FUSS & O'NEILL

Frequently Asked Questions (FAQs)

Town of Greenwich Drainage Manual
August 2011

This frequently asked questions (FAQ) document is intended to provide some basic information about Low Impact Development, the Town of Greenwich Drainage Manual, and related topics. Where appropriate, links are provided to websites to obtain additional information.

General Questions

Common LID Concerns and Misconceptions

LID Practices and Drainage Manual Technical Issues

Drainage Manual Implementation Issues

General Questions

1. What is LID?

Low Impact Development (LID) is an innovative stormwater management approach that uses the basic principle modeled after nature: manage rainfall where it lands. The goal of LID is to mimic a site's pre-development hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source, where technically feasible and practical. Techniques are based on the premise that stormwater management should not be seen as stormwater disposal. Instead of conveying and managing/treating stormwater in large, costly end-of-pipe facilities located at the bottom of drainage areas, LID addresses stormwater through small, cost-effective landscape features located throughout the site. LID is a versatile approach that can be applied equally well to residential, commercial and industrial sites for new development, urban retrofits, and redevelopment projects.

Effective LID includes the use of both non-structural (i.e., site planning techniques) and structural stormwater management measures that are a subset of a larger group of practices known as Best Management Practices or BMPs. The BMPs utilized in low impact development, known as LID BMPs, focus first on minimizing changes to a site's pre-developed hydrology through non-structural site planning techniques, followed by additional structural practices located throughout the site, as necessary, to fully meet the applicable stormwater management standards In doing so, LID places an emphasis on non-structural stormwater management approaches, seeking to maximize their use prior to utilizing structural controls.

See Section 4 of the Drainage Manual for additional detail

2. How did LID get started?

Development of LID principles began with the introduction of bioretention technology in Prince George's County, Maryland, in the mid-1990s. LID was pioneered to help Prince George's County address the growing economic and environmental limitations of conventional stormwater management practices. LID allows for greater development potential at less cost with less environmental impacts through the use of smarter designs and advanced technologies that achieve a better balance between conservation, growth, ecosystem protection, and public health/quality of life. LID has advanced significantly over the last 15 years expanding the number practices and with highly refined and tested standards to the point that LID is the preferred approach to stormwater management.

Today, numerous LID techniques are available to users including bioretention, permeable pavement, rainwater harvesting (rain barrels and cisterns), vegetated filter strips, water quality swales, green rooftops, disconnected downspouts, and amended soils. These techniques are seamlessly integrated into the site design to better control pollutants, reduce runoff volume and flow rate, manage runoff timing, and address a number of other ecological concerns.

3. Why should I use LID techniques?

LID has numerous benefits and advantages over conventional stormwater management approaches. In short, it is a more environmentally sound technology and a more economically sustainable approach to addressing the adverse impacts of urbanization. By managing runoff close to its source through intelligent site design, LID can enhance the local environment, protect public health, and improve community livability - all while saving developers and local governments money. The need for such an approach has never been greater. Stormwater regulatory programs require that a wide array of complex and challenging ecosystem and human health protection goals be addressed. Many of these goals are not being met by conventional stormwater management technology, and communities are struggling with the economic reality of funding aging and ever-expanding stormwater infrastructure. The challenge of how to restore stream quality in watersheds that have already been densely developed is even more daunting. Simply relying on impervious reduction and/or conventional stormwater management approaches to address these issues has shown to be ineffective and unsustainable. .

