

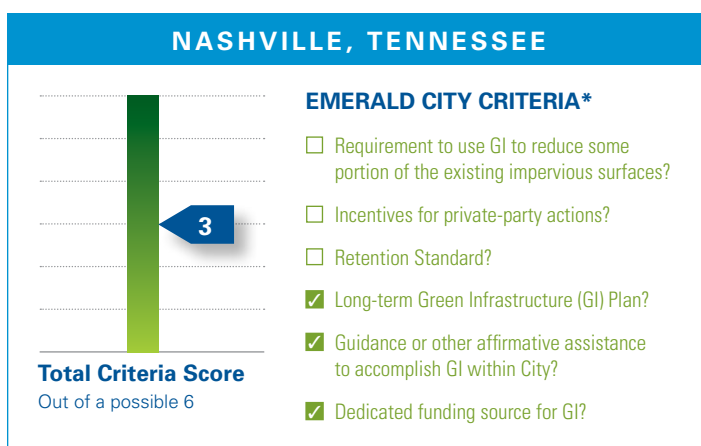
NASHVILLE, TENNESSEE

A CASE STUDY OF HOW GREEN INFRASTRUCTURE IS HELPING MANAGE URBAN STORMWATER CHALLENGES

TYPES OF GREEN INFRASTRUCTURE USED: Green roofs, rain barrels/cisterns, permeable pavement, rain gardens, vegetated swales, street trees, planter boxes, downspout disconnection, stream buffer, open space preservation



While Nashville's green infrastructure programs are still getting up and running, the city has shown a commitment to increasing its requirements and incentives for green infrastructure in the near future. Nashville's Green Infrastructure Master Plan analyzed the benefits that widespread green infrastructure implementation could achieve in the city's combined sewer system area; identified potential projects the city can implement; and suggested incentives that Nashville can offer to private properties to install green infrastructure, such as stormwater fee discounts, rebates, installation financing, and awards and recognition programs. The city also developed a fairly robust public engagement initiative consisting of online resources and high-profile demonstration projects, and it has a stormwater user fee based on impervious surface area, with credit available for on-site mitigation. Despite this progress, Nashville faces significant work ahead. It has not established a retention standard (within the next four years, the city's new MS4 permit will make on-site retention mandatory where possible). Nashville has no requirement to use green infrastructure to reduce impervious surfaces, nor has it established incentives for private actions. While the updated version of Nashville's stormwater management manual, currently under development, will establish an alternative compliance path based on stormwater volume reduction, this approach will be voluntary.



BACKGROUND

Nashville, located on the Cumberland River in Tennessee, covers 526 square miles and has a metropolitan area that spans 13 counties. The Metro Nashville area still has 47 percent of its urban tree canopy; in the city center, the figure dips to 13 percent.¹ The city's combined sewer system (CSS) was built in the late 1880s. It carried both stormwater and sewage to the Cumberland River without treatment until the late 1950s, when the city constructed the Central Wastewater Treatment Plant to treat wastewater prior to release. Today Nashville has a CSS servicing 7,878 acres, or 12.3 square miles, in the core of the city. Its land cover is 46.5 percent impervious and contains 19.5 percent of the urban tree canopy.² Of the 2,500 miles of streams running through Nashville and Davidson County, 350 miles are on Tennessee's official list of impaired waters.³



Nashville completed one of the first green streets in the Southeast, transforming a major downtown road into a pedestrian-friendly corridor by incorporating sidewalk-level bioretention planters, bioretention curb bump-outs, a landscaped median, porous concrete sidewalks, and planting 102 shade trees.

NASHVILLE'S STORMWATER MANAGEMENT BACKGROUND

In August 2007, the Metropolitan Government of Nashville and Davidson County signed a consent decree with the United States and the state of Tennessee that called for a nine-year plan to reduce the estimated 765.2 million gallons of combined sewer overflow (CSO) discharged to the Cumberland River each year.⁴ In response, the Metropolitan Department of Water and Sewerage Services of Nashville and Davidson County (MWS) are currently leading efforts to develop a CSO long-term control plan. In 2008, Metro Nashville established a Stormwater Master Planning District covering the entire CSS area and directed MWS and other Metro Nashville departments to develop a green infrastructure plan for the area; it was completed in 2009 and is explained below.⁵ The remainder of Nashville is serviced by separate sewer systems that are regulated through a National Pollutant Discharge Elimination System (NPDES) Phase I MS4 permit.⁶ A new MS4 permit for Nashville is expected to be issued in late 2011 or early 2012.

