SLOW THE FLOW

Reimagining Campus Blue-Green Street Revival

2025 EPA Campus Rainworks Challenge

University of Illinois at Urbana-Champaign

Registration #57

Master Planning Category

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ABSTRACT

Precariously changing climate conditions have necessitated rethinking stormwater management to reduce pressure on stormwater infrastructure, promote rainwater infiltration and storage and provide additional socio-ecological benefits. University campuses, with diverse populations and large areas, provide exceptional opportunities to demonstrate such benefits. “Slow the Flow,” located in the Urban Town Gown District of the University of Illinois campus, proposes low impact development strategies to reduce stormwater runoff, enhance infiltration and create additional short-term water storage. The project lies at the edge of campus, where a mix of academic and private residential buildings, cultural centers, and neighborhood commercial businesses create a complexly intermingled urban neighborhood. The site was analyzed to understand the mix of activities and uses, existing storm infrastructure, and opportunities for green infrastructure. The Storm Water Management Model was used to model pre- and post-design conditions. Modeling showed that the proposed design could reduce runoff by up to 50%, provide up to an additional 29,900 cubic feet of water storage, and reduce peak runoff rates to a maximum of 4.34 CFS. Proposed design also provides co-benefits, including improved biodiversity, safe and comfortable pedestrian and bicycle routes, and inviting social spaces for the campus and city residents. Streetscapes provided the best opportunities for introducing green infrastructure that would meet both City code and campus plans for future development. Transformation of the streetscapes with green infrastructure and other improvements demonstrate not only the functional stormwater management benefits but can also serve as a prototype for re-imagining streets throughout the campus.

BACKGROUND

Founded in 1867, the University of Illinois at Urbana-Champaign (UIUC) is the oldest and largest of the three institutions in the University of Illinois system. Located in the cities of Urbana and Champaign, Illinois, it lies approximately 140 miles south of Chicago within an established central business district adjacent to highly productive agricultural lands. It comprises a diverse student, faculty and staff population of more than 65,000 people. Dedicated to creating multifunctional landscapes that benefit its community, the university strives to incorporate stakeholder input and foster public engagement in creating an ever-evolving campus. As part of this vision, the 2022 Campus Landscape Master Plan outlines sustainable landscape objectives for the entire campus, which is divided into districts that have guidelines tailored to each area’s specific context.

This project addresses the Campus Town Gown district, chosen for its potential for stormwater management and its strategic role as a connection point between the campus and the surrounding Champaign community on the northwestern edge of campus. Development across the campus encompasses extensive impervious surfaces in many areas, resulting in high runoff volumes and fast flow rates that pose challenges to the existing stormwater infrastructure. This project aims to reimagine these spaces by introducing adaptable stormwater solutions designed to capture water at its “source” and reduce runoff speed and volume. We also aim to introduce consistent and cohesive aesthetics that reflect the community’s pride in the University and create greater opportunities for community interaction.

Location

Illinois has a widely varied climate due to its nearly 400-mile (640 km) length and mid-continental location. The University of Illinois lies in a humid continental climate region that experiences hot, humid summers and cold, moderately snowy winters. Average daily temperatures have seen increases by 1–2° F with overnight minimum temperatures increasing more than daytime maximum temperatures. With seasonal variations in warming, winter and spring temperatures have increased by 2-3° F. Precipitation amounts have increased in Illinois with total annual precipitation increasing by 5 inches over the past 120 years. This is equivalent to a 12 to 15% increase in the total annual precipitation.

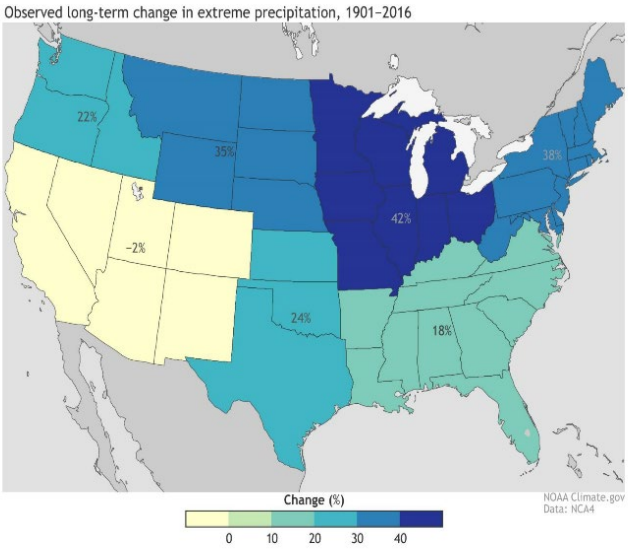

Figure1: Change in the top 1% of extreme precipitation (the99thpercentile). https://science2017.globalchange.gov