LID provides numerous benefits to developers and property owners, municipalities, and to the environment:

<u>Developers and Property Owners</u>

- Reduces land clearing and grading costs
- Potentially reduces infrastructure costs (streets, curbs, gutters, sidewalks)
- Reduces stormwater management costs
- Potentially reduces impact fees and increases lot yields
- Increases lot and community marketability
- Improves site aesthetics
- Potentially increases property values
- Encourages greater public stewardship and education

<u>Municipalities</u>

- Protects regional flora and fauna
- Balances growth needs with environmental protection
- Reduces municipal infrastructure and utility maintenance costs (streets, curbs, gutters, sidewalks, storm sewer)
- Increases collaborative public/private partnerships

<u>Environment</u>

- Preserves integrity of ecological and biological systems

- Protects site and regional water quality by reducing pollutant loads
- Reduces impacts to aquatic plants and animals
- Reduces downstream erosion
- Improves groundwater recharge
- Protects and preserves trees and natural vegetation

See Section 4.1.1 of the Drainage Manual for additional detail.

4. What about flood control?

Traditionally, stormwater management systems have been designed to function well under a single design condition, e.g. the 100-year flood, the 10-year storm, etc. Designing control systems for a single extreme event does not mean that they will perform adequately under other conditions.

Flow control standards, which have their origin in ensuring public safety and reducing property damage, have very little to do with ecosystem protection. For preserving stream integrity, experience has demonstrated the importance of a stormwater system that specifically addresses the frequent, smaller storms that occur on a regular basis (weekly or monthly). LID is a more effective ecosystem approach by using decentralized controls to mimic all aspects of pre-development hydrology, including the full range of storms that affect stream integrity. Additionally, if structural and non-structural LID practices are creatively used, LID BMPs are capable of addressing larger storms by restoring the natural rainfall-runoff relationship in developed areas. The more techniques that are applied, the closer to natural hydrologic function one gets. LID can also be used in conjunction with conventional flood control techniques to address known flooding problems. The Town's revised drainage manual requires the use of conventional BMPs if structural and non-structural LID BMPs are not adequate to completely manage the stormwater generated on the site, including stormwater runoff associated with larger design storms.

Another flood mitigation benefit of LID is in retrofitting development without any existing controls. In highly developed areas often the only space available to store, detain or management runoff is at the site level. Preventing or slowing down runoff on-site can reduce the magnitude of existing flooding problems.

5. How does LID relate to other practices such as Conservation Design, Better Site Design and Smart Growth?

Although the term "low impact development" is sometimes loosely defined (much like sustainable development), the appropriate definition of LID is distinct and should not be confused with other stormwater management and development strategies. The key distinction of LID from these other strategies is that it is an ecosystem-based approach. LID seeks to design the built environment to remain a functioning part of an ecosystem rather than exist apart from it. The approach relies more heavily on smarter and advanced technologies than it does on conservation and growth management; it is not a land use control strategy. LID provides technological tools to plan and engineer virtually any type of site to maintain or restore the site's hydrologic and ecological functions. It does not sacrifice

the environmental quality of dense urban watersheds for greater protection of conservation areas. Growth management strategies, such as Smart Growth, that emphasize the saving of green space and the redevelopment of existing urban regions, can utilize the retrofit capability of LID in order to promote ecologically-restorative infill and brownfields development in impaired stream areas. In addition, the full LID process starts with many of the same conservation and impact minimization principles inherent in other strategies. The LID approach includes five basic tools:

1. Encourage conservation measures
2. Promote impact minimization techniques such as impervious surface reduction
3. Provide for strategic runoff timing by slowing flow using the landscape
4. Use an array of integrated management practices to reduce and cleanse runoff
5. Advocate pollution prevention measures to reduce the introduction of pollutants to the environment

The initial site planning stages of an LID design can incorporate components of other popular strategies, such as Conservation Design and Better Site Design. LID distributed small-scale practices can then be applied to create a hydrologically-functional landscape.