Responsibility for Metro Nashville's stormwater program also belongs to MWS,⁷ and in 2006 the agency updated Metro Nashville's Stormwater Management Manual (SWMM). The manual provides the framework for site development,

including erosion and sediment control during construction and post-development water quantity and quality requirements. The 2006 SWMM contains guidance for green infrastructure practices including green roofs, bioretention, and use of pervious pavement.⁸ MWS is currently in the process of developing a new volume of the SWMM designed to encourage the use of green infrastructure, which will establish an alternative compliance path based on stormwater volume reduction and will provide incentives for the use of bioretention, permeable pavements, trees, green roofs, cisterns, and other green infrastructure practices that reduce stormwater volume. The approach will remain voluntary until required under the city's new MS4 permit.

Under Mayor Karl Dean's guidance, the use of green infrastructure to address stormwater and flooding concerns has taken on increased significance. In 2008 Metro Nashville joined a group of local governments promoting sustainability through peer-to-peer advice on stormwater issues. That same year, the mayor signed a green building permit and green certificate of occupancy ordinance; appointed an environmental sustainability manager; and created both a Green Ribbon Committee and a Green Team Committee, whose members, among other things, provided guidance on the use of green infrastructure to address stormwater runoff and commissioned a downtown Tree Master Plan.

In 2009, the Green Ribbon Committee released a full report that set forth 16 goals, including the establishment of tree canopy and tree-planting objectives for various property types to achieve; the greatest reduction of stormwater runoff possible; the establishment of a dedicated source of funding for stormwater management; and the removal of all Nashville streams from the state's list of impaired waters by 2020.⁹ In May 2010, these efforts were diverted for a time to deal with the aftermath of a catastrophic flood that caused the loss of 11 lives and more than \$2 billion of private property damage. As the city recovered from the experience, however, a new approach to open-space planning took shape. Since then, Nashville has moved forward with a plan to buy and remove more than 300 structures in the floodway to restore and preserve the land as open space. The city is also addressing stormwater by increasing the number of incentives and requirements that encourage the use of green infrastructure practices.¹⁰

NASHVILLE'S GREEN INFRASTRUCTURE MASTER PLAN

Downtown Nashville's 12.3-square-mile CSS was designated a stormwater planning district in 2008 under an ordinance that directed MWS, the Metropolitan Planning Department, the Metropolitan Development and Housing Agency, and the Department of Public Works to create a Green Infrastructure Master Plan; the plan was finalized and approved in the fall of 2009. In addition to identifying various green infrastructure practices in the stormwater planning district, the plan provides a detailed analysis of the impacts that four types of practices have on the volume of stormwater runoff: rainfall harvesting; green roofs; urban trees; and three infiltration practices (bioinfiltration areas, permeable surfaces, and tree planters).

For rainfall harvesting, the plan evaluated the effect that capturing runoff from the 1,300 acres of rooftops in the CSS area would have on stormwater runoff. On average, rooftops in Nashville were estimated to generate 65.5 gallons per day per 1,000 square feet, for a total of 1.36 billion gallons of runoff per year. If all of the 708 buildings suitable for green roofs were converted, 112 million gallons of runoff could be removed from the annual total. Similarly, the plan evaluated the impact of additional tree plantings within the CSS area and found 51,800 acceptable new planting sites; these would add 811 acres of urban trees and increase the canopy coverage from 19.5 percent to 30 percent. By doing so, Metro Nashville could expect to reduce stormwater volume by 660 million gallons annually. Similar evaluations were prepared

for other green infrastructure practices. In addition, the plan identified 50 potential green infrastructure projects that MWS could implement and provided brief overviews of six. Under the ordinance, the list of green infrastructure projects must be updated annually, and MWS was authorized to promulgate and enforce rules and regulations for the implementation of green infrastructure techniques.¹¹

NASHVILLE'S OPEN-SPACE PLAN: NASHVILLE: NATURALLY

In April 2011, Nashville released its first open-space plan, which aims to protect 22,000 acres over the next 25 years, including 10,000 acres of floodplain. The plan "Nashville: Naturally," builds upon the lessons learned from the flood of 2010 by focusing protection efforts on land in each of the nine bends of the Cumberland River. The network of open spaces is intended to provide buffers against floodwaters, improve water quality, protect agricultural soils, and offer recreational opportunities. Other goals include the restoration of the endangered Nashville crayfish population and the removal of all area streams from the impaired waters list. The plan further aims to double the 85-acre downtown tree canopy within 10 years and to transition 110 acres, or 20 percent, of the suitable impervious surfaces downtown to pervious or natural plantings.