Existing Hydrology and Landcover

The UIUC campus lies in a gently rolling area in the east-central part of Illinois. The site is generally flat with some isolated areas of moderate slopes. The campus straddles the divide between two watersheds. The southern half of the campus drains into the Embarras River, while the northern half drains to Boneyard Creek, a tributary of the Saline Branch of the Salt Fork, Vermilion River. Boneyard Creek is the most prominent urban waterway flowing through Champaign and Urbana. It is located just north of the Town Gown District and receives most of the storm sewer flow from this area.

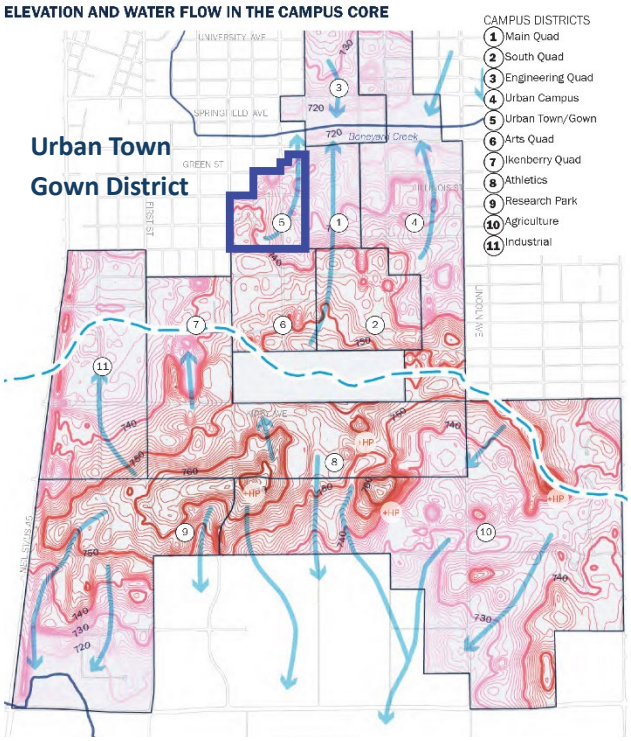

Figure2: Elevation and Water Flow in the campus core

The relatively flat topography of our site makes stormwater a major concern due to past flash flooding. Soils are typically clayey and silty loams but have been impacted by extensive urbanization. Although robust stormwater and green infrastructure for flood control have been implemented along Boneyard Creek, areas like the Town Gown District continue to contribute large amounts of runoff from expanses of impervious cover. The UIUC campus has therefore set goals for implementing sustainable stormwater infrastructure throughout the campus, reducing impervious cover, and increasing tree canopy and native plants in its landscape.