6. Where can I get more information?

In addition to the information presented in the Town of Greenwich Drainage Manual, other sources of information on LID and related topics can be obtained from the following websites:

- CT DEEP Low Impact Development Appendix to the Connecticut Stormwater Quality Manual - http://www.ct.gov/dep/lib/dep/water/nps/swgp/lid_stormwaterfinal.pdf
- CT DEEP Low Impact Development Appendix to Connecticut Guidelines for Soil Erosion and Sediment Control - http://www.ct.gov/dep/lib/dep/water/nps/swgp/lid_soilerosionfinal.pdf
- CT DEEP Watershed Municipal Outreach and Low Impact Development webpage – http://www.ct.gov/dep/cwp/view.asp?a=2719&q=464958&depNav_GID=1654
- Connecticut NEMO Stormwater webpage - http://nemo.uconn.edu/tools/stormwater
- EPA Office Of Water – http://www.epa.gov/owow/NPS/lid
- The Low Impact Development Center, Inc. – http://www.lowimpactdevelopment.org
- Links page on the Low Impact Development Center website – http://www.lowimpactdevelopment.org/qapp/links.htm
- Prince George's County Department of Environmental Resources Programs and Planning Division – http://www.princegeorgescountymd.gov/Government/AgencyIndex/DER
- Low Impact Development Design Strategies: An Integrated Design Approach - http://www.epa.gov/owow/NPS/lidnatl.pdf

Common LID Concerns and Misconceptions

7. What are the costs associated with LID?

A common concern is that LID is more expensive than traditional development approaches because it could require higher design and construction costs. This may or may not be true, depending on the type of practice selected and the experience of the project consultants and contractors with these new techniques. These potential cost increases are not indictments of the concept of LID but of designers, contractors, and material suppliers that may not be experienced in the use of LID approaches, including the benefits of LID. This *is* changing! For example, several years ago there were only a few permeable paver options available. Today, the consumer can choose from a large number of these innovative materials, and more widespread usage and acceptance of the technology has led to lower costs.

Additional LID cost concerns include the potential for greater expenses due to the increased use of on-site landscaping material and additional consulting costs due to the increased attention to detailed site design and the number of practices used. Despite these issues, experience has shown that LID still saves money over conventional approaches through reduced infrastructure and site preparation work. Case studies and pilot programs show at least a 15% reduction in costs associated with site development and maintenance for residential developments that use LID techniques[1]. This savings is achieved by reductions in clearing, grading, pipes, ponds, inlets, curbs and paving. Far outweighing any of the cost increases due to the use of LID, these infrastructure reduction savings enable builders to add value-enhancing features to the property, to be more flexible and competitive in pricing their products, or even to recover more developable space since large stormwater ponds are typically unnecessary.

It is impractical to make broad generalizations about costs because of the inherent variability between sites and the complexity of management issues. Even where initial construction costs for LID BMPs may be higher than initial costs for conventional stormwater practices, this initial expense is often offset by cost savings in operations and maintenance. This savings is possible because the maintenance of LID BMP features can generally be incorporated into regular landscaping maintenance activities and does not require expensive training or hiring of a separate contractor for maintenance.

Costs are very site-specific. Each project will be unique based on the site's soil conditions, topography, existing vegetation, land availability etc. Some common cost-related benefits of LID projects include:

1. Multifunctionality – LID allows any common landscape feature (turf areas, gardens, trees, etc.) to also be designed as a stormwater treatment device. In many projects, the proposed landscaped features are designed to be functional stormwater controls. In these situations, there is essentially no additional cost associated with landscaping and

[1] From EPA's *Fact Sheet: Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices* (http://water.epa.gov/polwaste/green/factsheet.cfm#cost). This fact sheet provides additional information about EPA's report *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, EPA publication number 841-F-07-006, December 2007.

construction for stormwater. Additionally, the cost of maintaining the landscaped areas was originally anticipated, so one of the only major additional costs for stormwater maintenance is to ensure that drainage areas are kept clear.