To help Nashville reach these goals, the plan makes numerous policy recommendations to connect wildlife and water networks, support urban and rural farming, connect people to green infrastructure, and preserve historic and iconic resources. From a stormwater perspective, some of the more important recommendations are to:

- integrate Metro department activities related to forest and water resource protection
- create incentives that encourage green infrastructure stormwater management on private properties;
- establish a stronger stream buffer to protect and restore a riparian buffer system;
- institute a no-adverse-impact policy that restricts development in flood-prone areas and requires development that alters flooding conditions to mitigate the impact of such actions; and
- explore sustainable open space funding and incentive programs that could be offset by the creation of green spaces such as green roofs in dense urban areas.¹²

The Metro Council and Mayor Dean have already set aside \$5 million from Metro Nashville's capital spending budget to begin an acquisition fund; they expect to build the fund with private contributions. Additionally, they've taken the first step toward meeting the 22,000-acre green space goal by agreeing to purchase a 135-acre former private airport for \$1.2 million. Doing so will serve to connect two adjacent parks, create a 936-acre swath of open space, and provide an additional buffer to surrounding neighborhoods to protect them from future flood events. To raise funds, Metro is partnering with the Land Trust for Tennessee and the Friends of Shelby Park.¹³

OTHER GREEN INFRASTRUCTURE INITIATIVES

Metro Nashville and MWS have implemented several other projects to better engage and inform the general public on the purpose and utility of green infrastructure practices. To encourage rain gardens, MWS has partnered with the Nashville District of the Army Corps of Engineers and the Cumberland River Compact, a nonprofit organization that engages businesses, individuals, community organizations, and government in the restoration and protection of the Cumberland River, to create a resource guide.¹⁴ In the spring of 2011, the Cumberland River Compact, MWS, and Impact Nashville built 50 rain gardens on residential properties with the help of volunteers. The rain gardens were offered free to homeowners (or renters with owner permission) and were concentrated within the watershed of Brown's Creek, one of Nashville's most polluted small streams.¹⁵ Plans are in place for Nashville Metro to partner with the Cumberland River Compact, the Nashville Tree Foundation, the Nashville Earth Day Festival, and Sound Forest to plant shade trees with the greatest benefits for stormwater mitigation on selected residential properties and in community spaces around Davidson County. While individual websites exist for each program, Nashville has developed a unique site, Impact Nashville (impactnashville.net), aimed at engaging residents in various citywide initiatives.

In 2009, Nashville completed a \$4.5 million pilot "green street" project along Deaderick Street, converting a major downtown road into a pedestrian-friendly corridor by incorporating sidewalk-level bioretention planters, bioretention curb bump-outs, a landscaped median, and porous concrete sidewalks, and by planting 102 shade trees. It is also one of the first green streets constructed in the Southeast.¹⁶

FINANCE STRATEGY

In 2008, MWS prepared a stormwater business plan that found the stormwater program's annual budget of \$12 million was below projected needs; an additional \$85 million was necessary just to resolve the backlog of projects, and to fully operate the stormwater program an annual operating budget of \$25.8 million was required. To fill the gap, the business plan recommended that a dedicated user fee for stormwater drainage be developed, with the rate structure based on a property's total impervious surface area. For customers with existing MWS water accounts, the fee would be billed monthly on the MWS utility bill. For customers without water accounts, a quarterly "stormwater only" bill would be issued.¹⁷ In 2009, a stormwater user fee came into effect for Metro Nashville. Currently, monthly rates for residents range from \$0 to \$4.50, with an average residential bill of \$3.00.¹⁸ Nonresidential property rates range from \$0 to \$400, depending on the amount of impervious surface.¹⁹ Property owners can receive a credit for mitigating stormwater runoff impacts through education or the implementation of source controls for water quantity or quality (up to 20 percent for each practice, capped at 50 percent).²⁰ However, the monthly stormwater fee does not appear to be significant enough to make much difference in customer behavior. In other words, the cost savings resulting from stormwater improvements seem unlikely to offset the cost of installing them.

In addition to the stormwater fee, Metro Nashville draws from its general fund, internal service fund, federal funds, and private funding to implement stormwater, open space, green building, and tree planting programs. And to encourage green buildings, the Metro Codes Department established a fast-track permitting process in 2009. To receive the green stamp of approval, units must be third-party certified.²¹ However, no additional incentives other than fast-track permitting are offered at this time, nor has Metro Nashville included any stormwater management requirements that encourage the use of green infrastructure practices in their green building permitting process, such as requiring green roofs or the use of volume-based controls on-site.

Like many of the original case studies in 2006, Nashville's green infrastructure programs are still developing tools and incentives used to encourage green infrastructure practices are expected to increase over the years. The Green Infrastructure Master Plan, which provides a summary of various incentive practices that other cities use to encourage green infrastructure, provides some hints as to incentives Metro Nashville might implement to encourage participation. From these incentives, five were selected for further

consideration for Metro Nashville: stormwater fee discounts, rebates and installation financing, development incentives, grants, and awards and recognition programs.²² In addition, Metro Nashville is working to identify incentives that will be incorporated in the upcoming stormwater management low-impact development manual.²³

*EMERALD CITY RATING SYSTEM

Each of the cities profiled in *Rooftops to Rivers II* is a leader in green infrastructure investment—rethinking the design of municipal services and infrastructure. These cities leverage funding in creative ways. They provide tools to residential and commercial land owners to retrofit private properties and realize the multiple benefits provided by green infrastructure. In short, they are changing how cities look and function.

