



Green Infrastructure & Stormwater Management CASE STUDY

Steele Memorial Library Green Roof Retrofit

Location: Steele Memorial Library, Elmira, NY

Client: Chemung County Library District

Design Firm(s): Fagan Engineers

Landscape architect/Project contact: James B. Gensel, P.E., CPESC

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ASLA Chapter: None

Project Specifications

Project Description: The existing Steele Memorial Library roof was due for a replacement. Fagan Engineers assisted the Chemung County Library District in applying for and obtaining a Green Innovation Grant from the EPA via the NYS Environmental Facilities Corporation to retrofit the existing 25,000 sq/ft traditional roof to a green roof. After structural analysis was completed, the total green roof area available was determined to be 18,800 sq/ft. Based on the structural analysis an extensive green roof system was selected. The green roof consists of a typical EPDM roof with:

- MiraDrain G4 Drainage Composite (1.21" thick),
- Engineered, Ultra-Light Growth Media (3" thick), and
- Vegetated Sedum Tiles (1.25" thick media layer and 1-2" plant height)

Project Type:

Institutional/education

A retrofit of an existing property

Design features: Green roof.

This project was designed to meet the following specific requirements or mandates: 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: less than 5,000 sq/ft, the project converted 18,800 sq/ft of traditional roof to a green roof.

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? No.

Cost & Jobs Analysis

Estimated Cost of Stormwater Project: \$500,000-\$1,000,000 (Public funding: Federal, state, local)

Related Information:

- Roofing Contract: \$668,898.53
- Plumbing Contract: \$72,401.00
- Construction Admin: \$43,926.00
- Engineering Design: \$58,568.00
- Legal: \$5,000

Was a green vs. grey cost analysis performed? No

Cost impact of conserving green/open space to the overall costs of the site design/development project: Not applicable.

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). This was not calculated however will be analyzed after a full year of service. The roof was installed in the Fall 2010 so the Winter cycle may be analyzed.

Number of jobs created: None

Job hours devoted to project:

Planning and Design: 550
Construction: 600
Annual Maintenance: Not available

Performance Measures

Stormwater reduction performance analysis:

Original grant application quantity analysis:

On an annual basis, a 3.5-4" deep sedum green roof in central Pennsylvania can retain approximately 50-60% of the annual rainfall according to the Penn State Center for Green Roof Research. The Steele Memorial Library is located in the Southern Tier of New York which has similar weather patterns to central Pennsylvania (38 inches in State College, PA versus 34 inches in Elmira, NY). The annual reduction of runoff for the Steele Memorial Library is estimated as follows:

Water Retained = (34 inches) * (1/12) * (0.5) * (25,000 sf) = 35,416 cf or = 264,917 Gallons per Year

Original Water Quality Volume Calculation: Chapter 4 of the New York State Stormwater Management Design Manual provides an equation to estimate the amount of runoff that should be retained to provide water quality mitigation. The Water Quality Volume (WQV) is estimated as follows: $WQV = (P)(RV)(A)I$, where WQV = water quality volume (cf), P= 90% Rainfall Event Number (0.87 in Elmira), I = Impervious Cover (%) = 100%, RV= $0.05 + 0.009(I)$; (Rv = 0.2 min) = 0.95, A = total area (sq/ft) = 24,960 sq/ft.

$WQv = (0.87)(0.95)(24,960) I = 1,720$ cubic feet

Green Roof System Storage Volume: The proposed green roof must mitigate the Water Quality Volume, which is estimated at 1,720 cubic feet.

$V_{sm} = Agr \times D_{sm} \times P_{sm}$ $V_{dl} = Agr \times D_{dl} \times P_{dl}$

Where: Agr = maximum green roof surface area = 18,800 sq/ft, Dsm = depth soil media = 4.25 inches = 0.35 ft, Ddl = depth of drainage layer = 1.2 inch = 0.1 ft, Psm = porosity of soil media = 0.256, Pdl = porosity of drainage layer = 0.250, * Depth of soil media include 3" of placed soil media and 1.25" of media included with sedum tiles.

$V_{sm} = (18,800 \text{ sf}) \times (0.350 \text{ ft}) \times (0.256) = 1,685 \text{ c.f.}$ $V_{dl} = (18,800 \text{ sf}) \times (0.100 \text{ ft}) \times (0.250) = 470 \text{ c.f.}$

To be conservative, assume no ponding. $WQv = 1,720 \text{ c.f.} < V_{sm} + V_{dl} = 2,155 \text{ c.f.}$

Therefore, the proposed design satisfies the WQv requirements established in the NYS Stormwater Management Design Manual.

Community & economic benefits that have resulted from the project: The proposed Green Roof Retrofit of the Steele Memorial Library has multiple benefits for the local community:

- The Steele Memorial Library is an ideal location for introducing green roofs to the Southern Tier of New York. The Library is a public facility that is utilized for educational purposes and the green roof would be a demonstration project for local school districts as well as the general public. The Chemung County Stormwater Coalition has also utilized this project in their education efforts.

- Green roofs last longer than conventional roofs, reduce energy costs with natural insulation, absorb stormwater, lessening the need for complex and expensive drainage systems. On a wider scale, green roofs improve air quality and help reduce the urban heat island effect, a condition in which city and suburban developments absorb and trap heat.
- The Steele Memorial Library is a facility maintained by the Chemung County Library District. Green Roofs are more energy efficient than traditional roofs. The existing library is a two story structure with approximately 46,000 sq/ft of floor space. A green roof will reduce overall heating and cooling, thus saving the Library District climate control costs at the same time being energy efficient.
- The proposed project is located within the City of Elmira Municipal Separate Storm Sewer System (MS4). A green roof would provide water quality and quantity mitigation in-line with the MS4 community goals.
- The proposed green roof will improve the water quality within the watershed including the removal of phosphorus, nitrogen, metals and pathogens such as coliform, streptococci and E. coli.
- The Library is located within an area of Combined Sewers where the Sewer District is actively pursuing means of reducing CSO incidents.

Additional Information

Links to images: We can email pictures of the installation and completion of the retrofit upon request. The original grant award information is found here:

http://www.nysefc.org/Portals/0/Doc_Library/GIGP%20Fact%20Sheets/120%20Chemung%20County%20Library%20District.pdf