200 FRIBERG PARKWAY, WESTBOROUGH, MA 01581
PHONE: (774) 760-0495 FAX: (774) 760-0017
WWW.495PARTNERSHIP.ORG

TO: 495/MetroWest Partnership Stakeholders

FROM: The 495/MetroWest Partnership

RE: **Low Impact Development Toolkit Update**

As part of Year 3 of the 495/MetroWest Partnership's Strategic Plan, the 495/MetroWest Partnership aims to curate and publish an online listing of contemporary resources to supplement the 2008 Low Impact Development (LID) Toolkit, ensuring access to up-to-date best practices and innovations in sustainable development. This document serves as a comprehensive overview of LID resources available to Massachusetts businesses, municipalities, and residents to aid in this effort.

Information/Guides

Low Impact Site Design Fact Sheet

Organization: MAPC

In 2010, the Metropolitan Area Planning Council (MAPC) provided design objectives for low impact site design, as well as an overview of design principles, site analysis, maintenance, cost, and additional references. Within site analysis, the source emphasizes locating development and roadways, creating a decentralized stormwater system, as well as potential benefits and limitations. The source notes that LID may require collaboration with qualified professionals and sometimes conflicts with local regulations and perceptions of development types. It highlights the potential cost savings and aesthetic benefits of LID designs. Maintenance requirements are generally reduced, and the overall cost may be higher for initial planning but often results in lower construction and maintenance costs with added property value.

Low Impact Development Technologies

Source: The Whole Building Design Guide (WBDG)

The Whole Building Design Guide outlines LID technologies and points to low impact development as an alternative to site design strategy. The WBDG notes the "greening" movement, as well as listing examples of profitable LID development sites. The source provides information on each mainstream LID practice, and refers viewers to federal directives, their resource page, publications, organizations, training and research links, and tools of analysis and design.

Low Impact Development Toolkit

Source: City of San Antonio, Texas

The City of San Antonio released an updated guide to LID practices in 2019. The source includes helpful metrics and visuals depicting the best uses of practices such as bioretention basins, bioswales, vegetated swales, vegetated filter strips, permeable hardscapes, as well as other lesser-discussed methods of wetland restoration and pollinator planting. The toolkit adds planting considerations, a plant list to target certain pollinators, and a recommended tree list designed to intercept rainfall, direct precipitation into the ground, and absorb stormwater through roots. Each listed method in the toolkit factors in the initial cost and the maintenance costs required for successful implementation.

Rain Garden Guide

Organization: Massachusetts Watershed Coalition

The Rain Garden Guide from the Massachusetts Watershed Coalition provides a detailed overview of designing, constructing, and maintaining rain gardens, which are shallow, planted depressions that capture and treat stormwater runoff. These gardens use native vegetation and engineered soil layers to slow, infiltrate, and filter runoff, reducing pollution and easing pressure on conventional stormwater systems. The guide outlines site selection, plant choices, soil amendments, and construction steps, making it a valuable resource for homeowners, developers, and municipalities. Rain gardens can be incorporated into residential yards, commercial landscapes, and public spaces to enhance infiltration, support biodiversity, and mitigate urban flooding. By integrating rain gardens with other LID techniques—such as permeable paving, vegetated swales, and bioretention areas—communities can create more resilient, sustainable developments that improve water quality and ecosystem health.

Green Roof Best Management Practice Fact Sheet

Organization: United States Environmental Protection Agency

The EPA's Fact Sheet on the Best Management Practices for Green Roof projects outlines the concept, applications, limitations, and effectiveness of such initiatives. As detailed in the document, Green Roofs provide a wide range of benefits, including improved water quality, reduced sewer overflows, and the prevention of sewage from entering local waterways. These projects can be implemented in various ways: as part of an initial construction project or as a retrofit for existing structures with sufficient load-bearing capacity on their roofs. Each project requires a unique design, tailored to factors such as the roof's load capacity, project budget, local climate, and specific design goals, such as desired stormwater retention volume. Ultimately, Green Roofs can significantly reduce the total volume of stormwater discharge and decrease the export of pollutants often associated with traditional roofing systems. Although regular maintenance is necessary to maintain their efficiency, the long-term benefits of Green Roof implementation are substantial.