2. Lower lifetime costs - A cost analysis should account for not just the initial capital costs but also the anticipated costs over the structure's lifetime, which can include operation, repair, maintenance, and decommissioning. Many LID techniques are self-perpetuating, easily repairable, or can be left as natural areas at the end of their functional lifetime, while conventional facilities may require higher costs to take out of commission and leave the area safe.
3. Additional environmental and social benefits - At the heart of LID are the multiple benefits it provides, all of which are not readily quantifiable. Not only do the techniques provide stormwater benefits, such as groundwater recharge and cleaner streams, but they also increase the urban forest, reduce the urban heat island, improve air quality, reduce thermal stream pollution, enhance the appearance of a community, and provide a stronger sense of place, etc.
4. Functional use of open space land - LID practices such as rain gardens can usually be designed as part of the development's open space, without any loss of developable area. Unlike large detention ponds, these multifunctional LID practices can be distributed throughout set-aside open space or previously designated landscaped areas, without incurring costs for land allocation to the drainage system.

(Please see EPA's findings on the cost of LID: http://water.epa.gov/polwaste/green/factsheet.cfm).

8. Will the new manual and the use of LID affect property rights and property values?

The new drainage manual in no way negatively affects property values nor does it interfere in any way with a property owner's ability to use a parcel of land for its highest and best use. LID is a technology and design-based approach that only effects how sites filter, infiltrate, retain, detain and use stormwater. It doesn't change the development potential, lot yield or costs of developing property. The manual does not prohibit a property owner from developing nor does it take away any development potential, but it does regulate how it can be developed, in a manner that does not harm the environment, prevents adverse impacts to adjacent property and protects the health, safety and welfare of the public.

The Town of Greenwich is not alone with the new focus on LID. LID is becoming the State standard as the Connecticut Department of Energy and Environmental Protection (CT DEEP) has adopted LID as the preferred approach for stormwater management state-wide and is integrating LID into its stormwater and erosion/sediment control design guidance and stormwater general permits. The U.S. EPA is also expected to promulgate national stormwater management regulations in the near future, requiring the use of LID and similar green infrastructure approaches by municipalities and private development. Regardless of the Town's adoption of this approach to stormwater management, it is going to be promoted, if not required, at both the State and Federal levels.

9. Is LID reliable if it depends on property owners maintaining their on-site practices?

   The successful use of LID on residential lots (e.g., rain gardens and rain barrels) is sometimes questioned since it relies on property owners to properly maintain the practices on their individual lots. LID is a comprehensive multi-system approach that has built-in redundancy, which greatly reduces the possibility of failure. Many LID techniques have nothing to do with nor can they be significantly influenced by the behavior of the property owner. These include basic site and infrastructure design features such as reducing the use of pipes, ponds, curbs and gutters; maintaining recharge areas, buffer zones, and drainage courses; using infiltration swales, grading strategies, and open drainage systems; reducing and disconnecting impervious surfaces; and conserving open space.

   LID's long-term success has much more to do with the knowledge, skills, and creativity of the site designers than what the property owner does or doesn't do. Although maintenance agreements/declarations will be required by the Town for added enforcement ability, the key factor in the success of LID BMPs is to ensure that the landscape practices (such as rain gardens) are attractive and perceived by the property owner as adding value to the property. If these LID BMPs are viewed as assets, the primary motivation for their long-term maintenance is that of property owners protecting their vested economic interests.

   LID site planning techniques and small-scale structural practices reduce maintenance burdens for property owners and local governments. The techniques are simple, need no special equipment, have relatively low maintenance costs, and encourage property owners to be responsible for the impacts associated with their land.

   See Section 5.5 of the Drainage Manual for additional detail.

10. Does LID work in densely developed communities such as Greenwich? Can LID work in the small individual lot, non-subdivision, setting?

    Given the flexible, diverse, and small-scale nature of structural LID practices, LID can be used on various lot sizes, large and small, for virtually any type of land use. Other Connecticut municipalities, including suburban and urban communities with areas of high density residential land use and small lots, have either adopted or are in the process of adopting LID design guidance and regulations. Examples of such communities include Torrington, Vernon, Meriden, Darien, Bridgeport, Plainville, and Avon. Additionally, the non-structural LID site planning principles including minimizing soil compaction and disturbance and reducing impervious surfaces are applicable to new development on lots of all sizes and land uses.

