GREEN ROOFS AND GREEN BUILDINGS:
A synergistic approach to green building design and LEED certification

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As many green roof advocates are aware, the US Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) green building certification program recognizes green roofs as an effective strategy that can achieve multiple credit requirements. Integrated design plays a key role in realizing the full synergies of green roofs as they relate to sustainable green building strategies.

LEED® for New Construction, or LEED®-NC is one of several sustainable green building rating systems developed and administered by the USGBC. Green roofs can facilitate a significant improvement in the LEED® rating of a building, contributing as many as 15 credits under the system, depending on design and level of integration with other building systems[1]. These synergistic benefits of green roofs are recognized by the LEED® - NC green building rating system as potentially meeting the partial or full intent of numerous credits, including the following:

Sustainable Sites Credit 5.1: Site Development - Protect or Restore Habitat – recognizes green roofs as contributing to restoration of ecological habitat in urban areas assuming native plantings are used.
Sustainable Sites Credit 5.2: Site Development – Maximize Open Space – recognizes green roofs as contributing to development area open space requirements.
Sustainable Sites Credit 6.1: Stormwater Design – promotes the increase of pervious surfaces in developments, such as green roofs, pervious pavement or grid pavers to increase infiltration and reduce pollutant loadings in stormwater runoff.
Sustainable Sites Credit 7.2: Heat IslandEffect - Roof – This credit references green roofs and/or high-albedo roof surfaces as a strategy for reduced heat absorption and micro-climatic impacts on human health and the environment. Reduced heat absorption in building can lower the energy costs associated with cooling the building as well as prolong the life of the roof structure.
Energy and Atmosphere Credit 1: Optimize Energy Performance – This credit recognizes the insulating potential of green roofs and the associated building heating and cooling energy savings that can result. Advanced Buildings Benchmark Version 1.1 Criteria is one compliance path to achieve this credit and includes "cool roofs and eco-roofs" as a requirement.

The USGBC, partnering with the Congress for the New Urbanism and the Natural Resources Defense Council, is currently in the process of expanding their LEED® suite of sustainable development rating systems beyond buildings. The LEED® for Neighborhood Development (LEED®-ND) rating system, currently in a pilot program phase, was developed to place a greater emphasis on the location of multiple buildings, how they relate to one another, their users and the supporting infrastructure and environment. According to the Pilot Version of the LEED®-ND Rating System (available on the USGBC website at www.usgbc.org) the goals of LEED®-ND are to encourage developments that revitalize existing urban areas, reduce land consumption, reduce automobile dependence, promote pedestrian activity, improve air-quality, decrease polluted stormwater runoff, and build more livable, sustainable, communities for people of all income levels[2].

As with the USGBC's LEED®-NC rating system, the pilot version of LEED®-ND also recognizes the benefits of green roofs as they relate to sustainable building design as discussed above. However, the pilot version of LEED®-ND goes one step further and recognizes green roofs as a strategy for connecting buildings to the environment and public health. Specific LEED®-ND pilot credits that address green roofs include:

Neighborhood Pattern and Design Credit 16: Local Food Production – Encourages green roofs to be utilized for gardening and produce production, thereby reducing energy associated with, production, processing, transportation and importation of food.
Green Construction and Technology Credit 1: LEED® Certified Green Buildings – Encourages a minimum percentage of buildings to pursue LEED® Certification. As discussed above, A number of LEED® - NC credits promote the development of green roofs for their multiple energy, stormwater and open space benefits.
Green Construction and Technology Credit 2: Energy Efficiency in Buildings – Recognizes the insulating properties of green roofs in contributing to energy efficiency. Similar to LEED® NC Energy and Atmosphere Credit 1, this LEED® - ND Credit references the Advanced Buildings Benchmark which specifically refers to eco or green roofs.
Green Construction and Technology Credit 9: Stormwater Management – Green roofs are recognized for their infiltration capabilities and as an effective strategy for reducing impervious surfaces, thereby aiding in managing stormwater on-site.
Green Construction and Technology Credit 10: Heat Island Reduction – As with LEED® NC Sustainable Sites Credit 7.2, this credit recognizes green roofs for their ability to reduce heat absorption and micro-climatic impacts on human health and the environment.
Green Construction and Technology Credit 16: Wastewater Management – The goal of this credit is to encourage on-site wastewater treatment and re-use opportunities to reduce sewage generation and potable water use. Green roofs can be integrated with rainwater harvesting systems that can provide water for non-potable water uses in the building such as toilet flushing. This strategy contributes to reductions in potable water use in buildings. Created wetlands on green roof-tops are also being used to provide on-site treatment of wastewater for non-potable water use on-site. This innovative approach to on-site wastewater treatment in urbanized areas (where open land is scarce) may also qualify for a LEED® - ND Innovation and Design (ID)Credit. These ID credits recognize innovative green building strategies that are not fully covered by the credit categories.

As this paper suggests, the multiple benefits of green roofs are clearly recognized by the US Green Building Council and by architects, engineers, planners, green building advocates and building owners who incorporate green roofs into their projects. Thanks to many green roof advocates, successful demonstration projects and rating systems such as LEED® , green roofs continue to grow in popularity as a proven strategy for providing a synergistic approach to green building design and re-connecting nature with the built environment.

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[1] Kula, Richard. (2005). Green Roofs and Maximizing Credits Under the LEED™ Green Building Rating System. Third Annual Greening Rooftops for Sustainable Communities Conference, May 2005, Washington, D.C., OR: Green Roofs for Healthy Cities.