Bioretention Areas Fact Sheet

Organization: MAPC

In 2016, MAPC updated the management objectives, application and design principles, benefits, limitations, maintenance, and cost of bioretention areas. Bioretention utilizes soil, plants, and microbes to treat stormwater runoff. They're designed to manage water quality, reduce peak discharge rates, and improve site aesthetics. They can be retrofitted into various settings, including parking lots, median strips, and residential areas, and offer cost-effective, decentralized stormwater treatment compared to traditional methods. However, proper maintenance is crucial to prevent premature failure, and they may not be suitable for

stormwater hotspots with high pollutant loads. The source lastly offers additional references to a published EPA study, and the Low Impact Development Center.

Evaluation of Dry Wells and Cisterns for Stormwater Control

Organization: United States Environmental Protection Agency (EPA)

The EPA provides a 2013 case study into the effectiveness of using dry wells to redirect surface runoff to local shallow groundwater in 2013 Millburn Township, New Jersey. The study found that most dry wells in the area "worked well in infiltrating runoff," reducing mass discharges of flows and pollutants to surface waters. The source includes an external link to the entire 364 page evaluation.

Grants/Technical Assistance Programs

Urban Runoff: Low Impact Development

Organization: Environmental Protection Agency (EPA)

The Environmental Protection Agency gives information on Low Impact Development and its potential to improve habitat, flood protection, cleaner air, and cleaner water. The source provides an overview of LID benefits and practices including bioretention facilities, rain gardens, vegetated rooftops, rain barrels, and permeable pavements. The site offers additional information on green infrastructure and several fact sheet pdfs from between 2012 and 2021.

Stormwater Permitting **(provides grants)**

Organization: MassDEP

MassDEP provides guidelines for what municipalities must follow to implement stormwater runoff infrastructure. The agency supports the implementation of the Municipal Separate Storm Sewer System (MS4) General Permit, Construction General Permit, and Multi-Sector General Permit, many of which are administered jointly with the EPA. State authorization for these permits, particularly near Outstanding Resource Waters, requires the submission of a WM15 application. MassDEP also offers educational materials, planning toolkits, and grant funding to help municipalities meet MS4 permit requirements. In addition, local governments may have their own ordinances governing stormwater management, making coordination at all levels essential for effective implementation.

Central Massachusetts Regional Stormwater Coalition

The Central Massachusetts Regional Stormwater Coalition (CMRSWC) is an initiative formed by 13 municipalities which represents around 30 communities in Central MA, including 11 within the 495/MetroWest Partnership service area. It supports towns in meeting EPA MS4 stormwater permit requirements by developing shared resources like Stormwater Pollution Prevention Plan (SWPPP) templates, standard operating procedures, and model bylaws. The Coalition helps reduce costs by rotating equipment such as GPS/GIS tools and sampling kits among member communities. It also partners with Worcester Polytechnic Institute to enhance stormwater mapping and data collection. In addition, CMRSWC provides public education materials, training workshops, and a best management practices (BMP) toolbox to improve stormwater management across the region.

UNH Stormwater Center

Organization: University of New Hampshire, Durham

The Stormwater Center at the University of New Hampshire, Durham is dedicated to improving stormwater management through research, testing, and outreach, particularly in response to Clean Water Act Phase II regulations. Studies have shown that traditional stormwater systems

often fail to meet water quality goals, emphasizing the need for scientifically tested, innovative approaches. The center conducts field research, technology comparisons, and targeted studies to evaluate stormwater treatment systems, including porous pavements and bioretention solutions. Through workshops, data reports, and partnerships with regulatory agencies, the center provides resources and training to engineers, municipalities, and industry professionals. This work directly supports Low Impact Development by advancing nature-based stormwater solutions that reduce runoff, enhance infiltration, and improve water quality. The center collaborates with public and private partners to design, implement, and maintain LID-friendly technologies, such as permeable paving, green infrastructure, and decentralized stormwater controls.

