

Water Quality and Quantity Benefits of Blue Roofs Compared to Green and Conventional Roofs

Green roofs have shown promise in delaying and retaining stormwater, allowing developers to meet low impact development standards. While research consistently demonstrates the hydrologic and environmental benefits of green roofs, the expense of implementation has limited their widespread application. Consequently, stormwater professionals have developed a substitute, known as blue roofs, which potentially offer similar hydrologic benefits at a minimized cost. Blue roofs are designed to temporarily detain stormwater on the rooftop by regulating outflow. Unlike green roofs, blue roofs do not have soil or vegetation, substantially decreasing construction and maintenance costs. This study compared blue and green roof performance utilizing adjacent blue roof, green roof and control roof plots. Nine plots (1.5m x 1.5m) were constructed: three of each surface type. Blue and green roof treatments used modular trays. Green roof trays had drainage holes on the bottom, and were filled with standard lightweight expanded shale media. Green roof trays were vegetated with several types of Sedum selected for optimal growth in mid-Atlantic climates. Blue roof trays had holes drilled on the tray sidewalls, and were filled with Stalite®, a lightweight, coarse, expanded slate aggregate. Internal drains routed outflow into collection bins underneath the plots. Bins were outfitted with HOBO® water level loggers to record water depth to ultimately compute outflow volume, peak flow and peak flow delay. Water quality samples were manually collected from the bins after each precipitation event. Precipitation data were collected onsite. Blue and green roof precipitation retention and peak discharge rates were similar. Blue roof nutrient loadings and concentrations were not significantly different from those of the control, while green roof nutrient loading and concentrations were significantly higher than those of the control and the blue roof. The results of this study suggest that blue roofs may be a viable alternative to green roofs. The hydrologic benefits of blue roofs are comparable to those of green roofs, and blue roofs discharged lower nutrient loads. Additionally, material cost for blue roofs was approximately one-third that of green roofs. Lower maintenance needs, reduced structural loading concerns, and ease of implementation further underscore why blue roofs are an emerging rooftop stormwater control measure.

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Shane DeGaetano received his Bachelor's degree in 2015 from Cornell University – he majored in Biological Engineering with a bioenvironmental concentration. He continued his academic career at North Carolina State University under the direction of Dr. Bill Hunt. His work evaluated the treatment potential of an emerging rooftop stormwater control measure, known as blue roofs. He completed his master's program in August 2017 and began his professional career with Arcadis with a focus on Green Infrastructure projects.