# Green Infrastructure & Stormwater Management CASE STUDY

## Christian Life Center for City Union Mission

**Location:** Kansas City, MO
**Client:** City Union Mission
**Design Firm(s):** BNIM
**Landscape architect/Project contact:** Jim Schuessler, ASLA
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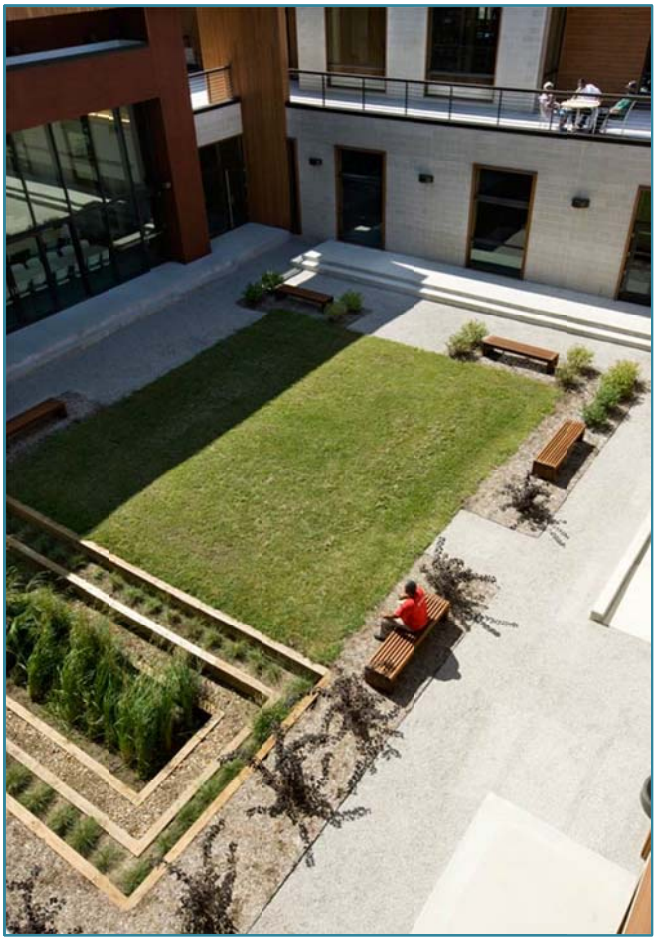
**ASLA Chapter:** Kansas City



### Project Specifications

**Project Description:** City Union Mission is a not-for-profit organization serving the base level needs of those whose lives have been disrupted in the Kansas City community. BNIM was hired to analyze the existing Men's Shelter Building and to address how the organization could meet an overwhelming increase in need. It quickly became clear that the facility was inadequate to meet rising demands, and the development of a separate structure housing the Christian Life Program was created. This program nurtures the re-entry process for one-hundred of the most promising men who will live and attend classes in the facility during their one-year curriculum. The resulting design supports the believe that students of the program deserve experiencing the best during their course and afterward wherever their new life leads.

**Project Type:**
Institutional/education
Part of a new development

**Design features**: Infiltration basins, designed similar to typical systems with two major differences. At City Union Mission, the inlet is subsurface and the outlet drain is elevated to create holding capacity. A level spreader dissipates the energy.

**This project was designed to meet the following specific requirements or mandates:** Local ordinance, to meet funding criteria

**Impervious area managed:** 5,000 sq/ft to 1 acre

**Amount of existing green space/open space conserved or preserved for managing stormwater on site:** 5,000 sq/ft to 1 acre

**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?** This project was not designed as a LEED project but was designed to be highly sustainable. Energy efficiency fixtures, shower water reclamation for toliets, low maintenance flooring and wall systems, were all embodied within the project. In addition, the following sustainable features were incorporated:

- Building orientation with courtyard configuration maximizes natural daylight into the facility. Every room has access to daylight.
- Custom insulated windows for high thermal capacity were installed.
- A geo-thermal heat pump system was installed.
- Passive solar techniques were utilized, including the thermal floor mass in the south-facing multi-purpose room.
- Fritted glass in the south curtain wall helps to manage heat gain.

## Cost & Jobs Analysis

**Estimated Cost of Stormwater Project:** $50,000-$100,000 (Public funding: Federal, private - most funding came from local private dollars; individuals, businesses, churches, foundations. We did receive $500,000 from the Federal Home Loan Bank of DesMoines.)

**Related Information:** The cost of the three infiltration basins at this site was $72,000.

**Was a green vs. grey cost analysis performed?** Yes, a typical detention pond to manage stormwater runoff from a 15,000 sq/ft building may cost approximately $40,000 to $50,000. In many regions, water quality BMPs are required in addition to detention ponds. The cost of the three infiltration basins at this site was $72,000. Monitoring at this site indicates that infiltration basins have the potential to reduce runoff volumes in addition to filtering pollutants, which could help to reduce the size, and hence cost, of required detention ponds.

The basins are creatively incorporated into the courtyard and surrounding landscape adjacent to building entries showcasing the on-site stormwater management strategies. Integrating stormwater controls into site landscaping provides additional opportunities to reduce overall site costs.