NRDC's Emerald City Rating System identifies six actions cities should undertake to maximize their green infrastructure investment. Our metric does not directly compare one city to another, due to geographical, population, budgetary and other differences. Instead, it identifies the presence or absence of common factors of success that NRDC believes are essential elements of a robust green infrastructure commitment. Only one city profiled, Philadelphia, is undertaking each of the actions identified, although each city is undertaking at least one.

REFERENCES

- 1 Graham, J., and I. Hanou (2010). "Metro Nashville Tree Canopy Assessment Project," accessed at <http://www.treesnashville.org/images/tca/pdfs/tcareport.pdf>.
- 2 Metro Water Services (2009). "Metropolitan Government of Nashville and Davidson County Green Infrastructure Master Plan," accessed at www.nashville.gov/stormwater/docs/reports/GreenInfrastructureRpt101120.pdf.
- 3 Graham and Hanou.
- 4 Metro Nashville (2009). "Substitute Ordinance No. BL2008-345: an ordinance amending Title 15 of the Metropolitan Code to create a stormwater master planning district," accessed at www.nashville.gov/mc/ordinances/term_2007_2011/bl2008_345.htm.
- 5 Metro Water Services. (2009). "Metropolitan Government of Nashville and Davidson County Green Infrastructure Master Plan."
- 6 Metro Water Services (2010). "Metropolitan Nashville and Davidson County MS4 NPDES Permit No. TNS068047 Annual Report: Permit Cycle 2, Year 7," accessed at www.nashville.gov/stormwater/docs/other/Cycle2_Year7_Annual_Report.pdf.
- 7 Metro Water Services (2008). "Stormwater Business Plan FY 2009–2013," accessed at www.nashville.gov/water/cwip/docs/stormwater_business_plan.pdf.
- 8 Metro Water Services (2009). "Stormwater Management Manual," accessed at www.nashville.gov/stormwater/regs/index.asp.
- 9 Green Ribbon Committee on Environmental Sustainability (2009). "Together Making Nashville Green, a report to the Honorable Karl Dean, Mayor," accessed at www.nashville.gov/sustainability/grc/index.asp.
- 10 Taken from Mayor Karl Dean's Keynote Address at the First National Green Infrastructure Conference, held at the National Conservation Training Center, Shepherdstown, West Virginia, February 24, 2011, accessed at <http://www.agiledesignstudios.com/GreenInfrastructureResourcesNGIC2.html>.
- 11 Metro Water Services (2009). "Metropolitan Government of Nashville and Davidson County Green Infrastructure Master Plan."
- 12 Metro Nashville and the Land Trust for Tennessee (2011). "Nashville Open Space Plan: A Report of Nashville: Naturally," accessed at <http://www.treesnashville.org/images/tca/pdfs/tcareport.pdf>.
- 13 Metro Nashville (Apr. 14, 2011). "Mayor Dean, Land Trust for Tennessee Release Open Space Plan" (press release), accessed at <http://www.nashville.gov/mayor/news/2011/0414.asp>.
- 14 Metropolitan Department of Water and Sewerage Services of Nashville and Davidson County (2011). "Rain Gardens for Nashville," accessed at www.raingardensfornashville.com/index.html.
- 15 Impact Nashville (2011). "Volunteer Opportunity: Rain Garden Plantings," accessed at impactnashville.net/opportunities/114.
- 16 Metro Public Works (2009). "Deaderick: Tennessee's First 'Green Street'," accessed at www.nashville.gov/pw/projects/deaderick.asp.
- 17 Metro Water Services (2008). "Stormwater Business Plan FY 2009–2013."
- 18 Metro Water Services (2010). "Metropolitan Nashville and Davidson County MS4 NPDES Permit No. TNS068047 Annual Report: Permit Cycle 2, Year 7."
- 19 Metro Nashville, 2011. "Clean Water Infrastructure Program," accessed at http://www.nashville.gov/water/cwip/stormwater_fee.asp.
- 20 Metro Water Services (2009). "Stormwater User Fee Credit Manual," accessed at www.nashville.gov/water/cwip/docs/SWUserFeeCreditManual.pdf.
- 21 Metro Nashville, 2011. "Green Construction," accessed at www.nashville.gov/ds/green_bldgs.asp.
- 22 Metro Water Services (2009). "Metropolitan Government of Nashville and Davidson County Green Infrastructure Master Plan."
- 23 Ayers, Emily. Personal communication, June 5, 2011.