Soak Up The Rain: Permeable Pavement

Organization: United States Environmental Protection Agency

The EPA's "Soak Up the Rain" initiative supports Low Impact Development projects by promoting a number of sustainable, eco-friendly practices, including permeable pavements. These pavements allow stormwater to infiltrate the ground, reducing runoff and improving water quality. Thus, they are able to enhance environmental sustainability in urban areas by minimizing traditional drainage needs and filtering pollutants. Upon visiting the website linked above, various local initiatives and projects can be found in Rhode Island, Connecticut, Vermont, and New Hampshire (nothing to note in Massachusetts, although there was a similar project in Provincetown), highlighting the efforts being made throughout the Northeast region to utilize this avenue to promote improved stormwater control.

Stormwater Management Model (SWMM)

Organization: EPA

EPA's Storm Water Management Model (SWMM) can be used for decision support, emergency response, planning, analysis, and design related to stormwater, combined, and sanitary sewer systems. It can be used to evaluate gray infrastructure stormwater control strategies, such as pipes and storm drains, as well as creating cost-effective hybrid green/gray stormwater control solutions. SWMM was developed to support local, state, and national stormwater management goals to reduce runoff through infiltration and retention and help to reduce discharges that could pose a threat to nearby bodies of water.

Rain Gardens

Organization: Neponset River Watershed Association

The Neponset River Watershed Association provides instructions for anyone looking to install a Rain Garden on their property. A rain garden is a depressed area or a “artificial puddle” in your landscape, planted with native plants, shrubs or trees (or even just grass), that collects rainwater from parking areas, driveways, walkways, or roof downspouts. During rainstorms, runoff enters the rain garden and slowly filters into the ground, where it can be cleaned naturally by the soil and plants before reaching our waterways. Allowing rainwater to slowly filter into the ground also allows more water to recharge our underground water supplies.

Complete Parking Lot Design

Source: PDH Online

Pages 29-44 of this 2020 document highlight green considerations and potential environmental impacts of parking lot design, with a focus on porous asphalt pavements to manage stormwater runoff. The document makes note of the environmental benefits of open pavement structure that porous asphalt provides. Porous asphalt likewise encourages the use of permeable paving. The source ties parking lot design to money-saving opportunities since improved runoff would

place less pressure on sewer systems, and in turn reduce maintenance costs. There is also discussion of limitations, advantages, construction, lighting, and additional considerations.

Rain Barrels and Cisterns: Stormwater Control for Small Projects

Organization: Bay Area Stormwater Management Agencies Association

In 2012, the Bay Area Stormwater Management Agencies Association analyzed the impact of low-cost systems that enabled individuals to supplement their water supply with a sustainable source by capturing rainfall. The source includes metrics surrounding the necessary amount of storage, as well as information on roofing materials, gutters and downspouts, additional accessories, and foundation and overflow. The document concludes with a design checklist and an operations and maintenance checklist to ensure the system is taken care of.

Commercial Sources

Recover Green Roofs

Organization: Recover Green Roofs

Recover Green Roofs is a design-build firm specializing in the design, installation, and maintenance of green roofs, including rooftop gardens, farms, and amenity spaces. Recover has designed and constructed residential, commercial, and institutional buildings across New England, emphasizing the benefits that a green roof provides to its community, local ecosystems, and the environment at large. They aim to create roofs that aid in recovering nature in the built environment to support healthier communities and more resilient cities.

Weston & Sampson

Weston & Sampson is a Reading-based firm specializing in infrastructure engineering and environmental consulting with a strong focus on sustainable development. They integrate Low Impact Development (LID) practices and green infrastructure into their projects to improve stormwater management, enhance water quality, and increase climate resilience. This is seen in their dedication to implementing Green Stormwater Infrastructure, as seen here. Notable projects include implementing bioswales, rain gardens, and infiltration basins in Massachusetts communities like Waltham and Fitchburg. Their multidisciplinary team collaborates to design solutions that reduce flooding while supporting environmental and community benefits.

Horsley Witten Group

Horsley Witten Group is a multidisciplinary environmental consulting firm headquartered in Sandwich, Massachusetts, with additional offices throughout New England. They specialize in sustainable site design, water resources management, and Low Impact Development (LID) strategies. Their work includes designing stormwater systems such as bioretention areas, permeable pavements, and green streets to reduce runoff and improve water quality. Horsley Witten has supported numerous Massachusetts communities through planning, design, and implementation of LID practices to build resilience and restore ecological function. They are also active in technical training and policy development around stormwater and green infrastructure.