11. Does LID work in cold climates such as in Connecticut?

    Researchers at the University of New Hampshire Stormwater Center have been conducting extensive field monitoring of conventional stormwater BMPs and LID designs, comparing the seasonal performance of both types of BMPs in cold climate conditions. Their research has found that LID practices generally perform better in the winter months than conventional BMPs such as stormwater ponds and hydrodynamic separators. Performance

evaluations indicate that LID designs including bioretention and permeable pavement have a high level of functionality during winter months and that frozen filter media do not reduce performance. These systems do not completely freeze, or thaw quickly, when exposed to non-frozen precipitation or snowmelt. Therefore, they can accept and filter/infiltrate stormwater year-round. These results support the use of LID systems in cold climates and should dispel the concerns of reduced winter performance for fear of filter media freezing. It is interesting to note that many of the conventional BMPs that are used routinely (ponds and swales), without concern for reduced winter performance, are showing otherwise (Roseen et al., Seasonal Performance Variations for Storm-Water Management Systems in Cold Climate Conditions, UNH Stormwater Center, March 2009).

12. Does the revised Drainage Manual require extensive additional application requirements?

    Standard 13 in the revised Drainage Manual requires preparation of a Stormwater Management Report, which demonstrates that a proposed project complies with the standards outlined in the manual. The required Stormwater Management Report consists of two parts. Part One of the report focuses on the LID strategies used on the site, while Part Two includes any additional site controls proposed, including traditional stormwater BMPs. The report also includes construction plans, operation and maintenance plans, erosion and sediment control plan, and various certifications by the applicant and/or design engineer. The manual includes detailed checklists to assist the applicant in preparing the report.

    The vast majority of the items required in this report are currently required by the Town of Greenwich for land use regulated projects under the existing Drainage Manual. The Town has developed a summary document comparing the application requirements under the current and revised Drainage Manual.

    See Appendix I of the Drainage Manual for checklists of all required items.

13. Does the manual prohibit the use of sump pumps?

    No. However, the use of sump pumps for management of stormwater or groundwater is strongly discouraged for new development and redevelopment, and prohibited in some instances. The manual identifies specific sump pump requirements for pumping of stormwater and uncontaminated groundwater.

    Pumping of stormwater (excluding rainwater harvesting systems such as cisterns), including, but not limited to, from yards, driveways, and roofs, is strongly discouraged and will be prohibited in most situations as part of a proposed stormwater management system design. This is because of the significant runoff volumes, maintenance requirements, standby power requirements, and overflows associated with large storms. All other feasible approaches must be investigated to avoid the use of pumps in stormwater management system designs. In the event the project proponent determines that pumps for stormwater are necessary the proponent must submit required backup information as described in the manual for review by the Town.

Pumping of uncontaminated groundwater, including, but not limited to, from basements, and foundations, is discouraged for new development or in the case of redevelopment involving the upgrade of existing sump pump systems. The replacement of an existing sump pump system is acceptable when a direct replacement of the pump is needed and in the case of redevelopment when the improvement doesn't require a sump pump. All other feasible approaches (footing drains to daylight, slab on grade, crawl space, etc.) must be investigated to avoid the use of pumps in groundwater management system designs for new development or redevelopment. In the event the project proponent determines that pumps are necessary to manage groundwater for new development or redevelopment applications, the proponent must submit required backup information as described in the manual for review by the Town.

See Section 3.2 of the Drainage Manual for additional detail.

LID Practices and Drainage Manual Technical Issues

14. Who is responsible for maintaining LID practices?

As with all existing stormwater BMPs, the owner or operator of the LID practice is responsible for long-term operation and maintenance in accordance with the approved Operation and Maintenance (O&M) Plan. Each plan of development submitted to the Town for review and approval must include a mechanism for implementing and enforcing the O&M Plan. Each applicant must also provide the Town with a copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of stormwater BMP(s).