The Urban Town Gown District

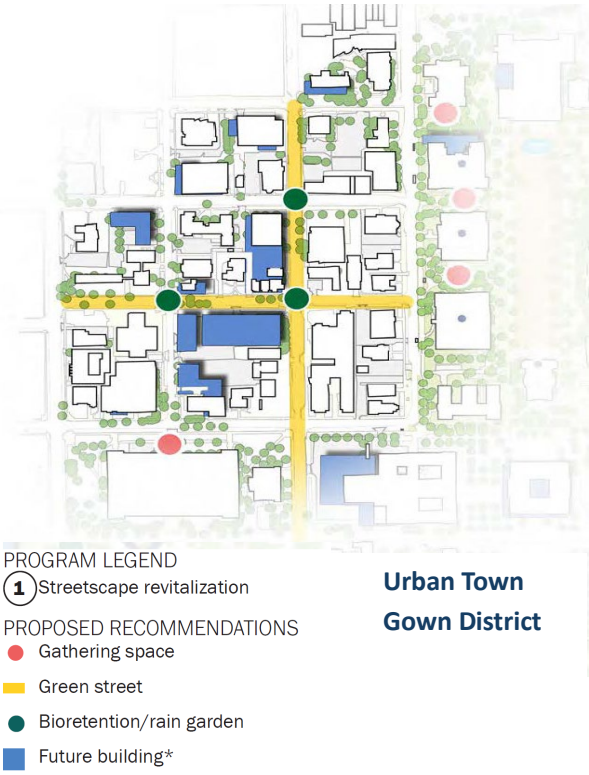

Figure 3: Campus Landscape Master Plan opportunities for green infrastructure in the Urban Town Gown District.

The Urban Town Gown district is identified in the UIUC Campus Landscape Master Plan as a priority for future sustainable landscape and green infrastructure improvements. Located at the intersection of campus and the City of Champaign, this district serves as a bridge between the university and the broader community. In the Urban Town Gown district, Chalmers St. and 6th St. have been identified as potential "green streets", or redesigned roadways that integrate green infrastructure. The district has high pedestrian and bicycle use, and moderately high vehicle traffic characterized by a mix of personal vehicles, commercial delivery vehicles and campus service vehicles. There is a unique opportunity to integrate sustainable design solutions that enhance both functionality and aesthetics while educating students and the community about the benefits of green infrastructure.

Currently, this area faces challenges that provide opportunities for meaningful improvements. Approximately 76% of the area is covered by impervious surfaces, contributing to stormwater runoff, flooding, and pollution of Boneyard Creek. The tree canopy covers only 19% of the area, increasing the urban heat island effect. Beyond environmental concerns, accessibility improvements would benefit the residents and daily users of this area. Streetscapes lack a consistent and cohesive aesthetic, lessening the area's visual appeal and usability. Addressing accessibility challenges is a primary design goal, ensuring that the space is welcoming and functional for all users. We propose improvements that accentuate the University's vision for the district to create a vibrant, resilient, and multifunctional campus edge that improve both environmental health and community well-being. Through this project, we seek to not only improve water management but also create awareness and engagement in sustainable infrastructure in the community.

Existing Stormwater Characteristics

To improve community health and wellbeing and the quality of local waterways, one of our goals in implementing green infrastructure is to reduce pollutant loading in runoff entering Boneyard Creek. Boneyard Creek is identified as "Impaired (Issues Identified)" by the EPA, especially impacting aquatic life. Impairment includes degraded habitat, metals (Cu), total nitrogen, and total phosphorus and exceeding Total Maximum Daily Loads. To improve conditions, we chose to implement strategies that target the reduction of contaminants through bioretention, disconnected downspouts, permeable pavements, and vegetated swales.

DESIGN OPPORTUNITIES AND CHALLENGES

Concept and Master Plan

Alignment with Existing Campus Master Plan

The 2022 Campus Landscape Master Plan details the vision of a sustainable campus highlighted in the 2017 Campus Master Plan (CMP) that emphasized the role of landscape in crafting the character the campus. The CMP provides broad campus landscape objectives which highlight the need to use green stormwater infrastructure strategies and increase the use of native and naturalized planting approaches. The Campus Landscape Master Plan includes goals, strategies, design standards and implementation examples for various districts on campus. These two documents guided our design proposal for the Urban Town Gown District. Other guidance came from City of Champaign engineering and development code.

Our proposed master plan for the Urban Town Gown District highlights implementation of green infrastructure and pedestrian/bike improvements along 6th St., Chalmers St., and Daniel St., turning these into the "Green Streets" envisioned in the Campus Landscape Master Plan. Additionally, two vacant/underutilized spaces are redesigned into vibrant plazas that highlight raingardens and native species plantings. One is located on Daniel St. across from the Illini Bookstore, the other is located at Chalmers St. and 6th St., the intersection of the newly imagined "blue-green" streets that emphasize water management.