**Cost impact of conserving green/open space to the overall costs of the site design/development project:** Open areas were preserved and planted with wildflower/native grasses to restore area between the street and parking lot as well as south of the building in the lot used for construction staging.

**Cost impact of conserving green/open space for stormwater management over traditional site design/site development approaches (grey infrastructure)?** Significantly reduced costs (10% or greater savings).

**Number of jobs created:** 5

**Job hours devoted to project:**

Planning and Design: 9,400
Construction: (Requesting information from contractor)
Annual Maintenance: 3,000

## Performance Measures

**Stormwater reduction performance analysis:**

Soil/Infiltration - The installed engineered soil and plants provide a good rate of infiltration while promoting healthy plant growth. All three of the basins drain well. Basins 1 and 2 never hold water for more than 24 hours. The infiltration rate is faster than expected in Basin #1 and #3 probably due to existing porous soils adjacent to the basin. These soils allow water to move laterally out of the basin, which helps the basins perform better.

Vegetation - Spartina pectinata (prairie cordrass) and Sporobolus heterolepis (prairie dropseed) have proved to be great performers. Plant roots have established 30” deep in less than two years. Cordgrass is well adapted to the wet zone of the basins. Dropseed does better in drier conditions and is growing well on the edges. Lobelia cardinalis (cardinal flower) is slow to establish, which makes it easy for weeds to spread. If low maintenance is a priority, the cardinal flower should not be considered for this application.

Water Quanity - The infiltration basins are properly sized to successfully manage 1.37”-storm events (the local water quality, or 90th percentile). Basin #1 has storage area of 368 sq/ft (or about 5% sizing factor) and 872 cu/ft of storage capacity.

Water Quality - Only one outflow from Basin #1 was recorded during 2009 and 2010. Thus all of the contaminants from rain events of less than 2.44 inches of rain were contained within the basin. On large rain events, it appears that runoff was probably picking up and exporting pollutants such as TN, TP, S, and TSS. However, the outflow data is insufficient to verify this hypothesis. It appears that heavy metals such as Zn were maintained within the basin.

Lessons Learned - Site characterization is an important part of BMP design. The bricks and porous fill material at Basin #1 could have been a problem if the building had a basement, by providing a preferential pathway for water movement into the building. It was not an issue here because of the building design, but provides a good reminder for other sites.

- Organic material added to the soil mix helped maintain soil moisture during dry periods.
- Plant selection is important. Each BMP is different, so plants should be matched to the soil and water conditions created at each site.
- Some plants grow very deep root systems which helps BMP performance as plants mature. Infiltration rates into soils are expected to improve over time as the roots grow larger and deeper.
- The planters were built with simple materials for low cost, yet they look quite nice and fit the surroundings. All BMPs do not have to be expensive.
- The greatest benefit of the BMPs at this site is reducing the amount of stormwater runoff that leaves the site. The site is located in an urban neighborhood of Kansas City, and the BMPs help reduce flows to the local sewer system. In this location, the water quantity benefits of BMPs are more important than the water quality benefits. Design objectives will be different at every site, and the BMP designs can be customized to the site-specific objectives.

**Community & economic benefits that have resulted from the project:** Community benefits include: Impact in the lives people in our community - people are given the opportunity to take a new direction in life in a beautiful, efficient environment. The neighborhood enjoys the additional economic growth with low impact on utilities and city infrastructure. While we've not specifically studied the impact of the Christian Life Center project on property values we do believe they have increased as a result of it's construction.

## Project Recognition

2010 AIA Kansas City - Merit Award; 2009 AIA Kansas - Honor Award; 2009 Kansas City Business Journal - Capstone Award | Community Impact; 2008 AIA Central States Region - Merit Award

## Additional Information

**Links to images:** Photo from BNIM, http://www.bnim.com/work/christian-life-center

Located in a neglected neighborhood near the urban core, the creation of a safe and healthy environment was paramount. To address this goal, the facility was developed around a secure courtyard that connects the interior and exterior throughout. Programmatic spaces include a dormitory, living area, classrooms, recreation rooms, and administrative offices. A large- multi-purpose space is used for dining, recreation and worship. Exterior materials include a rain screen of recycled hardwood combined with brick and burnished block masonry.

The site design incorporates a variety of sustainable features and is a showcase for urban stormwater management. The small site includes three bioretention cells that accept all of the roof run-off and there is no stormwater connection to the City's sewer system. Indigenous plant material that require low-maintenance have been integrated throughout the site. Hidden from view are the geo-thermal wells and the recycled water storage tanks, which hold filtered water from the showers for use in toilet flushing.

SUSTAINABLE FEATURES

- Storm runoff from the parking lots drain into two bioswales which collect sediment, clean heavy metals and encourage infiltration into the soils. The bioswales are planted with cordgrass and swichgrass to absorb a high percentage of rainwater.
- The central courtyard is planted with buffalo grass and requires no chemicals and only a couple of lawn mowings per year.
- Shortgrass prairie grasses are planted on side lots to improve the environmental quality of the area.
- Pervious limestone screening walk connects the building to adjacent streets.
- Steep slopes west of the building are stabilized with a geo-web stabilization product to resist the potential erosion of the hillside into parking lot.