See Section 5.5 of the Drainage Manual for additional detail.

15. Are all projects or activities subject to the requirements of the manual? Are any projects or activities exempt?

The standards contained in the Drainage Manual apply to new development, redevelopment, and other activities on both public and private parcels of land that will result in an increased amount of stormwater runoff and/or water pollutants flowing from a site or any activity that will alter the drainage characteristics of a parcel of land (prior to the application of stormwater Best Management Practices), unless exempt. There are two types of exemptions: (1) categorical exemptions, (2) conditional exemptions with PE certification. (Residential "teardowns" – demolition and reconstruction or replacement of an existing residential dwelling with another residence of any size – are not exempt.)

The Greenwich Stormwater Management Standards shall not apply to the following categorically exempt activities, although application of the standards is still strongly encouraged:

- Normal maintenance and improvement of land in agricultural use (as defined by Connecticut General Statutes), provided such activity conforms to acceptable management practices for pollution control approved by the Connecticut Department of Energy and Environmental Protection and the Greenwich Inland

Wetlands and Watercourses Commission. This exemption does not apply to construction activities that are not directly related to the farming or agricultural operation.

- Routine maintenance of existing landscaping, gardens (excluding structural modifications to stormwater BMPs including rain gardens) or lawn areas including those maintained by the Town of Greenwich Parks and Recreation Department and Board of Education
- Resurfacing of an existing impervious area on a non-residential lot such as repaving an existing parking lot or drive with no increase in impervious cover.
- Routine maintenance to existing town roads that is performed to maintain the original width, line, grade, hydraulic capacity, or original purpose of the roadway.
- Customary cemetery management.
- Emergency repairs to any stormwater management facility or practice that poses a threat to public health or safety, or as deemed necessary by the approving authority.
- Any emergency activity that is immediately necessary for the protection of life, property, or the environment, as determined by the approving authority.
- Repair of an existing septic system.
- Construction of utilities (gas, water, electric, telephone, etc.), other than drainage, which will not permanently alter terrain, ground cover, or drainage patterns.
- Repair or replacement of an existing roof of a single-family dwelling.
- Construction of a second (or higher) floor addition on an existing building.
- The construction of any fence that will not alter existing terrain or drainage patterns.

Projects adding up to 500 square feet of impervious surfaces are exempt from the Greenwich Stormwater Management Standards, provided that all of the following conditions are met:

- The project design, including the proposed drainage design, if any, will not have an adverse effect on offsite properties or offsite drainage infrastructure, as certified by a professional engineer.
- At least one of the following or similar LID measures shall be implemented on the project site to help mitigate the effects of site disturbance and new impervious cover:
    - Disconnecting roof down spouts
    - Constructing a rain garden
    - Installing a rain barrel
    - Planting new trees or placing existing trees in a conservation easement or constructing a planted buffer to intercept sheet flow from the new impervious cover
    - Restoring a riparian or wetland buffer
- The project proponent submits an exemption request, including professional engineer certification, in lieu of a Stormwater Management Report.

This exemption can only be used until the cumulative addition of impervious surfaces on a site exceeds 500 square feet, regardless of ownership changes. For projects adding up to 500 square feet of impervious surfaces, application of the Greenwich Stormwater Management Standards is still strongly encouraged.

Residential "teardowns" – demolition and reconstruction or replacement of an existing residential dwelling with another residence of any size – are not exempt.