Materiality

Materials selected for the landscape and outdoor furnishings of the Slow the Flow project were chosen for their aesthetic qualities, durability, and functionality in a variety of environmental conditions. Planting materials selected are dominantly native with low maintenance requirements such as 6-12" tall fescue grass and Buffalo grass paired with a sand base for proper drainage and root growth in swales and bioretention features. The soil mix comprises 50%

OPPORTUNITIES

- Provide separated bike lanes in areas of high pedestrian activity.
- Incorporate permeable pavers in parking lots to allow infiltration in bioretention basins and slow runoff into existing storm sewers.
- Expand tree vaults along streets edges for greater infiltration.
- Disconnect downspouts of adjoining buildings where possible.
- Redesign vegetated areas to include more native plants improve pollinator habitat.
- Redesign interstitial spaces for better community engagement and social interaction, including ecological benefits for stormwater management and biodiversity.
- Implement relatively low-cost green infrastructure in areas such as large surface parking lots that will be redeveloped in the 10-20 year timeframe.

Challenges

- Mix of University and private property on the site.
- Complex existing storm sewer infrastructure.
- Lack of space to introduce green infrastructure.
- Future plans to introduce new buildings, parking structures and to redesign certain areas of the District in the +10-year timeframe.

topsoil, 25% sand, and 25% silty loam content, offering an optimal blend for plant health and use of hardwood mulch at varying depths, 1-3" depth. Interlocking permeable pavers are used for the walkways and parking spots to provide water infiltration and storage, and to reduce runoff. For the subbase layering, materials like open-graded crushed stone and geotextile fabric enhance the stability and water permeability of the paving system. In the plaza areas, composite decking is proposed for boardwalks and raised seating platforms.

DESIGN PERFORMANCE

6th Street

The design of 6th Street on the UIUC campus incorporates various green infrastructure strategies to enhance stormwater management and improve the urban streetscape. UIUC-owned parking lots allow surface runoff to flow naturally to bioretention features or existing storm sewer catchment basins. The large lot on the southwest corner of 6th and Chalmers Streets is repaved with permeable asphalt concrete to match the adjoining lot to the west. Smaller lots and street parking utilize permeable pavers in the parking spaces only, providing additional short-term water storage, infiltration and pollutant mitigation.

Bioswales are integrated along the sides of the street, featuring gentle slopes and drought and moisture-tolerant plantings. A small plaza and raingarden are introduced at the northwest corner of 6th St. and Chalmers St. These systems capture and infiltrate stormwater, while filtering pollutants through soil media and plant roots. Importantly, the bioswales are planted with native species from the Illinois region, including *Echinacea purpurea* (Purple Coneflower), *Rudbeckia hirta* (Black-eyed Susan), *Carex vulpinoidea* (Fox Sedge) and *Asclepias tuberosa* (Butterfly Weed). These native plants are well-adapted to local climate and soil conditions, providing efficient stormwater uptake, filtering capabilities, and valuable habitat for pollinators and birds, enhancing overall biodiversity and ecological resilience. Functionally, the bioswales serve both as ecological stormwater features and as visual landscape enhancements. In addition, the street includes retention features, such as recessed green areas (mini-swales), designed to collect and slowly release stormwater. These systems mitigate peak runoff during storm events and are coordinated with site grading and natural drainage paths to maximize efficiency.

Daniel Street Plaza and Streetscape

Daniel Street has great potential to become a dynamic campus center. It is home to the Illini Bookstore, Psychology Laboratory, and the Hub apartment complex, lying within a bustling part of the campus. However, despite the heavy foot traffic, it lacks an engaging streetscape. Given its proximity to both the popular Green Street and the high-traffic bookstore, the street has strong potential to be transformed into a lively, eco-friendly commercial plaza. This space could serve as a welcoming destination for students and visitors to UIUC—offering comfortable parking, shopping,

