns #1, #2 and #3. Floodwaters can drain from this greenway in 3 to 36 hours as determined by the implementation engineering process. The Castleberry Management Greenway can be used for play space, recreation, an urban forest, a nature preserve and/or urban gardening. Plans could include a constructed stream and wetlands to infiltrate water down to the water table. Greenway capacity is 1,781,000 gallons.


Image #4

The Bread Factory Detention Vault is one of two detention vaults recommended in our conceptual plan. In 1983, an EPA study revealed that manmade drainage systems [urban sewer systems] transported shock loads of chemicals and pollutants into natural streams in urbanized areas. The group proposes the Bread Factory Detention Vault primarily to capture industrial, commercial and roadway runoff. It will capture polluted runoff from all parts of the Bailey Street Bakery Company property – roofs, loading docks, and parking lots. To it we have added runoff from the contiguous Burger King restaurant and Chapel Hill Baptist Church properties. We propose that this detention vault temporarily detain runoff because of the unknown levels of pollutants from the combination of commercial properties. After the rains have stopped, detained runoff will be released into the existing combined sewer system for treatment. It will be necessary for adjoining property owners to cooperate to come up with a workable solution to downstream pollution and flooding issues. From their total 15.43 acre property area, the detention vault will capture only the most polluted 5-year rain event. Capacity 1,734,000 gallons. (Map #9)

The Flipper Detention Vault will receive runoff in excess from the 5-year rain event from the Bread Factory Detention Vault as well as all flows from the 5.3 acre residential and green area along Walnut Street and Atlanta Student Movement Boulevard east of Walnut Street. The Flipper Vault will be located under the Flipper Baptist Church parking lot. It will have a capacity of 1,412,000 gallons (Map #10).

Conclusion

Capturing 9.2 million gallons of storm water runoff will prevent flooding our downstream neighbors. It will have a positive impact on their public health and on the environment. Constructed greenway floodplains are public amenities that will benefit the Atlanta University Center campuses, the nearby housing projects, and other community members.

The next step is to nurture cooperation and collaboration among the academic, governmental and non-governmental property owners. Once they agree to move forward, detailed public planning and engineering will be necessary to secure implementation funding.

Installation of cisterns and detention vaults, and constructing a greenway not only reduces potential flooding issues but has other benefits. It will strengthen the AUC and Historic Castleberry District storm water infrastructure. Storm water retained in cisterns can be used to irrigate the vast surrounding lawns and for other purposes thereby reducing City of Atlanta water consumption. The cisterns and greenspaces will reduce water treatment costs and improve both water and air quality.

Broad based and thorough cost/benefit analysis including flood reduction benefits, health benefits and valuable community revitalizing amenities, as well as sewer infrastructure, capital, operating and compliance savings are likely to show a sufficient return on investment for the Atlanta University Center, the Historic Castleberry Hill District and the City of Atlanta.

Team members acquired several skills during the course of the project. We conducted several land survey analyses to determine potential locations for the cisterns, detention vaults and a greenway. The project strengthened the group members' analytic skills performing data analyses of the storm water runoff for the 5, 10, 25, 50, 100 and 500 year rain events. In addition, team members honed communications skills by presenting their project to the community members, AUC faculty and staff, and local government officials. The team is thankful for EPA/ECO-Action's opportunity and looks forward working with them in the future.

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