Projects adding between 500 and 1,000 square feet of impervious surfaces are exempt from the Greenwich Stormwater Management Standards, provided that all of the following conditions are met:

- The project design, including the proposed drainage design, if any, will not have an adverse effect on offsite properties or offsite drainage infrastructure, as certified by a professional engineer,
- At least one of the following or similar LID measures shall be implemented on the project site to help mitigate the effects of site disturbance and new impervious cover:
    - Disconnecting roof down spouts
    - Constructing a rain garden
    - Installing a rain barrel
    - Planting new trees or placing existing trees in a conservation easement or constructing a planted buffer to intercept sheet flow from the new impervious cover
    - Restoring a riparian or wetland buffer
- At least one of the following measures shall be implemented on the project site using LID or conventional stormwater BMPs to help mitigate the effects of site disturbance and new impervious cover:
    - A zero increase in peak flow to all points of concern for the 1, 2, 5, 10, and 25-year design storms
    - The runoff volume from the new impervious cover shall be infiltrated for the 10-year design storm
- The project proponent submits an exemption request, including professional engineer certification, in lieu of a Stormwater Management Report.

This exemption can only be used until the cumulative addition of impervious surfaces on a site exceeds 1,000 square feet, regardless of ownership changes. For projects adding between 500 and 1,000 square feet of impervious surfaces, application of the Greenwich Stormwater Management Standards is still strongly encouraged.

Residential "teardowns" – demolition and reconstruction or replacement of an existing residential dwelling with another residence of any size – are not exempt.

Projects adding between 500 and 1,000 square feet of impervious surfaces located within, near, or discharging to a critical area (as described in *Section 5.7.3*) are also not exempt.

See Section 3.3 of the Drainage Manual for additional detail.

16. Are the requirements in the manual considered "regulation" or "guidance"?

The Town of Greenwich Drainage Manual provides guidelines for land development activities and stormwater management in the Town of Greenwich. The manual is to be used as guidance for developers, engineers, and local regulatory authorities to design and

review new development and redevelopment projects in a technically sound and consistent manner. The manual is intended to augment other existing design guidance, including the Connecticut Department of Energy and Environmental Protection Stormwater Quality Manual (as amended) and the Connecticut Department of Transportation Drainage Manual (as amended). The Town of Greenwich Drainage Manual is generally consistent with these state-wide manuals to ensure consistency with state stormwater management policies and to eliminate potential redundancy with other existing guidance. This manual references applicable sections of the Connecticut Stormwater Quality Manual and Department of Transportation Drainage Manual, but also includes more detailed design guidance; greater emphasis on Low Impact Development (LID), sustainable site design, and green infrastructure; and specific Stormwater Management Standards tailored to the unique characteristics and issues facing the Town of Greenwich.

As part of the implementation of the revised Drainage Manual, the Town plans on revising Building Zone and Inland Wetlands and Watercourses Regulations to require the use of the manual in the development of all land development and redevelopment projects, effectively promulgating the Drainage Manual, by reference, through existing Town regulations.

17. Can septic system percolation tests be used to design stormwater infiltration systems?

Septic system percolation tests can be used to initially assess the feasibility of a site for stormwater infiltration practices, but cannot be used as the basis for final design of stormwater infiltration systems.

Septic system percolation tests are not acceptable for estimating saturated hydraulic conductivity at specific locations where stormwater infiltration systems are proposed. A percolation test is a method to determine septic system sizing in Connecticut and elsewhere. This test does not determine water movement in soil, or hydraulic conductivity. For example, a 30 minute per inch percolation rate does not mean a 2 inch per hour hydraulic conductivity. If it did, then a 30 minute per inch percolation rate would mean that the soil would "move" 48 inches of water per day. At this "rate", we would never have stormwater runoff or the need for stormwater management structures. Therefore, the use of percolation tests to assign a water movement value will greatly over-estimate the soil/site capability to infiltrate stormwater. Furthermore, percolation test results can be highly variable and are only typically used by some other jurisdictions after applying a significant reduction factor (of up to 3 to 4) and factor of safety.

However, the results of septic percolation testing can be used (when performed within 200 feet of the proposed BMP location, and on the same contour) to support determination of hydrologic soil groups, initial infiltration rates, water table and/or depth to bedrock.