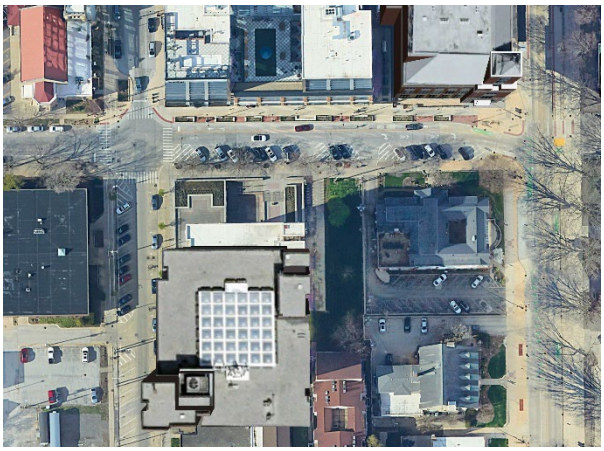

Figure 4: Existing conditions along Daniel Street

Figure 5: Proposed improvements along Daniel Street

and inviting social spaces. The proposed design transforms the street, adding significant stormwater capture and infiltration, while improving its overall aesthetics. The one-way travel on this part of Daniel St. lends itself to relocating parking spaces to the north side of the street, enhancing pedestrian access to a new plaza east of the Psychology Lab. Permeable pavers are proposed for all parking spaces, in the crosswalk and sidewalk adjacent to the plaza. The plaza incorporates distinctive paving materials to create a sense of arrival and define the area as a welcoming public garden. Within the garden, wooden platforms and various seating options could attract students, visitors, and nearby residents. The platforms are surrounded by raingardens, which not only filter stormwater but also create a calming, biodiverse ambience. Native trees, shrubs, forbs and grasses enrich the raingardens. These include a selection of native flowering species, such as *Anemone canadensis*, *Baptisia bracteata*, *Polemonium reptans*, and *Symphyotrichum shortii*. Along the sidewalks, we chose hardy, ornamental species like *Carex pennsylvanica, Carex rosea*, and *Elymus hystrix*. These planting strategies help create distinct visual identities between the plaza garden and the street edges, offering pedestrians a diverse and enjoyable spatial and botanical experience.

PROPOSED STORMWATER SYSTEM

Managing Rainwater in the Project Area

Due to the urbanized nature of the Town Gown District, the EPA Storm Water Management Model (SWMM) was chosen to model pre- and post-design stormwater runoff and pollutant loads. Existing storm sewer infrastructure information was provided by the University of Illinois Facilities & Services Department as a geodatabase including detailed information for streets, sidewalks, parking, and buildings. Topography provided in the Facilities geodatabase was fine-tuned using 2-ft resolution LiDAR data.

One of the challenges presented by the project area is that the infrastructure is shared between the City of Champaign and the University of Illinois. Design was guided by City Code and recommendations for updates to Campus design standards listed in the Campus Landscape Master Plan (CLMP). The opportunities recognized in the CLMP as well as our own analysis of the site conditions focused on introducing bioretention features and permeable pavement as the primary

interventions. Because these features are typically most effective for smaller rain events, we chose to model 1-year, 24-hour and 5-year, 24-hour design storms.

In SWMM, the project area was divided into 11 sub catchments, incorporating both existing and proposed rainwater infrastructure. The model connected each sub catchment to the existing storm sewer system to accommodate extreme storm events. Precipitation data from the Champaign 3S weather station were input for 1-year and 5-year return periods, using a Type-II distribution on 6-minute intervals. Design of proposed green infrastructure elements prepared in CAD provided accurate measurements as well as detailed locations for connections to existing storm sewer junctions. The model utilized a single land use type, Medium Density Urban Development, and estimated pollutant loading for three pollutant types: total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS).

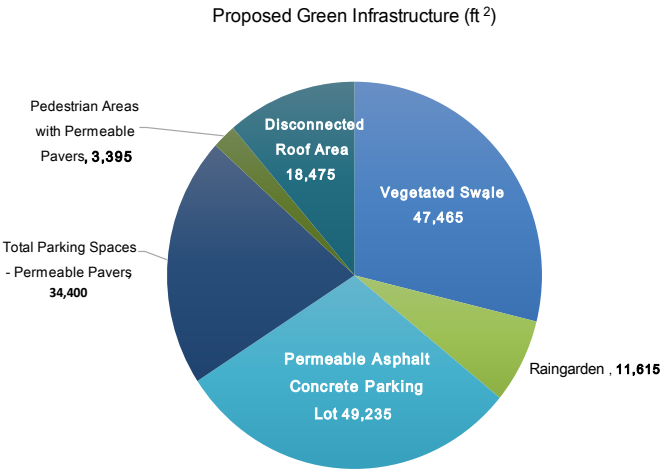

Figure 6: Proposed Green Infrastructure

The team realized that modeling pollutant loading and washoff could be challenging given the lack of site-based data. However, a decision was made to investigate the *potential* for water quality improvement, even if absolute values generated by simulations may not be accurate. Values for pollutant amounts, buildup and washoff were estimated from sample data reported in a downtown Champaign area Illinois State Water Survey water quality report (Bender et al, 1981) and from the National Water Quality database (USGS, EPA, 2015).