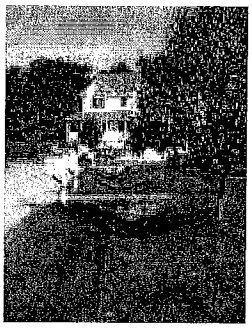
[2] US Green Building Concil. (2007). LEED for Neighborhood Development Rating System – Pilot Version, June 2007. http://www.usgbc.org/ShowFile.aspx?DocumentID=2845

MASSACHUSETTS LOW IMPACT DEVELOPMENT TOOLKIT

homepage

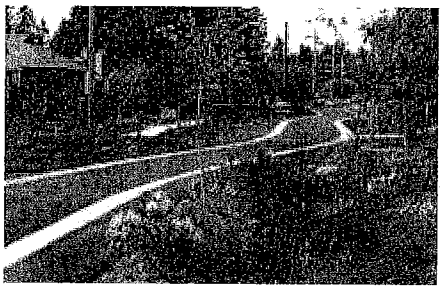
Welcome to the Massachusetts Low Impact Development Toolkit homepage.

Low Impact Development (LID) strategies use careful site design and decentralized stormwater management to reduce the environmental footprint of new growth.



This approach improves water quality, minimizes the need for expensive pipe-and-pond stormwater systems, and creates more attractive developments.

The Massachusetts Low Impact Development Toolkit is a set of materials designed to help citizens, public officials and developers implement LID.



We are continually adding new material to this site, so please check back frequently. For more information or to order hard copies of our materials, please email: lid@mapc.org.

Explore the Toolkit:

- An introduction to LID—for public officials, advocates, & citizens
- An introduction to LID—for developers and property owners
- An introduction to LID—for engineers, planners, and landscape architects
- Low Impact Development FAQs

A Brief Synopsis: Stormwater Management Changes under the Wetlands Protection Act and Water Quality Certification Regulations

Recent revisions to both the Wetlands Protection Act (WPA) Regulations and the Water Quality Certification Regulations now incorporate updated Stormwater Management Standards. Effective January 2, 2008, these revisions codify the Stormwater Policy and Standards but do not effect other aspects of both regulations. These regulations, interim guidances and more detailed summaries can be found at MassDEP's website: http://www.mass.gov/dep/service/regulations/newregs.htm#proposed

The five main goals for these revisions are:

Increase Water Recharge of Stormwater: Returning treated and clean stormwater back to local underground drinking water supplies and replenishing base flow to local streams and rivers is one strategy for keeping water local.

Promote Low Impact Development (LID): Site design techniques and Stormwater Best Management Practices (BMPs) reduce impervious surfaces, disconnect drainage pathways, increase water recharge and decrease pollution. Whether reflected in new LID Site Design Credits, explicitly listed as BMPs, or requiring that LID techniques be "considered" for every development, MassDEP encourages a wide range of LID techniques across Massachusetts.

Ensure that Redevelopments Always Improve Existing Conditions: In response to MassDEP's Stormwater Advisory Committee's recommendation that the 1996 Stormwater Standard for redevelopment be strengthened; the WPA regulations now requires that all redevelopments must fully meet the Stormwater Management Standards pertaining to pollution prevention, erosion and sediment control, operation and maintenance, and illicit discharge removal, meet the structural BMP standards to the maximum extent practicable and improve existing conditions. MassDEP is providing guidance for Conservation Commissions and project proponents on how to implement these improvements at: http://www.mass.gov/dep/water/laws/policies.htm#storm

Provide Better Environmental Protection: By promoting prevention rather than remediation through "pre-treating" the stormwater *before* it seeps underground – or flows into local streams - we avoid expensive solutions to "clean-up" aquifers and surface water bodies afterwards. MassDEP now requires identification and removal of Illicit (illegal)Discharges to stormwater systems and increased treatment of stormwater. The effectiveness of stormwater BMPs is improved by clearly identifying who is responsible for Operation and Maintenance (O&M) and requiring that these activities be tracked and properly inspected.

Reflect Updated Scientific Information on Stormwater: The new 2008 Stormwater Handbook will include revised Total Suspended Solids (TSS) removal rates and new BMPs that reflect scientific studies of stormwater from the past decade.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection
Wetlands/Waterways Program
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Wetlands Jurisdiction

The revised wetlands regulations provide that a stormwater BMP approved in response to a Notice of Intent (NOI) filed in or after January 2, 2008 does not by itself create any additional wetland resource areas or buffer zone. The NOI review of proposed modifications to such BMPs is limited to the stormwater functions of the stormwater management system, compliance with the Stormwater Management Standards, and those performance standards that would apply if a stormwater management system were not used.

The Stormwater Standards: What has Changed?

Standards 1 and 2 have no substantive changes. As more fully set in the Massachusetts Stormwater Management Handbook the requirements of Standards 3 through 9 have been changed. A new Standard 10 dealing with Illicit Stormwater Discharges has been added.

Where to Find Stormwater Management Information on MassDEP's Website

Massachusetts Stormwater Report Checklist and Certification
http://www.mass.gov/dep/water/laws/policies.htm#storm

Automated Excel Spreadsheet for Calculating Total Suspended Solids Removal
http://www.mass.gov/dep/water/laws/policies.htm#storm

Massachusetts Stormwater Management Handbook: Volumes 1, 2 and 3
http://www.mass.gov/dep/water/laws/policies.htm#storm

Summary of Stormwater Amendments to Wetlands Protection Act Regulations 310 CMR 10.00) and 401 Water Quality Certification, 314 CMR 9.00
http://www.mass.gov/dep/water/laws/strmreg.doc

Text of the Stormwater Revisions to Wetlands Protection Act Regulations, 310 CMR 10.00
http://www.mass.gov/dep/water/laws/310c10p.doc

Questions Answered and Workshop Information

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See the MassDEP's Wetlands Circuit Rider Web Page and Event Calendar at:
http://www.mass.gov/dep/water/resources/cridr.htm