When infiltration is proposed within Hydrologic Soil Group C soils or when the "Dynamic Field" method (i.e., when the design accounts for exfiltration of stormwater from the recharge practice at the same time that the storage chamber is filling) is used to size the infiltration system, regardless of Hydrologic Soil Group, field infiltration rates must be determined by saturated hydraulic conductivity testing, as described in Appendix B of the revised Drainage Manual..

When the more conservative "Static" or "Simple Dynamic" Methods are used to size the infiltration system in Hydrologic Soil Group A or B soils, field infiltration rates are based upon NRCS soil textural classification, as determined using test pits or soil borings, and associated default infiltration rates.

See Appendix B of the Drainage Manual for additional detail.

18. What does "maximum extent practicable" mean?

In the manual, references to "maximum extent practicable" (MEP) require project proponents to (1) demonstrate that all reasonable efforts have been made to meet the standard, (2) evaluate all possible management measures, and (3) if full compliance cannot be achieved, to implement the highest practicable level of management.

The MEP concept is intended to provide flexibility and relief from strict compliance with the standards for constrained sites. The MEP qualifier provides added flexibility, acknowledging that "practicability" is a key design consideration, especially for smaller sites with poor soils or high groundwater or bedrock. The concept of MEP has been used by other jurisdictions in the northeast. Massachusetts and Rhode Island, both with densely developed coastal communities, have used the MEP concept in their stormwater design manuals and standards for many years.

Drainage Manual Implementation Issues

19. How will the Town implement the manual?

The implementation of the revised Town of Greenwich Drainage Manual will be led by the Planning & Zoning Commission (P&Z) and Inland Wetlands and Watercourses Agency (IWWA). As with the current manual, the DPW Engineering Division will continue to provide the technical review of applications to both commissions. The DPW Engineering Division may also review some applications that do not require approval by either P&Z or IWWA, but which are nevertheless subject to the manual and only require a building permit.

In order to fully implement the revised manual, the Town plans to revise the Building Zone and Inland Wetlands and Watercourses Regulations accordingly. Successful implementation of the manual will require outreach and training for design professionals. The final release of the Town's Drainage Manual is planned for January 1, 2012.

20. How do the LID principles in the manual relate to the Grade Plan/Floor Area Ratio Requirements in the Town's Building Zone Regulations?

The standards within the Town's Drainage Manual are separate from the Grade Plane/Floor Area Ratio Requirements of the Building Zone Regulations. The Town Stormwater Committee that helped develop the revised manual acknowledges that there are conflicts between the current Grade Plane/Floor Area Ratio Requirements and some of the

LID principles in the revised Drainage Manual. The Planning & Zoning Commission is currently working to address this issue.

21. How does the definition of "impervious cover" differ between the manual and the Building Zone Regulations?

Impervious cover (i.e., impervious surface) is defined in the Town's Drainage Manual as any material or structure on or above the ground that prevents water from infiltrating through the underlying soil. Impervious surface is defined to include paved parking lots, rooftops, driveways, patios (i.e., solid or open-joint patios or decks with an underlying impervious surface), paved roads, water surfaces (i.e., pools, ponds, fountains, etc), and highly compacted soils. Impervious surfaces exclude permeable pavement that is designed, constructed, and maintained to allow stormwater to drain through the surface, including porous asphalt, porous concrete, permeable interlocking concrete pavers, concrete grid pavers, plastic turf reinforcing grids, and similar materials or products identified as "permeable" or "pervious" by the manufacturer. Underground parking is considered an impervious surface if there is less than 3 feet of soil cover over the parking area.

Alternately, the Town's Building Zone Regulations consider porous asphalt, porous concrete, permeable inter-locking concrete pavers, concrete grid pavers, plastic turf reinforcing grids and similar man-made materials and products as impervious surfaces when calculating a parcel's impervious coverage. The Stormwater Committee acknowledges this inconsistency and is working with Planning and Zoning to address this inconsistency.