Stormwater Summary

	Average Infiltration (in)	Max Peak Runoff (CFS)	Total Runoff (10^6 gal)	% Runoff Reduction	Total N (lbs)	Total P (lbs)	TSS (lbs)
Existing Conditions, 1-year, 24 hr	1.61	3.42	0.29	--	0.148	0.195	0.146
Existing Conditions, 5-year, 24 hr	2.23	5.34	0.45	--	0.306	0.399	0.209
Proposed Design, 1-year, 24 hr	2.55	3.42	0.17	24%	0.076	0.142	0.085
Proposed Design, 5-year, 24 hr	4.35	4.34	0.24	50%	0.051	0.092	0.062

Table 1: Summary of Stormwater Performance

Table 1 summarizes model simulation values for average infiltration, runoff, and pollutant amounts for pre-design and post-design conditions for 1-year, 24-hour and 5-year, 24-hour design storms. There is an increase in average infiltration of nearly 60% for the 1-year event, and by 95% for the 5-

year event. The proposed design reduces both the total amount of water entering the storm sewer network and the peak runoff flow. It provides up to 29,900 cf of water storage capacity, which significantly exceeds the Campus Landscape Master Plan's identified opportunity for 9600 cf. These features could also potentially reduce as much as 51% of total nitrogen, 73% of total phosphorus and 58% of total suspended solids entering the storm network.

ESTIMATED COSTS AND FUNDING SOURCES

Funding strategies for the Slow the Flow project at the University of Illinois can draw on a diverse mix of student fees, institutional support, grants, and private donations. Central to this funding structure is the Illinois Green Fund (IGF), managed by the Student Sustainability Committee (SSC) and supported by student fees through the Campus Environment Fee (SCEF) and Cleaner Energy Technologies Fee (CETF). The Revolving Loan Fund (RLF), also overseen by the SSC, reinvests utility savings from past sustainability projects. Combined, these resources provide over $1 million annually for campus sustainability efforts. Additional support comes from grant funding, institutional budgets, external partners, and individual donors.

To ensure consistent and equitable investment in the campus landscape, the Campus Landscape Master Plan also proposes several key funding strategies. First, a percentage of capital project budgets should be highlighted for landscape improvements to make sure that new developments are fully implemented with current campus features. A Tree Planting fund is also recommended, requiring involvement from projects that take away trees, while also allowing donor contributions to increase the campus canopy. Recognizing the inequities in landscape investment across campus, the CLMP calls for direct annual funding to maintain and enhance areas not included in capital projects. This supports the wider vision of campus as a communal resource. A proposed Rainwater Management Utility Fee would fund green stormwater infrastructure maintenance, together with other campus utility fees.

Finally, donor engagement should be prioritized and could play a more significant role in implementation. Projects from the past, such as the Stock Pavilion landscape improvements and Red Oak Raingarden, demonstrate and showcase the value of philanthropic and community support. Establishing a dedicated gift account and strengthening the collaboration between the University Landscape Architect and the University of Illinois Foundation (UIF) would help ensure ongoing funding and long-term maintenance support for future projects like Slow the Flow. All these strategies and ideas would work collectively to ensure a sustainable, equitable, and well-maintained campus landscape for both the short-term and long-term projects.

CONCLUSION

This project showcases a timely opportunity to introduce green infrastructure that can act as model for future sustainable development across campus. It proposes a set of plant and hardscape materials that can provide a template for GI design and streetscapes for both the campus and City. It also prioritizes safe, comfortable pedestrian and bicycle experiences. This project attempts to demonstrate opportunities for long-range GI investment (Daniel Street Plaza) while acknowledging the intended future growth and development of the campus, introducing lower cost, interim solutions in areas slated for redevelopment in the 10–20-year timeframe.

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